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THE
CYCLOPÆDIA;
OR,
Universal Dictionary
OF
ARTS, SCIENCES, AND LITERATURE.

VOL. XIV.

THE
CYCLOPÆDIA;

OR,

UNIVERSAL DICTIONARY

OF

Arts, Sciences, and Literature.

BY

ABRAHAM REES, D.D. F.R.S. F.L.S. *S. Amer. Soc.*

WITH THE ASSISTANCE OF

EMINENT PROFESSIONAL GENTLEMEN.

ILLUSTRATED WITH NUMEROUS ENGRAVINGS,

BY THE MOST DISTINGUISHED ARTISTS.

IN THIRTY-NINE VOLUMES.

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CYCLOPÆDIA:

OR, A NEW

UNIVERSAL DICTIONARY

OF

ARTS and SCIENCES.

EXU

EXTRINSIC, is applied, in the *Schools*, in various senses.

Sometimes it signifies a thing's not belonging to the essence of another; in which sense the efficient cause and the end, or scope of a thing, are said to be extrinsic, or extrinsic causes.

Sometimes it implies a thing not being contained within the capacity of another. In which sense those causes are said to be intrinsic, which introduce something into a subject from without: as when fire introduces heat, &c.

Sometimes it denotes a thing added, or applied to another. Thus, accidents and adherencies are said to be extrinsic to the subject; and thus vision is extrinsic to the object seen.

EXTRINSIC Argument, Service. See the substantives.

EXTUBERANTIA, from *extubero*, to swell out, in *Surgery*, tumours situated under the skin.

EXUBERANCE, compounded of *ex* and *uber*, plentiful, of *uber*, udder, in *Rhetoric*, a redundancy. See **REDUNDANCE**, and **PLEONASM**.

EXUCONTIANI, a branch of Arian heretics. See **EXUCONTII**.

EXVERRÆ, in *Antiquity*, a kind of brush used in cleaning houses, out of which a dead person had been carried.

EXULCERATIO, from *exulcero*, to cause ulcers, in *Surgery*, an incipient ulceration; an excoriation.

EXUMA, in *Geography*, one of the Bahama islands, situated on the east of the Great Bank, between Stocking isles on the S.W. and Long isle on the E.: about 25 miles long and three broad. Although this island is almost uninhabited, it is one of the best of the Bahamas, on account of the fertility of its soil, and the excellence of its anchoring ground, in the found to which it gives name. N. lat. 24° 20'. W. long. 74° 30'.

VOL. XIV.

EXU

EXUMA Sound, a large channel among the Bahama islands, extending from N.W. to S.E., between Cat island or Guanabani to the east, and a range of small islands and rocks to the west and south-west: the entrance is south of the island of Eleuthera. In this found the whole British navy might ride in safety.

EXUMBILICATIO, from *ex*, out of, and *umbilicus*, the navel, in *Surgery*, a swelling in the situation of the navel.

EXUPERY, St., in *Geography*, a town of France, in the department of the Correze; six miles S.E. of Uffel.

EXUSTION, of *ex*, and *uro*, I burn, the act of burning with fire; used in some operations by surgeons. See **BURN**.

EXUVIÆ, formed from *exuere*, to put off, to divest, in *Physiology*, transient parts of certain animals, which they put off, or lay down, and assume new ones.

Such, especially, are the skins or sloughs of serpents, shells of lobsters, and the like; which are annually changed, and renewed in the spring.

The outer integument of the body, which in man and other large animals is so durably fixed on the body, is in many of the animals of the reptile kind much more loosely fixed, and is changeable several times during the period of their lives. The serpent kind all shift their skins several times in their lives, and the water-newt has been lately observed to do the same; but no creature in the world does it so often as the caterpillar, almost every species of their insects throwing off their old skin once in ten or twelve days, or less; and this in such a manner as is extremely worthy of an attentive observation. Malpighi observed that the common silk-worm changed its skin four times during its continuance in that state; the first of these changes happening at eleven or twelve days from its appearance from the egg,

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and the others at the distance of five or six days each; and probably the rest of the caterpillar kind observe nearly the same periods.

Neither is this change of the skin confined to the few creatures we have mentioned; but among the whole insect class, the most numerous of that of all animated beings we know, there is scarcely one species, every individual of which does not throw off its skin, once at least, before it arrives at its full growth. The term changing the skin is scarcely expressive enough for this operation in the caterpillar kinds; for the creature throws off the external covering of every the minutest part and organ of its body, and the skins they thus deposit have so much the appearance of a complete insect, that they are very often mistaken for such, presenting us with every thing that we see in the external appearance of the living animal. Reaumur, *Hist. Inf.* vol. i. part 1. p. 225.

EXUVIÆ, in *Agriculture*, the cast-off parts of animals or their coverings, and likewise the shells and other marine productions which are met with in the bowels of the earth, when they have been deposited for a vast length of time, probably from once living creatures. These are sometimes called *EXTRANEOUS Fossils*, but more commonly *RELICUIA*, which see. They are of considerable variety, and differ greatly in their appearances. All substances of this nature are capable of much use as manures, where they can be procured in sufficient abundance, especially upon all the heavier and more stiff descriptions of soil, as they supply the calcareous principle in some degree, while they have the effect of rendering them more light and open.

EY, in our *Old Writers*, the same with *insula*, an *island*, from which comes *eyet*, a small island or islet, vulgarly called *eyght*. Hence the names of places ending with *ey* denote them to be islands, as *Shappcy*, &c.

EYACH, in *Geography*, a river of Germany, in Wurtemberg, which rises about 4 miles S. of Ebingen, and runs into the Neckar, three miles above Rothenburg.

EYASIOR, a bay on the N. coast of Iceland. N. lat. 65° 50'.

EYBACH, a town of Germany, in the territory of Nuremberg; five miles S. of Nuremberg.

EYBELSTADT, a town of Germany, in the principality of Wurzburg; three miles S.S.E. of Wurzburg.

EYBENS, a town of France, in the department of the Mère; three miles S. of Grenoble.

EYBENSCHITZ, or EWANICE, a town of Moravia, in the circle of Znaym, formerly famous for an assemblage of very numerous religious sects. The Hussites and Lutherans worshipped in the same church; the Calvinists had two churches; the Jews had a synagogue; besides which there were Anabaptists, Quakers, Holy Brethren of Switzerland, Photinians, &c. The inhabitants at present are chiefly Roman Catholics and Jews; 20 miles N.E. of Znaym. N. lat. 49° 8'. E. long. 16° 17'.

EYBENSTOCH, or EYBENSTADT, a town of Germany, in the circle of Erzgebirg; 20 miles S.S.W. of Chemnitz. N. lat. 50° 25'. E. long. 12° 35'.

EYCHENFLIES, a town of Germany, in the principality of Wurzburg; 12 miles S. of Gemunden.

EYCK, HUBERT VAN, in *Biography*, a painter, born at Maaseyk in 1366. He is regarded as the founder of the Flemish school of painting, the Giotto of Flanders; and exhibited, for that early period of art, great genius and skill. In concert with his brother John, he was celebrated for many extraordinary and curious works, executed in oil, after the latter had made his discovery of that mode of painting.

He painted well also in distemper, but gave that up after he adopted the other. One work of his, painted in conjunction with John, was preserved in a chapel of the cathedral of Ghent. Sir Joshua Reynolds saw it there, and says of it, (see his *Journey to Flanders*), "it represents the adoration of the lamb taken from the Apoccalypse: it contains a great number of figures in a hard manner, but there is great character of truth and nature in the heads, and the landscape is well coloured."

It is now among the spoils of the French in the gallery of the Louvre. While it was in Ghent, (at least for a time after being wrought, it was held in such estimation as to be shut up from public view, except on festivals; and at other times was only shewn to ambassadors or princes themselves who desired to see it.

Philip I. of Spain wished to purchase it; but that not being practicable, he employed Michael Coxis to copy it, who spent two whole years about it, and received four thousand florins for his labour from the king, who placed it in the Escorial. This artist died in 1426, aged 60.

EYCK, JOHN VAN, younger brother to Hubert, was born at Maaseyk in 1370, and studied with his brother, though in the end he excelled him.

To him the world is indebted for the first use of oil in painting, which he discovered in the year 1400.

Painters before this wrought their works in distemper, (see *DISTEMPER*), and then to secure them from the action of air and dampness, they were accustomed to varnish them; with what composition it does not appear. Vasari (Part 2, page 213, ed. 1681,) relates that Giovanni di Bruggia, so he calls him, "had painted a picture in the usual way, and having varnished it, set it to dry in the sun's rays, as was customary; but either from the wood being ill seasoned and ill put together, or from the extreme violence of the heat, the picture was cracked and quite spoiled. He therefore deliberated how he should in future best prevent accidents of this nature happening to his works, and endeavoured to make a varnish which would dry in the shade, without the necessity of exposing it to the sun.

"After many experiments, he found at last that oil of linseed and of nuts, were more siccativ than any others he had tried. These, when boiled with other ingredients, made the varnish so much wished for by him and other painters. He afterwards discovered that mixing these oils with his colours gave them a hardness, and in drying not only equalled the water colour, but gave them more brilliancy and force: and that, without the necessity of varnishing afterwards: and he was surpris'd to find also, that they united far better in oil than in water."

The fame of his discovery soon spread over Flanders and into Italy, and when he grew old, but not till then, he imparted his secret to several painters, both Flemish and Italian. And it must be confessed the art of painting is very highly indebted to him for this foundation of the wonderful success with which succeeding ages have profited by this very useful discovery.

As a painter he possessed very good talents, considering the early period of the art. He copied his heads generally from nature; his figures are seldom well composed or drawn. But his power of producing richness of positive colours is surprising, and their durability no less so. He paid great attention evidently to nature, but saw her in an inferior style. He laboured his pictures very highly, particularly in the ornaments which he bestowed with a lavish hand, but with all the Gothic taste of the time and country in which he lived. In the gallery of the Louvre is a picture of the "Divine Being," as he chose to call it, represented

presented by an aged man with a long beard, crowned with the pope's tiara, seated in a chair with golden circles of Latin inscriptions round his head, but without the least dignity of character, or evident action or intention. It is the very bathos of the art. At the earl of Pembroke's, at Wilton House, is a small picture which does him more credit. It represents the nativity of our Saviour, with the adoration of the shepherds, and the composition consists of four figures, besides the Saviour and four angels, and has in the back ground the anomaly of the angels at the same time appearing to the shepherds. It is in oil, and the colours are most of them very pure, except those of the flesh. The garment of Joseph is very rich, being glazed (see *GLAZING*, in *Painting*;) thick with red lake, which is as fresh as if it were new. Almost all the draperies are so glazed with different colours, and are still very clear, except the virgin's, which, instead of maintaining its blue colour, is become a blackish green. There is a want of harmony in the work, but it is more the effect of bad arrangement of the colours than the tones of them. The glory surrounding the heads of the virgin and child is of gold. We have been the more particular in stating these circumstances of this picture, because our readers will naturally be curious to know how far the original inventor of oil painting succeeded in his process, and they will see by this account that he went very far indeed, in what relates to the perfection of the vehicle he used, which, if he had happily been able to employ as well as he understood, the world would not have seen many better painters. He lived to practise his discovery for 31 years, dying in 1441, at the advanced age of 71.

EYDY ENGLY, in *Geography*, a town of Hindoostan, in Vihapour; 14 miles S. of Galgala.

EYE, in *Anatomy and Physiology*, the organ of vision. The eye-ball is the immediate agent in refracting the rays of light, and in collecting them into one point, so as to form an image of the object from which they are reflected. For this purpose we find in it a series of perfectly transparent parts, which execute the various refractions; a nervous pulp, on which the rays of light thus refracted make an impression to be conveyed to the sensorium by the optic nerve; and certain membranous opaque coverings, containing the above-mentioned parts, and supporting them in their relative situations. The visual organ, simple, when thus considered, becomes much more complicated, if we include in our definition all the apparatus added for the purposes of protection or assistance. The muscles which move the globe in various directions, the eye-lids, which cover and protect it in front, and the parts which secrete the tears, and convey them into the cavity of the nostril, are all so intimately connected in situation and function with the globe, that a regard to natural arrangement leads us to include them in the same article; in which we shall consider, first, the anatomy of the whole apparatus, and afterwards the physiology of vision.

The eyes are two in number, exactly symmetrical, placed in two bony cavities, called *orbits* which are situated under the forehead, and separated from each other by the nose. The detailed description of the orbits will be found under the article **CRANIUM**. The figure of these cavities is that of a pyramid with four unequal sides, directed obliquely forwards, and outwards from the point to the base. The size varies but little in different individuals, and is usually independent of general stature. It exceeds considerably that of the globe, which is supported by much fat and other soft parts, so that it can be moved with great quickness and facility in every direction.

The globe of the eye is situated in the anterior part of the

orbit, nearer to the internal than the external side of the cavity, and is more or less prominent in different individuals. The base of the orbit being truncated obliquely, the eye projects beyond its edge on the external side, while it appears more deeply buried towards the nose. It is supported in front by the moveable eye-lids; on the other sides by its muscles, which, as well the nerves and blood-vessels of the organ, are enveloped in a soft fat, filling the rest of the orbit, and keeping the eye on a level with the face. In the emaciation consequent on age or disease, this fat is absorbed, the eye loses its prominent situation, and sinks much deeper in the orbit; hence the angular edges of the bony cavity are rendered more evident, and the character of the face undergoes a marked alteration.

The size of the eye varies but little in different subjects; its apparent varieties depending in great measure on the larger or smaller opening formed by the eye-lids. It is smaller in the female than in the male, and proportionally larger in the infant than in the adult. The sexual and national differences in the external proportions of the eye will be more minutely considered in the explanation of the plates, which follows the anatomical description.

The figure of the eye represents two portions of distinct spheres, of different diameters, united towards the front. The section of the smaller sphere is transparent, and occupies about the anterior fifth of the globe, projecting from the larger sphere, which is opaque. By this disposition, the axis of the eye exceeds its transverse diameter in a small ratio, of which we shall have occasion to speak more minutely hereafter.

The axes of the globe and the orbit are not the same; that of the latter is directed obliquely outwards, so that, if prolonged behind the apex of the pyramid, it would meet its fellow within the cranium: the axes of the two eyes are parallel, and point directly forwards. The strong cylindrical chord, made up of the optic nerve and its firm investment, enters the orbit in the direction of the axis of the latter, and is attached towards the inner side of the posterior surface of the globe.

The globe or ball of the eye is composed of concentric membranous coats or *tonics*, investing transparent parts of different densities, usually called *humours*. The external covering, which gives the figure to the eye, is firm and thick, formed of two distinct portions; the anterior, which is transparent, is called the *cornea*; the posterior, opaque and white, the *sclerotica*. A certain portion of the front of the globe is covered by a membrane, which connects the ball to the lids, and is called the *conjunctiva*. The inner surface of the latter is lined by a thin opaque membrane, of delicate structure, covered on both sides by a dark coloured pigment, and called the *choroides*: this is plaited on the inner surface of its anterior part into projecting folds, the *ciliary process*, and it is connected by its front edge with another membrane, the *iris*, which floats transversely at a small distance from the cornea, and has a circular opening about its middle, termed the *pupil*. The *retina*, a soft transparent expansion, commencing from the optic nerve, and nearly equalling the *choroides* in extent, lines the inner surface of that membrane. This embraces by its whole internal surface a pellucid body, occupying the greatest portion of the globe, and named the *vitreous humour*. In front of this, and partly imbedded in it, is placed the *crystalline humor*, another transparent body, nearly spherical in shape, and of greater comparative density. The space left between the latter and the cornea, is divided partially by the iris, and filled with a clear watery fluid, named the *aqueous humour*. The rays of light pass through the transparent cornea, the aqueous humour, the

opening in the iris or pupil, the chryſtalline lens, and vitreous humour, undergoing various refractrons in their paſſage, and are finally collected ſo as to form an image on ſome part of the concave ſurface of the retina, from which the impreſſion is conveyed to the ſenſorium.

The coats or membranes of the eye.—The ſclerotic coat (*die ſte Haut*, Germ.) extends from the entrance of the optic nerve to the cornea, covering about four-fifths of the globe, and truncated in front for the reception of the cornea. The external ſurface is covered behind and in the middle by the muſcles of the eye and the ſurrounding fat, and in front by the conjunctiva. The inner ſurface, connected with the choroid by a delicate cellular ſubſtance, by blood-veſſels and nerves, is uſually tinged of a duſky colour by the pigment of that membrane; an effect produced after death by tranſudation, ſince the ſtain is not viſible in an eye examined in its moſt recent ſtate. This ſurface is pierced by numerous ſmall lobes, particularly about the entrance of the optic nerve, and near the origin of the cornea, by which arteries enter directly into the choroid coat; the openings are leſs numerous towards the middle, and give paſſage to veins, and to many ſmall nerves which run through the ſclerotica obliquely, for two or three lines, and lie in ſuperficial furrows of its inner ſurface in their way to the ciliary circle and iris. The ſclerotica preſents in front an aperture nearly circular, of which the tranſverſe is rather longer than the perpendicular diameter. The inner edge of this opening is bevelled off, and the outer paſſes over the oppoſite ſloping edge of the cornea, which is thus ſet in the ſclerotica. A ſmall round opening, appearing on the inſide as a circular ſpot, pierced by numerous ſmall holes, is placed nearly in the centre of the poſterior and thickeſt portion of the tunic, and tranſmits the medullary part of the optic nerve. This is equi-diſtant from the upper and lower parts, but nearer to the inner or naſal, than to the outer or temporal ſides of the globe. It grows gradually ſmaller from its commencement at the outer, to its termination on the inner ſurface of the ſclerotica, the nerve diminiſhing in diameter in the ſame proportion in this part of its courſe.

The ſclerotica is of a white colour. It is nearly a line in thickneſs at the back of the globe, but becomes conſiderably thinner at the front. Its thickeſt part is near the inſertion of the tendons of the recti, which is rather beyond the middle. Next to the cornea it becomes again ſlightly thicker. Its ſtructure is firm and denſe, conſiſting of ſtrata of fibres running parallel to and decuſſating each other in every direction, ſo as to complete a ſtrong fibrous membrane, not ſeparable into layers, at leaſt not in the adult, even after very long maceration. In the fœtus it may be divided into two laminæ throughout its whole extent, the union between them not being very firm. In this inſtance the external layer appears diſtinct, and totally independent of the ſheath of the optic nerve. The thin internal layer is manifeſtly continued from the fine membrane immediately inveſting the nerve. The diſpute, whether the firm ſheath of the optic nerve derived from the dura mater expands as it reaches the bulb, and conſtitutes the ſclerotica, is a point of little moment. The ſheath and the ſclerotica are evidently united moſt intimately, if the membrane is not continuous. Zinn deſcribes the outer layer of the vagina of the optic nerve as collecting, before it arrives at the ſclerotica, into numerous denſe, ſhining, firm fibres, which are inſerted into the poſterior, thick, prominent edge of that tunic, where it is pierced by the medullary part of the nerve. The inner layer, thicker than the external, paſſes deeper between the nerve and the ſclerotica, on the inner ſurface of which it gradually diſappears. The difference between the ſclerotica and the ſheath of the

nerve is marked by the ſudden increaſe of thickneſs in the former, by its white colour, and by its denſe ſtructure, composed of fibres interlacing each other, the ſheath of the nerve being thin, and of looſer texture.

The brilliant white colour of that portion of the ſclerotica covered by the conjunctiva, has been attributed to a peculiar membrane, to which the name of *tunica albuginea* has been given; and it has been ſuppoſed that this coat was formed by the union of the tendons which terminate in front the four ſtraight muſcles of the eye; but theſe tendons are not extended to the cornea, are not broad enough to unite by their edges, and are always diſtinct from each other, and the intervals between them are of equal brightneſs with the parts covered by the tendons. No ſuch tunic in reality exiſts; the ſclerotica ſhining advantageouſly through the transparent conjunctiva is the only cauſe of the brilliancy and whiteness.

The ſclerotica is ſupplied by veſſels from the ciliary arteries and veins; they are few in number, and capillaries in ſize. We can obſerve in it no traces of nerves. It is elastic, and capable of undergoing very conſiderable extenſion, as obſerved in hydrophthalia. The chief uſe of this tunic appears to be that of defending the delicate parts it contains, giving the figure to the eye, offering an inſertion for its muſcles, and ſupporting its veſſels and nerves.

In the fœtus it is comparatively thin and feeble, its colour is not ſo decided, and from its ſemi-transparenteſs the colour of the choroid can be diſtinguiſhed through it. It is more particularly behind that the ſclerotica has a blueiſh tint from this cauſe; it is leſs evident anteriorly, the membrane being rendered more opaque by the tendons of the different muſcles.

The cornea (*horn-haut*) is the transparent ſubſtance encaſed in the opening left at the front of the ſclerotica; it occupies, therefore, about the anterior fifth of the eye. Its form is not quite circular, the tranſverſe diameter being rather longer than the vertical. Its convexity is greater than that of the ſclerotica, the cornea appearing as a ſegment of a ſmall ſphere placed on the truncated plane of a larger. Anteriorly, it is covered by the conjunctiva, which at this part is very delicate, and adheres firmly to the cornea, giving it a ſhining poliſhed ſurface. They are eaſily ſeparable by long continued maceration. The poſterior ſurface of the cornea is concave, and lined by the membrane of the aqueous humour, conſtituting the anterior limit of the anterior chamber of the eye. The circumference of the cornea, cut obliquely, ſlides under the edge of the ſclerotica, ſloped in the contrary direction, ſo that the two parts touch by a conſiderable extent of oblique ſurfaces; the ſclerotica advancing on the cornea anteriorly, while the latter paſſes under the ſclerotica in the oppoſite direction. The conſequence is, that the anterior circumference of the cornea is leſs than the poſterior: the chord of the ſegment formed by the external convexity is deſcribed by Petit as equal to five lines, that of the internal to five and a half.

The cornea and ſclerotica are united to each other ſo intimately, that the former was for a long time regarded as a transparent continuation of the ſclerotica; but the form, organization, and properties, as well as the diſeaſes of theſe tunics are ſo different, that we have no heſitation in conſidering them as diſtinct. Further, by long continued maceration, and then plunging the eye into boiling water, they come eaſily apart in a pretty regular line, the connection by cellular tiſſue being entirely deſtroyed. The line of ſeparation is not equally marked in every animal, neither is the figure of the correſponding ſurfaces the ſame as in man; in every inſtance, however, the cornea and ſclerotica are diſtinct,

distinct, though the union differs in its manner and degree. The cornea possesses a middle thickness between those of the anterior and posterior portions of the sclerotica: in this respect it is nearly uniform throughout, except at the edge, where it is fitted into the opening left in the sclerotica. Here its margin is accurately defined by a double groove, marking the union between it and the sclerotica. It is to this groove, distinguishable from the bordering part of the sclerotica by its dark colour, that the anterior edge of the ciliary circle of the choroid coat firmly adheres.

The cornea is composed of an indeterminate number of concentric laminae, connected by a fine tissue, the cells of which are filled by a transparent fluid; to use the words of Zinn, "areolæ aquâ pellucidissimâ semper sunt ebrizæ." The external layers are more easily elevated than the internal; they are often separated by diseases, an effusion of pus or blood taking place between them, or lymph being deposited so as to destroy the transparency of this membrane. The cornea has not, in its healthy state, any vessels carrying red blood, but is supplied by exhalants, which secrete the fluid of which we have been speaking. No nerve has been traced into its substance. The pellucid fluid contained in this membrane does not exude in the living state, but is constantly absorbed and renewed. After or a short time before death, it is supposed to ooze out gradually, and form that obscure film before the cornea which destroys its transparency. This is not visible in subjects who die suddenly; but where the disease has been of long continuance, the obscurity of the cornea begins sometimes before death, the loss of brilliancy being often regarded as one of its forerunning symptoms. The aqueous humour does not pass through the cornea during life; after death it evidently does, the eye becoming flat and wrinkled; its tension may be soon restored by immersing it in water. Zinn believes that the obscure pellicle, observed on the cornea after death, consists of the conjunctiva in an opaque state, since it cannot be washed off, but may be removed by careful dissection with the knife. The cornea is not so elastic as the sclerotica, nor capable of undergoing equal extension; it will, however, recover its former dimensions, after being stretched, as is proved by an experiment of Mr. Home. It gives no mark of sensibility when wounded, at least in its healthy state; it may when in a state of inflammation, and its vessels at such time carry red blood.

In the fœtus it is rather more prominent than in the adult; and is described as being thicker, the interstices of the laminae being larger, and containing a greater quantity of fluid, so as to diminish the capacity of the anterior chamber, and to approach, by its concave surface, nearer to the iris. It can be reduced to half this thickness by compression. These observations have been made by Zinn and Petit: the deficiency of aqueous humour and this particular condition of the cornea was supposed by the latter to be one cause of the obscure vision of infants. It does not lose its brilliancy after death to so great a degree as in the adult; which is attributed to its not allowing of transudation with equal facility. For the same reason it scarcely decreases in volume under the same circumstances. The cornea has been sometimes observed to be partly ossified in old age; the occurrence is, however, extremely rare.

The choroides, or, perhaps more properly, the chorioïdes (gefafs-haut) forms the second coat of the eye, lying immediately under the sclerotica. It extends from the entrance of the optic nerve to the circumference of the cornea. The external surface is every where connected with the sclerotica by a fine cellular tissue, by numerous vessels passing between these membranes, and by the ciliary nerves. This

tissue is more abundant in the fœtus than in the adult, and more particularly surrounds the large vessels and nerves. It connects the two coats pretty closely, but is so delicate as to allow of their being easily separated from each other by impelling air between, the connection being preserved only by the vessels, which have a greater degree of firmness. It is more abundant near the cornea, and forms the basis of the ciliary circle. The internal surface of the choroid is in close and accurate contact with the retina at all points; but the two parts are not united by the medium of vessels, or cellular tissue. The posterior part of the choroid presents a small round hole, through which the medullary fibres of the optic nerve pass. It was long supposed that the choroid coat was continued at this spot from the pia mater, or the thin membrane immediately investing the optic nerve. More accurate examination, however, has proved that they are not continuous membranes. As the choroid approaches the entrance of the optic nerve it adheres more firmly to the inner surface of the sclerotica by means of the numerous ciliary arteries, and the cellular tissue surrounding them. The pia mater of the optic nerve, after perforating with it the holes in the sclerotica, is reflected on all sides, forming a small ring, and lost on the inner surface of that tunic. At this part the choroid adheres to the pia mater very closely by cellular tissue, surrounding the rising medullary papilla, from which the retina has its origin, by a circular and well defined margin. This is very evident by dividing the optic nerve longitudinally at its entrance into the eye. The choroid terminates in front by a wide aperture, nearly at the point of union between the cornea and sclerotica. Just before it ends we observe it folded into the ciliary processes, and forming on the outer surface, by its altered structure and appearance, the *orbiculus ciliaris*, the anterior edge of which is intimately connected with the iris.

The choroid is very delicate, thin, and easily torn. It is of a reddish brown colour on each surface. On the outside this colour is inherent in the structure of the membrane, and does not depend on the deposition of any colouring substance externally to its tissue. In the perfectly recent eye, the finger is scarcely stained by wiping it, neither does it tinge water, if suffered to remain in it for a few days. After that time the coloured tissue is softened, and parts with some of the colouring matter. On the internal surface of the choroid this colour is more decided, and depends evidently on a dark kind of mucous secretion, called *pigmentum nigrum*, included in a fine cellular tissue, increasing in quantity and intensity as we approach the anterior margin, where it takes a blackish tint. Towards the entrance of the optic nerve the pigmentum is much thinner, the structure of the choroid appearing through it. It seems to be a peculiar secretion from the vessels of the membrane, occupying both sides of the vascular tissue, but more particularly its inner surface. It is described by Hunter as a "substance approaching to the nature and appearance of a membrane lining the choroid coat; and somewhat similar to the rete mucosum which lies under the cuticle of the human body; there is also some of the same kind of substance dissolved through the cellular membrane, which unites the choroid with the sclerotic coat." When it has been washed away by maceration, the inner surface appears villous. The colouring matter is not altered sensibly by heat, nor by any chemical tests of whatever nature to which it has been subjected: the colour is in some cases deepened as to intensity, but never changes.

The choroid is formed by almost innumerable arterial and venous vessels, united by a fine cellular tissue, into the form of a membrane. On examining it from without, after carefully

fully removing the sclerotica, we observe, first, the flat ciliary nerves, lying externally to the vessels, running forwards on the convex surface. Besides these nerves we can generally see two vessels, rarely more, one on each side; which having penetrated the sclerotica at its back part, run horizontally forwards, giving scarcely any branches to the choroid, and divide at the ciliary circle. They are the long ciliary arteries, and are frequently filled with blood. Under these arteries and nerves are numerous vessels, about the middle of the choroid, arranged in a particular form, and called on this account *venæ vorticosæ*. There are usually three venous trunks from which branches are thrown off on each side, forming irregular parallel arches, meeting each other in the intervals between the trunks. In a recent eye these vessels are filled with blood, and are very apparent. By immersing the choroid in alcohol, they become of a white colour, and are then still more readily distinguishable from the other vessels. The intervals between these veins are occupied by the ramifications of the short posterior ciliary arteries, appearing as dark-coloured threads lying under the arches. These arteries pierce the sclerotic near the entrance of the optic nerve; in the first instance they are on the external surface of the choroid; but as they advance they dip under the branches of the *venæ vorticosæ*, and approach the inner surface of the membrane. These numerous branches are given off at very acute angles, and are directed immediately forwards, forming an extremely fine net-work on the inner surface, so that the angular meshes are only visible when considerably magnified. The disposition of its vessels gave rise to an opinion that the choroid was composed of two layers, an external, formed by the veins, and an internal, by the arteries. The latter has been named *tunica Ruyschiana*. This distinction is now completely rejected by the best anatomists, who agree in considering the choroid as a simple membrane. After long maceration it becomes almost transparent; and at this time the singleness of its structure is sufficiently evident: when held between the eye and the light it appears as a net-work of vessels crossing in every direction, and not separable from each other. Parts of it have been occasionally found ossified.

At the distance of a line or more from the cornea, the external surface of the choroid begins to be enveloped in a grey, soft, short, pulpy tissue, of moderate thickness, representing a circular belt, to which different names have been attached. It is usually called the *orbiculus ciliaris*, or ciliary circle; it is described also under the names of *ligamentum ciliare* and *plexus ciliaris*: Zinn calls it *annulus cellulosus*; Soemmerring, from its structure made up "*nervis ciliaribus, vasisque his intermixtis sanguiferis*," describes it under the term of *annulus gangliiformis*. It is more than a line in breadth; its anterior part thicker and closer in structure than the posterior: it adheres with some little firmness to the sclerotic at the groove observed in the latter, close to its inner connection with the margin of the cornea. It may be easily separated by the finger, but is strong enough to resist the impulse of air driven between the choroid and sclerotic coats by the blow-pipe. Fontana has described a triangular canal as running along the circle of this spongy substance, intermediate to its connection with the sclerotic. It has been noticed since by Soemmerring, and particularly by Murray, and is partly formed by the groove at the edges of the cornea and sclerotic. It is filled by an aqueous fluid. The ciliary circle is united more closely with the choroid, and can scarcely be separated from it without tearing the latter. It is always of a whitish, or grey colour, very distinct, therefore, from the dark-coloured choroid; and not so broad as the ciliary processes within. It receives in its substance

the ciliary nerves and arteries in great abundance in their passage to the iris. The ciliary circle marks the line of distinction between the choroid and iris.

The iris was for a long time described as a direct continuation of the external layer of the choroid; and the ciliary processes of the internal. The simplicity of this membrane has necessarily destroyed that opinion; and it appears that the iris is a distinct membrane, both in its structure and functions, separated from the choroid by the *orbiculus ciliaris*, in the anterior margin of the substance of which it seems partially encased, the outer edge of this circle projecting forwards beyond that of the iris, as may be seen after the cornea and sclerotic have been carefully removed.

The inner surface of the front of the choroid forms the ciliary processes, which are thin plaits disposed in the manner of radii round the chryalline lens, and lodged in corresponding depressions of the vitreous humour. The ring made by the union of these plaits, considered as a whole, is called the *corpus ciliare*. On making a perpendicular section of the eye from right to left behind the middle of the sphere, with an attention to disturb the connections of the several parts as little as possible, we observe, on looking into the anterior section, through the pellucid vitreous humour, a dark ring, resembling the disk of a radiated flower, surrounding the chryalline lens. It is two lines in breadth, and rather narrower on the nasal side than on the temporal. It is terminated posteriorly by a serrated, undulating, accurately defined and black margin. Nearer to the chryalline it presents white streaks with black intervals placed alternately, so that apparently two rings are formed, the posterior and widest of an uniform dark colour, the anterior composed of white and black lines alternately. The white lines are the edges of the ciliary processes, and the black interstices the depressions between them covered by *pigmentum nigrum*. When the membrane is removed from the vitreous humour, especially if the eye is not recent, a great portion of the pigment is left on the surface of the latter, giving an impression corresponding inversely to the opposite appearance of the processes. In the eye of the new-born infant this is still more remarkably the case. In the recent eye of the adult this dark varnish remains deeply fixed on the substance of the intervals of the processes, and requires much washing and maceration, in order completely to remove it.

After a careful absterion of the pigment it is very evident that the *corpus ciliare* is a direct continuation of the choroid. It is of a grey colour, lighter towards the iris from the white colour of the ciliary circle on its outer side. The *corpus ciliare* is concentric posteriorly with the sclerotic; farther on it gradually quits it by the interposition of the ciliary circle, and turns inwards towards the lens, corresponding more to the convexity of the vitreous humour than to the concavity of the sclerotic. The projecting folds will now float freely from one side to the other, when immersed in water, being restrained by no transverse lateral connections. On a close examination of these parts we may observe the ciliary processes rising from the inner surface of the choroid, about a line and a half from the iris, by two or more almost imperceptible striæ "*lineolæ tenuissimæ*," which soon unite to form a single fold, increasing in depth the nearer it approaches the chryalline lens. The number of the ciliary processes varies from sixty to eighty, but is generally nearest the former of these numbers and sometimes below it. They are alternately longer and shorter. Of the three edges formed by the triangular fold, the posterior is slightly denticulated, concave, and lodged in the opposite groove of the vitreous humour; the anterior, convex, is the base rising from the choroid, the internal,

not a line in length, measures the space between the great circumference of the iris and that of the chrySTALLINE; it is evidently denticulated. Of the three angles, the one corresponding to the chrySTALLINE is rounded, passing a little in front of the anterior part of the capsule, without, however, forming any connection with it. Zinn, who appears to have investigated this point with his usual accuracy and minuteness of research, is decidedly of opinion that the ciliary processes are not adherent to the capsule of the lens; "non unicâ fibrâ, aut ullo vinculo capsulæ lentis adnectuntur." Haller believes that the ciliary processes support the chrySTALLINE lens in its situation, not by any immediate connection, but by the intervention of the vitreous humour, with which they certainly have a tolerably intimate connection. He agrees with Zinn in not allowing them to be muscular. The angle corresponding to the great margin of the iris is joined to it, and to the round edge of the ciliary circle, by vessels and cellular tissue: at the line of union several straight lines are seen going off on the posterior surface of the iris to the edge of the pupil. The posterior angle is much elongated, and terminates in the fine striæ we have mentioned on the inner surface of the choroid. The surface of the ciliary body, but more especially the intervals of the processes, is covered by a very dark mucus, much deeper in colour than that which lines the rest of the choroid: it is nearly black. The posterior edges of the processes not being covered by it, appear of a light grey. When the pigment has been washed off, the surface of the corpus ciliare appears villous, like that of the choroid behind: it is generally rugous. The structure is made up wholly of vessels united by fine tissue, as the rest of the choroid; we do not believe them to possess any muscularity, or any power of motion. The arteries come from the short ciliaries, which, after having run parallel to each other on the internal surface of that membrane, pass into each ciliary process to the number of twenty at least. They run in a serpentine course along the fold, giving off numerous branches, which, by their multiplied divisions and frequent anastomoses, form an extremely fine net-work. When they have arrived at the floating edge they turn in one towards another, and anastomose, forming concentric arches. The veins of the ciliary processes join the venæ vorticossæ of the choroid.

The choroid in the fœtus, at the time of birth, is well formed: it may be detached easily from the scleroticæ and cornea, leaving on the first a reddish tint. Its outer surface is of the same colour as in the adult: the pigmentum on the inside is black instead of brown; is less fluid, and more strongly fixed. After it has been removed, the choroid retains a sensibly red colour, derived from its very vascular organization, and differing from that in the adult, under similar conditions. Towards the optic nerve, where the pigmentum is in smaller quantity, the reddish choroid is very apparent. The ciliary circle is not so fully marked as in the adult, and adheres but weakly to the scleroticæ. The ciliary processes are comparatively more developed, and are very distinct: they are of a reddish colour, but not so deep as the posterior part of the choroid.

The iris, (regenbogenhaut, oder blendung.) so called from the variety of colours on its anterior surface, is a plane membranous ring, floating in the aqueous humour, subtending the segment of the sphere, formed by the circumference of the cornea, and dividing the anterior from the posterior chamber of the eye. It is perforated by a circular opening, called the pupil, (lichtloch, oder seheloch, Somm.) This aperture does not occupy the centre of the iris, but is rather nearer to the nasal than the temporal mar-

gin of its great circumference; hence the iris is broader, by about one-fifth, towards the temple than on the side next the nose. The diameter of the opening varies very considerably, according to the quantity of light directed on the retina. The anterior surface of the iris corresponds to the posterior concavity of the cornea, separated from it by a space called the anterior chamber, which contains by far the greatest portion of the aqueous humour. This surface is flat, and very differently coloured in different individuals. It is brilliant, and we can distinguish in it an external wider circle of a light r, and an internal narrower ring of a darker; often of a different tint. On this surface also we see a number of striæ, more or less serpentine, or parallel, large or small, converging towards the lesser circle, on which the striæ are not so numerous, or so conspicuous. The distinction between them depends more on their colour than on any elevation above the surface; and they are more serpentine in proportion as the pupil is dilated, and the iris contracted. The posterior surface of the iris is opposite to the anterior convexity of the chrySTALLINE, separated from it by a narrow space, the posterior chamber of the eye, filled by the lesser part of the aqueous humour. It is covered by a thick, dark coloured mucus, nearly black. Here also, when the colouring matter has been washed off, we observe straight lines converging to the centre of the pupil, but very distinct from those on the anterior surface. This surface was formerly known by the name of *uvea*. The great circumference of the iris is let into the thickness of the anterior edge of the ciliary circle, at the line where the cornea terminates internally. It may be separated without any laceration by the finger, or more easily still by maceration in water.

Although the appearance of the two faces of the iris is very different, we cannot in the human subject make any division of it into two layers, though this is the case more or less in other animals. It appears as a simple membrane, made up of vessels, nerves, and membranous fibres. When examined with the assistance of a magnifying power, the two circles on the anterior surface of the iris appear composed of numerous fibres, converging from the circumference of the iris towards the pupil, and distinguished from each other chiefly by their colour. The longer ones are generally white; the shorter are finer, and of a darker colour. They are tortuous when the pupil is dilated, and nearly straight when it is contracted. When they arrive at the circumference of the lesser circle, the larger of these fibres divide into two branches, separating at oblique angles, and inclining towards similar branches with which they unite, to form an undulating or denticulated circular line, dividing the greater annulus from the smaller. From this margin there depart several delicate fibres, similar in their course to the larger striæ, which converge as radii towards the pupil, and form the lesser ring of the iris, by which that opening is immediately surrounded. Haller, who minutely describes the appearance of the iris under the magnifying power, agrees in the principal features of his account with the one here given. He says that several of the radiated striæ are collected into flocculi, and that these united make a ferrated arch, convex towards the pupil, at the margin of the lesser circle, the flocculi being "varie in stammulas quasdam introrsum euntes dispositi." This radiated structure is covered by a fine transparent membrane, of which we shall speak below, as including the aqueous humour. When the pigment has been washed from the back of the iris, this surface appears of a whitish colour, and presents a great number of rising straight lines, converging from the circumference to the pupil, appearing almost as continuations of

the ciliary processes. These lines, totally different from the radiated and serpentine striæ on the anterior surface, become more prominent, forming a kind of plait when the iris is extended, so as to augment its breadth. As they approach the pupil, they are gradually effaced, but with a highly magnifying power may be traced to the opening of the pupil. No circular fibres are in any case visible. The regular disposition here described is not visible to the naked eye: we can observe irregular lines converging towards the pupil in the living subject, but cannot by any means discern their exact disposition. After death they are still less apparent.

The long ciliary arteries are the chief source from which the iris derives its supply of blood. These vessels, two in number, one on the nasal, the other on the temporal side of the eye, run between the choroid and sclerotic coats, till they arrive at the ciliary circle. Here they divide usually into two principal branches, going off at very obtuse angles, which advance to the circumference of the iris, where the two branches of one artery anastomose with those of the opposite, so as to form an arterial circle, corresponding nearly to this circumference. From this arterial ring, augmented by the accession of the anterior ciliary arteries, are produced a great number of small branches, more or less parallel, or tortuous, directed towards the pupil, and anastomosing freely by lateral communications. On arriving at the lesser ring of the iris, many of these bifurcate; their branches anastomose, and produce another vascular circle, corresponding to the circumference of the lesser ring of this membrane, from which other radiated vessels go to the margin of the pupil. This circle, however, is by no means so regular as that round the circumference of the iris; and many branches from the latter pass on, without joining it to the lesser ring, and to the pupil. With these arterial ramifications many veins are intermixed, which join, some the *venæ vorticosæ*, others the veins accompanying the long, and the anterior ciliary arteries. The ciliary nerves, which we have before described as entering the ciliary circle, divide in that part into numerous fine threads, running towards the anterior surface of the iris, into which we can trace them but a very short way: they soon become so confounded with the fibres before mentioned, as to escape all research, even by the assistance of the microscope.

The iris then appears as a membrane composed principally of arterial and venous branches and nerves, connected by membranous tissue. The fibres arise probably from the disposition of the latter of these parts, and totally differ from those of a muscular kind both in structure and functions. A supposed necessity of assuming their muscularity, in order to account for the motion of the iris, has alone given rise to that opinion, which is now rejected by the most eminent physiologists. Numerous membranous flocculi are described by Zinn on the anterior surface of the iris, plainly distinct from the vessels; they in some measure float in the aqueous humour in the intervals of the radiated fibres before described, producing, in conjunction with these two, innumerable refractions of the luminous rays.

The various colours of the iris in the same, and in different individuals, essentially depend on the pigment which covers the posterior surface of the iris, which gives the prevailing shade of the tint. For if this is removed, the iris is nearly transparent. The exact nature or immediate cause of these colours is unknown. Soemmerring observes, that the lighter the colour of the pigmentum and of the iris, the more delicate are the coats of the eye, and the converse holds equally good; the darker the eye, the fewer are the ciliary plicæ. The colour of the pigmentum corresponds in some degree

with that of the hair and skin. In the human subject it is most commonly dark. In many classes of animals, there is a difference of colour in the same eye; in the cow, or sheep, for instance, there are, in the same eye, certain portions of a silvery white, and others of a fine green colour, the remainder being black. In the human species we see different shades from nearly black to nearly white; and we find these to correspond in a striking manner with the colour of the skin and hair, if we trace it from the black iris, and skin of the African negro, through the different races of men, to the fair skin and light eyes of the northern European. We sometimes meet with persons whose skin and hair are very white, and yet the iris is dark, which is a sign of a dark pigmentum; but if we examine more carefully, we shall also find that the eye-lashes are dark. The iris of one eye is often lighter in colour than that of the other, and sometimes only one-half of the iris is white. Whether this difference in the same individual is owing to the pigmentum being different in colour, is not, we believe, ascertained. The iris is totally white in the wall-eyed horse. In the Albino, of whatever race, the iris is somewhat white, but almost pellucid, slightly tinged of a colour between a pale violet and red. The pupil is of a full pink, or rather red. These phenomena are caused by the deficiency of the pigment, the tinge arising from the numerous blood-vessels of the iris and choroid coat; and correspond with the total want of colouring matter in the rete mucosum. For other peculiarities in the eye of the Albino, or *Leucæthiops*, we refer the reader to the description of the first plate illustrating the anatomy of the eye. In all cases the colours of the iris, the "*stupendæ colorum varietates*" are very much clearer when seen through the medium of the aqueous humour, which evidently augments their intensity; when the cornea is removed, and the aqueous humour dissipated, they lose much of their brilliancy.

The iris possesses but little sensibility in its healthy state; its motions are involuntary, and depend not on any direct excitation, but on the quantity of light falling on the retina; rays of light, so directed as to fall only on the iris, have no visible effect in altering its figure. It changes most plainly and rapidly when the eye is brought suddenly near to the flame of a candle, or removed from a light to a darker place. In the first case the breadth of the iris is increased, and the pupil proportionally contracted; in the second the converse may be observed. This alteration in the diameter of the pupil is connected in some degree also with the closeness or distance of the object. The iris, in all its motions, appears to possess a peculiar mode of action, observed in no other animal tissue. Its dilatation diminishes the pupil, and its contraction widens that opening. Here then the presence of the stimulus produces an elongation of its parts, and its absence their contraction, the inverse of what happens in muscular action. That the iris acts sympathetically only, is further proved by its loss of motion in paralytic affections of the retina, as in *gutta serena*, the pupil being in these cases widely dilated. This affords another argument to shew that the contracted state of the iris is the state of rest, and that this part moves only in consequence of the action of light on the retina. Farther, its motion ceases at the moment of death, and cannot, like that of muscular fibres, be renewed by the application of stimuli. The very different diameters of the pupil in the dead subject depend on the state of the iris at the instant of dissolution, and constitute a further argument against its muscularity. The motion of the iris has been ascribed to the sudden turgescence or depletion of its vessels; the former condition increasing its breadth by making the serpentine

entine vessels straight. But no such change can be observed in the tremulous and delicate iris of the albino, which seems made up almost wholly of vessels, and the motion of the iris continues unimpaired when the action of the heart is occasionally interrupted. Blumenbach believes the cause of its motions to depend on its *vita propria*, or peculiar vital properties, as the iris, “*tam quod ad fabricam et vividissimum in multis animalibus colorem, &c. quam quod ad motum, nulli plane in universo animali corpore analogum, tam multa habet singularia, et propria.*”

In the infant, at birth the iris is covered at the posterior surface by a very large quantity of dark pigment. In the fœtus, before the end of the seventh month, the opening in the iris, the pupil, is occupied by an extremely delicate membrane continuous with its margin, called the *membrana pupillaris*, (*lichtlochshaut.*) It is supplied by many vessels derived from those of the iris; yet it differs from that membrane very materially in structure and appearance. The *membrana pupillaris* is extremely thin and transparent, while the corresponding edge of the iris is thick, and covered by a layer of the dark pigment. Soemmering particularly mentions it as an independent membrane. It gradually disappears before birth, at which time no vestige of it remains; its particular use is unknown. It has occupied the pens of Albinus, Hunter, Haller, Walter, Wrisberg, and Blumenbach. Wrisberg has given a paper on the subject in his “*Commentationes Medicæ,*” Gött. 1800.

The *retina*, (*mark-haut,*) deriving its name from the reticulated disposition of its component parts, forms the third membranous investment of the eye, being situated immediately between the choroid coat and vitreous humour. As it is connected directly with the optic nerve, we shall introduce here some remarks on the latter. The optic nerve, after decussating its fellow, with which it is most intimately connected, passes into the orbit by the foramen opticum, covered by a firm sheath derived from the *dura mater*. It now assumes a cylindrical form, and pursues rather a serpentine course forwards and outwards, receiving in its passage a small artery and vein. It soon after enters the globe of the eye, on the inner or nasal side of its axis. As the nerve approaches the eye, the fasciculi of opaque pulpy fibres gradually diminish in size, and increase in number by an irregular sub-division, till they terminate in the retina. Near the eye, where the fasciculi are most numerous, the substance of the nerve has a considerable degree of transparency, from the number of interstices between them, filled by a transparent jelly. At this part also we observe in the middle of the substance of the nerve small vessels running in its axis, the central artery and vein of the retina. On arriving at the bulb, the sheath of the nerve becomes connected with the sclerotic in the manner already described. The nerve contracts, forming an irregular cone, the temporal side diminishing more than the nasal, so that if divided vertically, the inner section of the cone would be the thickest. The convex end of the cone having traversed the thickness of the sclerotic coat, meets with a thin concave layer of membrane, (*lamina cribrosa,*) intimately united with the inner edge of the opening in that tunic, and perforated by numerous foramina. Through these the medullary fibres of the nerve are transmitted, there being a larger hole in the middle (*porus opticus*) for the central vessels. The convex end of the nerve, covered by this perforated membrane, projects towards the inside of the eye, and the medullary part of it forms within the membrane a conical white papilla, with a depression in the middle. This prominent disk may be distinguished from within by its projecting beyond the level of the retina, and

by the difference of its colour. From this circle the retina spreads under the choroid as far as the commencement of the corpus ciliare. It has no connection with the choroid, being simply in contact with it, and receiving no tinge from the pigmentum. The concave surface of the retina embraces closely the vitreous humour, but has apparently no further union with it than what is derived from the passage of the central artery into that body. The anterior margin of the retina corresponds to the great circumference of the corpus ciliare, the choroid beyond this line being in immediate contact with the vitreous humour. The termination of the retina at this line has been doubted by many anatomists, who maintain that it is continued over the vitreous humour to the edge of the chrySTALLINE. They assert that a very delicate layer is continued from its apparent termination between the ciliary processes and vitreous humour, to the edge of the chrySTALLINE. In order to see this part the choroid must be carefully removed, and the eye immersed in water, when the prolongation of the retina becomes evident. That a delicate membrane really adheres to the anterior part of the vitreous humour would thus seem clear, but whether it is a continuation of the retina admits of doubt. If the examination be made in a recent eye, the latter membrane terminates most decidedly at the edge of the ciliary processes. Insertion of the eye in spirits gives to the vitreous body an opaque and pallid surface, which may be mistaken for a continuation of the retina. But the retina easily separates from this apparent prolongation, and appears to end by a regular, acute, and well-defined margin, very different from what we should expect if the membrane had been lacerated. We believe its termination to be at the great circumference of the corpus ciliare, and consequently more than a line from the circumference of the chrySTALLINE lens.

In all other animals that have a corpus ciliare the retina terminates as we have described. In birds it forms a projecting roll at this part. In animals which have no ciliary processes the retina ends suddenly towards the commencement of the iris, and it is manifest that the anterior surface of the vitreous body retains no portion of it. It further appears that an instrument passed into the eye, in the human subject, behind the ciliary processes, occasions acute pain, which is not the case if the wound be made anterior to their commencement. And we have no example in the animal body where the medullary part of a nerve is continued into a membrane of no sensibility, whose only use could be that of supporting the soft parts within it.

The retina in the living subject is most perfectly transparent; it becomes of a pale white soon after death. It possesses some thickness, but is so soft as to be torn with slight force. It is formed essentially by a medullary substance continued from the optic nerve. When examined attentively as it lies spread over the vitreous humour, we observe in it many transparent lines, distributed without any regular order, united by other transverse lines, between which opaque areole are visible. These lines are probably the ramifications of vessels of the retina. For in addition to the medullary pulp, of which the retina is composed, this membrane presents a vascular and filamentous network, occupying its inner surface, made up by the central vessels, and a very fine tissue supporting them. On this network the medullary part rests, so that the retina may be almost described as being composed of two layers. It is, however, impossible to separate them throughout, even by maceration. On the outer, or temporal side of the membrane, about two lines distant from the entrance of the optic nerve, and in the very axis of the eye, we observe in the

recent organ a yellow spot, of a deeper colour towards its centre, and of about a line in breadth. It is generally concealed by a fold of the membrane, for which reason it escaped for a long time the researches of anatomists, Soemmerring having been the first who observed and described it. The centre of this yellow spot is perforated by a small hole. These facts are best seen by detaching the posterior part of the sclerotic and choroid coats under water; the eye should be as recent as possible. "In vero retina centro luculentissime tum cernitur foraminulum plane rotundum cum limbo luteo, quod duo vaforum sanguiferorum rami eleganti corona cingunt." The folds surrounding it are thus prevented, and the membrane continuing tense, these appearances are sufficiently evident. They may also be advantageously seen through the transparent vitreous humour in a simple section of a recent eye. In this way, however, it is difficult to prevent the retina from falling into folds. Another method of demonstrating it is, by removing the cornea, iris, and chrySTALLINE. The retina then remains undisturbed, and the foramen, with its yellow zone, is plainly visible in a strong light. Mr. Home says, that it is apparently a little below the posterior end of the visual radius. He observes also, that in separating the vitreous humour from the retina, there is a greater adhesion at this particular part. This spot is pale in children, bright yellow in young persons, and again pale in old age. It has been observed that the intensity of the colour is connected with the state of vision: that it diminishes where that is obstructed, and that the yellow spot entirely disappears when vision is lost. The plait which has been described as extending from this spot to the optic nerve we believe to be only accidental, and caused by the adhesion of the vitreous humour, when the latter has been somewhat displaced in the examination.

The foramen centrale, first discovered by Soemmerring in the human eye, has been since demonstrated in the eyes of several quadrupeds, where these organs are directed forwards, and have their axes parallel to each other.

The central artery gives its principal branches to the retina; a small trunk only enters the substance of the vitreous body. We frequently find the larger of these branches filled with blood, and two of them surrounding the central foramen "instar coronæ." The central vessels exhibit a very elegant appearance, when seen through the transparent lens and vitreous humour, on the surface of the retina. The central artery varies much in its origin, being derived sometimes from the trunk of the ophthalmic, at others from the internal long ciliary, or the inferior muscular. There are sometimes more than one arterial trunk, but the principal always runs on the axis of the optic nerve, and enters with it as before described. The central vein usually corresponds to the artery in its origin and course.

The retina is very completely formed in the full grown fœtus. Its vessels are particularly numerous and apparent. The yellow spot is not visible in the fœtus of nine or eight months; nor can it be observed at all times even in the eye of the new-born infant.

The humours of the eye.—The humours of the eye are three in number; viz. the vitreous, the chrySTALLINE, and the aqueous, each possessing a delicate transparent membranous investment peculiar to itself. The vitreous body (glaskörper) so named from its resemblance to glass, is composed by the vitreous humour, properly so called, and the membrana hyaloidea, which contains it. It is a soft transparent mass, extending from the back of the eye to the chrySTALLINE lens, occupying rather more than three-fourths of the globe, and

possessing a spherical figure, with a depression in the middle of its anterior surface, in which a part of the chrySTALLINE is lodged. Its surface is covered in the greatest part of its extent by the retina, with which it is connected only at its posterior part, as before related. Beyond the termination of the retina it is covered by the ciliary body, and is marked by radiated grooves, into which the ciliary processes are received. It is perfectly pellucid, offering, at first sight, no distinction of membrane, or humour. The membrana hyaloidea contains the vitreous humour, forming its external capsule. Numerous plates of membrane pass from its inner surface, intersecting each other, and thereby forming small cells of different figure and size, in which the humour is immediately held. Towards the commencement of the corpus ciliare this membrane divides into two layers, the internal of which, continuing to cover the vitreous humour, passes behind the chrySTALLINE, whilst the external goes on under the corpus ciliare to the circumference of the chrySTALLINE, attaching itself to the anterior part of the capsule, in which the lens is contained. This layer is described by Zinn under the name of the "membranula, or zonula coronæ ciliaris;" which latter term denotes the radiated circle on the front of the vitreous humour, marked by the pigment of the ciliary processes. This membrane has probably been mistaken for a continuation of the retina. Zinn does not believe it to be a continuation of the outer layer of the hyaloidea, which he asserts to be throughout a simple membrane. Between it and the membrane immediately investing the vitreous humour there is formed a triangular, curvilinear cavity, the base of the triangle being formed by the capsule of the chrySTALLINE. This canal is named from its first discoverer, F. Petit: it was called by him "le canal godronné," from its peculiar appearance. It is covered externally by the black radiated striz of the ciliary processes, and here it corresponds to those processes. Hence we notice in it radiated fibres, equal in number to the ciliary processes, and in contact with their posterior edge. These fibres are not so long as the looser membrane between, which corresponds to the hollows between the ciliary processes. They bind it down consequently from space to space, so that when air is impelled into it, we see this canal godronné alternately elevated and depressed. Being equal in breadth to the corpus ciliare, it must be rather broader on the temporal than on the nasal side. It has no communication with the cavity of the chrySTALLINE capsule. Little is known concerning the intimate structure of the membrana hyaloidea. It receives a few small ramifications from the central vessels of the retina, and secretes, no doubt, the vitreous humour. It is capable of undergoing a certain degree of extension without rupture. Boiling water, or concentrated acids, act but feebly on it, producing only a slight contraction.

The humour may be obtained, from its containing membrane and cells, by pressure, or by making incisions into, and suspending the vitreous body: when thus procured, its quantity is proportionate to the volume of the eye. Its weight, as ascertained by Petit, was 10½ grains in an eyeball which weighed 142 grains. It is somewhat viscous, and perfectly limpid. The specific gravity, as determined by Chenevix, is 10053. It is composed of water, albumen, gelatine, and muriate of soda; and is easily miscible with water, which, even when boiling, produces only a slight opacity.

The arteria centralis sends to the vitreous body a branch called the central artery of the vitreous humour: this passes from behind forwards to the back of the chrySTALLINE capsule, on which it is distributed in a beautifully arborescent form.

form. A few very fine branches from this vessel are spread over the *membrana hyaloidea*.

The structure of the vitreous body may be most advantageously examined in the section of a frozen eye. We then observe numerous icy flakes, separated by membranous septa of the most delicate appearance. These flakes are of different lengths and breadths; they resemble, on the whole, wedges with the base backwards, and the summit forwards; the convex part next the circumference of the vitreous body, and the thinnest directed towards the chrySTALLINE; in other words, they appear as segments of a circle, the centre of which would be in the lens. This structure may be exhibited by means of acids, which render the membrane somewhat opaque; and still better by immersing the vitreous body in a solution of potash, which acts only on the membrane, and gives no degree of turbidness to the contained fluid. The cellular septa may be shewn by allowing the fluid to escape through a simple incision, and afterwards impelling air through the same opening.

The chrySTALLING humour—so called from its transparency, is a lenticular body, situated on the anterior surface of the vitreous humour, which is hollowed to receive it, and enclosed in a peculiar membrane, called its *capsule*. The chrySTALLINE is placed at the distance of about four-fifths from the posterior end of the axis of the eye: but, as its *a* is the same with that of the pupil, and the iris is one-sixth broader on the temporal than on the nasal side, the centre of the chrySTALLINE is rather on the inner side of the axis of the eye, though in the same horizontal plane with it. Its anterior surface is opposite to the back of the iris, from which it is separated by a space called the posterior chamber of the eye, and containing a part of the aqueous humour. The circumference corresponds to the canal of Petit, and to the ciliary processes, which project a little over its anterior surface into the aqueous humour. The two surfaces of the chrySTALLINE are not of equal convexities, the posterior being the most prominent. According to the experiments of Petit, the anterior convexity represents a segment of a sphere, whose diameter would vary from six to nine lines; and the posterior, of a sphere, the diameter of which would be somewhere between four lines and a half and five and a half. These forms of its superficies, however, are by no means constant, the difference of convexity being in some instances scarcely discernible. The chrySTALLINE varies much in figure, transparency, and consistence, according to the age of the subject. It is firmer in old people, and very frequently acquires a yellow tinge. In the healthy adult the chrySTALLINE is perfectly transparent, not of equal consistence throughout, but gradually increasing in density to its centre. The exterior parts are thick and glutinous, and may be rubbed off by the fingers. Those more deeply seated are solid, and appear, after immersion in weak acids or alcohol, disposed in the form of numerous concentric laminæ, harder as we approach the centre. Each of these laminæ is composed of extremely fine parallel fibres lying in a direction from the circumference to the centre. When exposed to air after a short maceration or immersion in alcohol, it further breaks into irregular triangular segments, converging by their points to the centre of the lens, which again subdivide into smaller portions. When immersed in boiling water the soft external parts acquire a milky white colour, and a firmer consistence. In this state it may be easily removed, leaving a nucleus much more solid, of a pearl colour, shining faintly, and not undergoing any further alterations by repeated immersions. Alcohol produces similar effects, but not in so sensible a manner. Long continued maceration changes the chrySTALLINE into a pulpy mass. Exposure

to the air renders it dry, solid, and friable on the surface, the primitive form, and even transparency, being still preserved: in this state it may be kept for a long period. Sections of the dried lens exhibit its laminated structure. Examined chemically, the chrySTALLINE is found to consist of albumen and gelatine, with a very small quantity of water, and has not either any thing acid or alkaline in its composition.

It receives no red blood-vessels; we can trace no nerve even to its capsule; nor does it possess any animal sensibility. Anatomists have even doubted whether this body possess any vital properties. Leeuwenhoek has described the fibres of the chrySTALLINE, and indeed sometimes calls it a muscle. Little can be drawn from such examination, when we consider the very great power of his microscope, and the probably dry state of the chrySTALLINE he examined. Dr. Young has given an apparently accurate description of numerous fibres, with intersecting tendons, in the chrySTALLINE of an ox. These he believed to be muscular, and to possess a power of increasing the sphericity of the part. This opinion he afterwards changed, as we shall notice hereafter. The late Mr. Hunter conceived that the chrySTALLINE could change its figure. He observed the remarkable fibrous laminæ which surround the more solid parts in the cuttle-fish, and concluded the structure to be analogous in other animals, where coagulation develops the fibrous structure. We are disposed to admit of a change of figure in the lens, but the arguments for its muscularity are not convincing. Though it may be separated into spherical laminæ after death, we cannot infer that the pellucid, colourless, viscid lens in the living eye is composed of fibres and lamellæ divided by regular segments. The re-agents above mentioned totally alter its nature, rendering it opaque, and partially friable. The appearance of fibres is equally strong in the coagulated part of the blood, when immersed in the same menstrua. But if we admit the radiated fibres of the several artificial laminæ, the transparent nature and refractive powers of the lens are hardly reconcilable with the idea of muscular action. The lens, in experiments made instantly after death, is not acted on by those stimuli which so evidently affect muscles under similar circumstances. No change of figure, no action of its component parts, can be seen on the application of electricity. In short, if we consider the peculiar appearance of the recent lens, its perfect transparency in a healthy state, and its peculiar diseases; the want of cellular tissue, of red blood-vessels, and nerves, the deficiency of sensibility and contractility, animal, or organic, indeed, of all properties possessed by the common muscular fibre, we must conclude that no sufficient proofs of muscularity exist. A supposed necessity for the presence of muscular fibres, in order to account for certain supposed changes in the figure of the lens subservient to the accommodation of the eye to different distances, has given rise to an opinion, hitherto unwarranted by anatomical investigation.

The chrySTALLINE is contained in a transparent membranous capsule, composed of two portions; one of these is derived from the *hyaloidea*, inserted into the capsule on its anterior surface, beyond its greatest circumference, and already described under the name of *membranula coronæ ciliaris*. This is probably continued over the whole anterior surface, but cannot be demonstrated so extensively; towards the circumference it is manifest by a transverse section of the canal of Petit. The *hyaloidea* is in close union with the posterior part of the proper capsule, but may be separated from it. The proper capsule, thus maintained in its situation, forms a complete bag, between which and the surface of the lens

we find a small quantity of transparent aqueous fluid, more abundant on the anterior side, and escaping instantly when the capsule is wounded, (*aquila Morgagnii*.) Its quantity is very small in the recent eye. Haller believes it to be produced by transudation from the lens; probably it is secreted by the capsule, and prevents the adhesion of the opposed surfaces. The anterior part of the capsule is more elastic than the posterior. The latter, as it can be separated from the hyaloidea, is thinner and softer, but still thicker than that membrane. It contracts and becomes opaque by immersion in boiling water: similar effects, but in a less degree, are produced by acids; it is not altered by alkalies; it becomes yellow by remaining in the air. The texture of the capsule is but little known. It is supplied by vessels from the central artery, which penetrates the vitreous humour. After a minute injection in the fœtus, a small trunk can be perceived coming from this artery, giving off numerous radiating branches on the posterior surface of the capsule. Some of these have been even traced into the substance of the lens; but no such vessels can be seen in the adult. Vessels have been traced also crossing from the choroid processes to the circumference of the capsule. Some of these may be continued to the lens itself; but, if they exist at all, they must be extremely minute.

The *aqueous humour* is a limpid transparent fluid, occupying the curvilinear space between the crystalline, the front of the corpus ciliare, and the cornea. This cavity is divided by the iris into two unequal parts, communicating with each other by the opening of the pupil. The larger portion being between the iris and the cornea, the smaller between the iris and the lens; the first is called the anterior, and the last the posterior chamber of the eye. Much pains have been taken, by freezing the eye, to ascertain the relative dimensions of these. The aqueous humour weighs generally between four and five grains; the exact quantity in each chamber, and the dimensions of these cavities, have been most carefully ascertained by Petit; and the results of his investigations are contained in the *Memoires de l'Academie des Sciences*. The very existence of a posterior chamber has been doubted; but the most accurate researches shew that there is always a space between the front of the lens and the posterior surface of the iris, occupied by aqueous humor.

The aqueous humour resembles the fluid contained in the cells of the *membrana hyaloidea* in its composition; it has the same specific gravity, and the same proportions of albumen, gelatine, and water, and muriate of soda, according to the observations of Mr. Chenevix. It offers the same phenomena when exposed to the action of similar chemical agents. This humour is probably contained in a fine capsule, somewhat similar to those belonging to the other humours. We can observe at least an extremely fine membrane lining the posterior surface of the cornea, reflected from its circumference to the anterior surface of the iris, and advancing over that membrane towards the opening of the pupil; to the aperture of which it cannot however be traced. This membrane may possibly be continued through the pupil, and line the posterior chamber. We suppose it to secrete the aqueous humour. This may be furnished perhaps by the arteries of the iris, or ciliary processes. It is very rapidly renewed after wounds in the cornea.

Muscles of the globe.—The globe of the eye is situated towards the front of the orbit, supported by a cushion of soft and yielding fat, and receiving the insertion of various muscles, which execute its rapid and varied motions. These

arise from the bony orbit; five coming from the posterior part, at the apex of the cone, and one near the front edge. They follow different directions towards opposite parts of the eye-ball; and are named from their direction, or apparent action, the four straight, and two oblique muscles; or the elevator, depressor, abductor, adductor, great and small rotators of the eye. The four recti are closely connected at their posterior attachment, so as to form part of the sides of a hollow cone, of which the base is the bulb of the eye, and the form nearly the same as that of the orbit. In this space are contained, besides fat, the ciliary arteries, the ciliary nerves, and lenticular ganglion, and the large optic nerve. These four muscles, arising by small tendinous ends, become presently fleshy and of increased size, which diminishes as they arrive at the middle of the bulb, the muscles terminating in flat tendons. In the latter part of their course they are closely invested by a cellular sheath, which connects them with the anterior part of the orbit, and is continued on each side, connecting the tendons in some measure, and passing forwards between the sclerotica and conjunctiva. The tendons of the recti proceed beyond the middle of the bulb, which is slightly hollowed externally for their reception, and are attached, at about equal distances from the cornea, on four opposite sides. These tendons are nowhere in contact with each other, not even at their termination, which is their broadest part; and are so closely united with the sclerotica, as not to be separated from it without manifest laceration. Mr. Home, and Mr. Pierce Smith assert, in the *Philosophical Transactions*, that the tendons not only pass to the anterior part of the sclerotica, but are continued in one united sheet over the cornea. This very ancient opinion, produced as a new and important discovery, has long since been overturned by the most eminent anatomists, and scarcely requires discussion here. Neither would the representation, if well founded, assist us in explaining the phenomena of vision, or the motions of the eye. The tendons are inserted very considerably beyond the transverse vertical diameter of the globe, gaining thereby an extent of power, which they could not possess if attached behind that line. The construction is plainly subservient to the motions of the globe; any further use is perhaps problematical.

The *rectus superior, attollens* of Albinus, is attached posteriorly, between the levator palpebræ superioris and the foramen opticum, by short tendinous fibres; it passes nearly horizontally, above the optic nerve, and, turning over the bulb, is attached to the anterior part of the sclerotica, about $\frac{1}{8}$ th of an inch from the edge of the cornea. It covers, anteriorly, the globe of the eye and the tendon of the superior oblique; posteriorly, the optic nerve, the ophthalmic artery, and the nasal branch of the ophthalmic nerve. Above it, lies the levator palpebræ superioris.

The *rectus inferior, depressor* of Albinus, resembles the preceding in form, but is smaller in bulk, situated on the lower part of the orbit. It is attached behind by a tendon common to it with the abductor and adductor; a tendon fixed to the sphenoidal bone near the sella turcica, and passing through the foramen lacerum orbitale; it divides into three portions, one for each of these muscles. The rectus inferior passes horizontally forwards, and is united to the sclerotica opposite to the insertion of the rectus superior. It corresponds below to the floor of the orbit; above it are the optic nerve at some distance, and in the interval the nerve of the third pair.

The *rectus externus, abductor*, Alb. has a greater length of muscular belly than any of the four, which it otherwise much resembles. It has two attachments posteriorly; one to the tendon before mentioned, the other, contiguous to

that of the *rectus superior*, is derived from a ligamentous band crossing obliquely the upper part of the foramen lacerrum. Between these attachments a fissure is left for the passage of the nerve of the third pair, of the sixth pair, and of the nasal branch of the ophthalmic. The muscle itself proceeds obliquely to the outer side of the globe, and is united to the anterior part of the sclerotica, at about the same distance from the cornea as the two preceding muscles. On its outer side are the surface of the orbit, and the lachrymal gland; on the inner the optic nerve, the nerve of the sixth pair, and the ophthalmic ganglion.

The *rectus internus, adductor*, Alb. lies on the inner side of the orbit. It is attached behind to the common tendon, and to the inner side of the foramen opticum, as far as the origin of the *rectus superior*. It passes, in a straight course, to the inner side of the globe, and terminates in a manner analogous to the rest. It is the shortest, and the thickest of the four *recti* muscles; the former circumstance arising from the relative form and position of the orbit and the eye-ball.

Of the two oblique muscles, one arises from the bottom of the orbit as the *recti*, the other from its anterior, and internal part. The first of these, the *obliquus superior*, or *trochlearis*, is attached posteriorly to the internal and upper part of the orbit, about two lines from the foramen opticum, by short tendinous fibres. The muscular portion is small and somewhat rounded, and passes towards the internal angular process, where it terminates in a delicate tendon, which passes through a cartilaginous pulley fixed to the upper side of the orbit. This pulley is formed by a cartilaginous plate, with its edges turned upwards and attached to the orbit, so as to form a complete tube, situated obliquely, of about a quarter of an inch in length. The pulley is bound to the orbit by ligamentous fibres at both its ends, and especially in front. Soemmerring has described a "ligamentum lunatum ex arcuatis fibris tendineis splendentibus compositum," passing between the edge of the orbit and the pulley, and preventing it from being drawn backwards in the actions of the muscles of the eye. This canal is lined by a synovial membrane, which continues to invest the tendon of the *obliquus superior*, after it leaves the trochlea to its insertion in the globe. The tendon is reflected at an acute angle, and descending a little backwards and outwards, passes under the *rectus superior*, and terminates below it on the outer, posterior, and upper surface of the sclerotica, about half way between the optic nerve and the edge of the cornea. It corresponds, in the first part of its course, to the orbit within, the optic nerve without, the *rectus superior* above, and *rectus internus* below; in the second its tendon lies between the conjunctiva, the *rectus superior*, and the eye-ball.

The *obliquus inferior* is fixed by a small tendon to the anterior edge of the orbit, rather below and on the outer side of the opening of the ductus nasalis. It passes obliquely outwards and backwards, between the *rectus inferior* and the orbit, and turning upwards, between the globe and the *rectus externus*, is attached by a tendinous expansion to the sclerotica at the superior part of its outer side, behind the insertion of the *obliquus superior*.

The immediate actions of the *recti* muscles are simply those of directing the axis of the eye towards different points. According to their attachments they will elevate or depress the pupil, turn it towards the nose or the temple. By the differently combined actions of these muscles, the eye may be moved in any of the intermediate angles. By the succession of such actions it may be moved rapidly round in the orbit. In all these cases the action of one muscle is

moderated by its opposite. The motions of rotation inwards and outwards, motions in which the eye does not move from its place, but only on its axis, are executed, the first by the superior, the last by the inferior oblique. By the united action of the six we are enabled to preserve the eye in the same relative position with regard to the object, whether it be at motion, or at rest; and whether the head is fixed or moving in any direction, so as to alter its position with respect to the object; in short we can by their means direct the eye to any point, and keep it fixed there under any change of the situation of either. To use the expressive words of Mr. Hunter, "the object becomes as it were the centre of motion or fixed point, commanding the direction of the actions of the eye, as the north demands the direction of the needle, let the box in which it is placed be moved in what direction it may." From the two eyes being always thrown on the same objects, and the will not being able to change the direction of one of them only, for instance to depress the left while the right is elevated, they are always seen to correspond in their motions, which are executed in the two eyes by the opposite muscles. If the eyes are directed to the right for example, it will be instantly seen that the *rectus internus* of the left eye, and the *rectus externus* of the right will be principally employed. The will extends only to the moving both the eyes at the same instant; we have no power over either separately.

The straight muscles move the eye from object to object, and keep its point of vision fixed upon any particular one, be it moving or at rest, while the head remains a fixed point, while it moves progressively with the eyes in following a moving object, and even in some cases where the head and the object are moving in opposite directions. They produce the circular movement when the head is at rest; and when the eye is to become fixed, the head performs the circular movement. By these means the object, the axis of the eye, and the point of sensation, are all preserved in the same straight line. But there are some movements of the whole head, of which the eye is a part in which the straight muscles alone are not sufficient to effect this, and where the oblique muscles are especially called into action. "Thus, when we look at an object, and at the same time move our head to either shoulder, it is moving in the arch of a circle, whose centre is the neck. When the head is moved towards the right shoulder, the superior oblique muscle of the right side acts, and keeps the right eye fixed on the object; and a similar effect is produced on the left eye by the action of its inferior oblique muscle: when the head moves in a contrary direction, the other oblique muscles produce the same effect. As this motion of the head seldom takes place uncombined with its other motions, some of the straight and oblique muscles will be employed at the same time, according as the motions are more or less compounded."

It has not been clearly determined whether these muscles can alter the figure of the eye, nor in what direction the change would be produced, although considerable labour and ingenuity have been bestowed on the subject. Mr. Home advances, that an increased curvature of the cornea, an elongation of the axis of vision, and a motion of the crystalline lens; all which changes he supposes to have taken place in the adjustment of the eye to view objects at different distances, depend in great measure on the contraction of the four straight muscles. Compression of the eye will force the aqueous humour against the centre of the cornea, while the globe is at the same time steadied, so that the radius of the curvature of the cornea will be rendered shorter, and its distance from the retina increased. When the recent eye of an adult was distended by air being
blown

blown through an opening made in the optic nerve, the axis of vision was elongated from $17\text{-}20\text{ths}$ of an inch to $17\frac{1}{2}$. Mr. Home supposes that in this case pressure is made in the most unfavourable way for producing the greatest elongation in the axis of vision, and that a lateral pressure from without would be more effectual: this pressure he believes to be made by the recti-muscles. That the eye-ball does not recede in the orbit, under these circumstances, he concludes to be sufficiently proved by its not having done so in his numerous experiments. It is not demonstrated, however, that any action of the recti, or at least any powerful action, took place in any of these experiments. Dr. Hofack, who believes in the elongation of the axis by muscular action, supposes the four recti to make the compression, and the oblique muscles to keep the eye in its proper direction and situation. To us it is yet problematical, whether any change is produced in the axis of the eye by the action of its muscles. How far such changes could contribute to the adjustment of the eye to distances, will be more properly considered hereafter.

The great mobility of the eye has rendered this organ well suited to express many of our wants, to assist, in some degree, our gestures, or our voice, and to supply their place when their action fails. The part performed by the eye, in expressing the different passions, the spirit which it gives to the other features, are interesting subjects, on which our limits will not allow us to enlarge.

The course of the optic nerve in the orbit, and its termination in the retina, are described in our account of that membrane. The other nerves of the orbit will be described under the article NERVE. Some particulars concerning them will be found in the explanation of the plates representing the anatomy of the eye. The arteries are derived principally from the ophthalmic, of which a description will be found under the article ARTERY. The veins of the globe of the eye join the vena ophthalmica cerebialis, which opens into the cavernous sinus. The veins of the choroid and iris, as named by Walter, are an inferior, short, and an anterior long ciliary joining the infra-orbital vein; an internal ciliary, a superior ciliary, a posterior and some long ciliary veins, joining the trunk of the ophthalmic. These veins return the blood carried to the eye by the ciliary arteries. They arise by very minute ramifications from the iris and the ciliary processes, run for a short way in trunks, and perforate the sclerotica in different parts, in a manner analogous to that of the ciliary arteries, but more particularly at its posterior surface. The vena vorticosa of the choroid, having collected into trunks, follow the same course. The vena centralis retinae collects its branches from the anterior termination of the retina into three or four trunks, which unite into a single one, entering the optic nerve in company with the central artery. The reader will find a minute and most complete description of the veins of the eye, in J. G. Walteri epistolâ de venis oculi. Berolini, 1778, 4to.

The eye-brow, eye-lids, and lacrymal apparatus.—Considerable protection is afforded to the eye by the edge of the orbit, but its anterior surface is further guarded by several adventitious organs. These parts, to which Haller has given the name of "tutamina oculi," consist of the eye-brow, the eye-lids, and the parts destined to secrete and remove the tears.

The eye-brow is an arched eminence, covered with hair, placed at the base of the forehead, above the upper eye-lid, extending from the root of the nose to the temple. It differs very much in its length, breadth, and thickness, in different individuals, and is generally very strongly marked

in old age. The eye-brow, at its commencement on the nasal side of the orbit, is at different distances from its fellow on the other side; sometimes the two arches meet at the root of the nose, at others there is an interval of more than half an inch. It describes but a slight curve, the convexity of which is turned upwards, and terminates at the temple by a pointed end. The eye brow is formed by a thick doubling of the skin covered by hairs, by cellular tissue and fat, by a strong muscle, and by bone. It has a plentiful supply of blood-vessels and nerves. The superciliary ridge of the frontal bone contributes very essentially to the prominence of the eye brow, causing great variety in this respect in different persons.

The orbicularis palpebrarum, and the frontalis muscles, send many of their fibres into the substance of the brow, which are very closely intermixed with the fibres of another muscle, called from its office the *corrugator supercili*. This muscle is short, made up of numerous muscular fibres, occupying the superior and internal part of the base of the orbit. It is attached by small tendinous fibres, divided into two or three portions, to the protuberance above the nose on the frontal bone; it passes, making a slight curve, over the internal half of the orbital arch, and terminates by uniting its fibres with those of the orbicularis and frontalis, by which it is wholly concealed. It is separated from the frontal bone by the vessels and nerves coming from the orbit.

The eye-brows are covered by hairs of different lengths, which vary much in number, in colour, and in length, in different individuals. They are more numerous towards the nose, and coarser. Their colour is generally the same with that of the hair of the head. They are generally thicker in brown than in fair persons. The hairs are disposed obliquely, pointing outwards, and standing off from the skin; the inferior hairs are turned obliquely upwards, the super or obliquely downwards, so as to deffuse by their points, and form an angular projecting line in the middle of the brow. They are commonly, but erroneously, figured as horizontal. When the eye-brows meet, the hairs next the nose most commonly point upwards. Each hair forms a curve according to its place, and is not straight. It commences by a bulb in the skin, becomes fine, gradually swells in the middle, and terminates in an extremely fine point.

The eye-brow is susceptible of various motions, and forms, by its prominent situation and mobility, a very principal feature in the expression of different passions. It will be elevated by the action of the occipito-frontalis, and considerably lowered by the orbicularis palpebrarum. The corrugator supercili, having its fixed point near the root of the nose, will by its action contract and wrinkle the skin of the brow perpendicularly, drawing the whole towards the nose, producing what is called a frown. When we regard a distant object, or one which reflects but little light, we elevate the eye-brow; we lower and contract it on the contrary, when the object is near, or very bright, or the sensibility of the eye from any cause, too great. Thus it protects the organ from the impression of too vivid a light, and guards it in some measure from foreign bodies.

The eye-lids are two moveable bodies, placed in front of the eye-ball, and occupying the whole opening of the bony orbit, which determines their extent; they are distinguished into upper and lower. The upper lid, the largest and most moveable, when lowered, covers the principal part of the eye, descending much below its transverse diameter, "infra æquatorem oculi descendens;" the under lid rising but a small way to meet it. On the convex anterior surface

of each we observe a few wrinkles following the curve of the lid, varying in number according to the position of the part. When the eye is open there is always one large fold of the skin in each eye-lid: this is more particularly marked in the upper, in consequence of the levator palpebræ drawing it under the edge of the orbit. The wrinkles are effaced when the eye-lids are closed in sleep, so that they exhibit an uniformly smooth surface. The skin of the upper lid is continuous above with that of the brow; the skin of the lower with the cheek; the only line of distinction is the edge of the orbit, and the depression within the margin. The posterior surface of the eye-lids is concave, smooth, in contact with the globe, and always moist. The edge of each lid is straight for about one-fourth of an inch next the nose, where it corresponds to the caruncula lacrymalis. In the rest of its extent it is slightly concave, corresponding to the projection of the eye-ball, and of considerable thickness, which diminishes towards the temple. The anterior margin of this edge is angular, and supports ranks of fine hairs, called eye-lashes; the posterior is bevelled off, so as to form with the globe, when the eye is shut, a triangular canal, narrow towards the temple, and gradually increasing in size towards the nose. It is particularly large at the angle, where the straight and concave portions of the eye-lid meet, which is marked by a projecting papilla, perforated by the punctum lacrymale. From this point outwards, we observe also, between the two margins, a line of small holes, the openings of sebaceous glands. The two lids are united at each end, forming two angles, or canthi, of which the nasal or internal is a little rounded off, and called the great angle; the temporal or external is acute, and termed the lesser angle. The difference is produced by the alteration in the outline of the lid above-mentioned, and by the disposition of the tendon of the orbicularis muscle. The opening between the lids in different persons varies a little in its transverse diameter, which is measured by the two angles. The perpendicular diameter, depending on the action of muscles, is constantly changing, and determined by the degree of their contraction. We believe it is to the greater or less transverse, and vertical diameters of the opening of the eye-lids in various individuals, and not to any great variation in the bulk of the globe, that the apparent size of the eye is principally owing. The apparent difference in the volume of large, or small eyes, is certainly greater than can be attributed to a difference in the globe, which we know to vary but inconsiderably.

The eye-lids are composed of many different tissues, disposed in layers, one beneath the other, over a broad cartilage, which gives the figure to the whole. The curtain formed by these is not sufficiently thick to prevent strong lights from affecting the eye. Beginning from the anterior surface, we find successively a fine skin, a muscle, a fibrous expansion, and a plate of cartilage, on the posterior side of which are sebaceous glands covered by a mucous membrane. In the upper lid there is a second muscle between the anterior surface of the cartilage and the fibrous layer. As the cartilage supports the rest, we shall commence with it.

In the substance of the opposed margins of the eye lids we find thin pieces of cartilage, named the *tarsi*, extending through nearly the whole length of the lids. These differ in form and size. The tarsus of the upper lid is broad in the middle, narrowing gradually at each end, resembling the segment of a circle, the arc of which is towards the margin of the orbit, and the chord opposite the lower eye-lid. It is much larger than the lower, which is of nearly uniform breadth throughout, corresponding to the external figure of

the inferior lid. The convex anterior surface of each corresponds to the muscle, the posterior is lined by a membrane between which and the cartilage are glands. The connected edge of each, thin, in the upper lid convex, in the lower nearly straight, gives attachment to some ligamentous fibres. The ciliary or opposite margin is thick, covered only by the conjunctiva: its particular figure has been already described as contributing to form the triangular canal between the closed lids. The outer extremity of each is fine and pointed, the nasal or internal is rounded, and of greater thickness. The tarsi are thin and flexible, fibro-cartilaginous in structure, of a yellow colour. As the solid part of the eye-lids, they favour their gliding over the surface of the globe of the eye, keeping them equally extended in every movement. When the upper lid is elevated, its tarsus passes in some degree under the edge of the orbit, keeping the surface next the globe uniformly smooth, while the skin forms a deep fold in front, the tarsus retreating from it partly as it glides far back over the globe. The broad ligaments of the tarsi are fibrous productions, extending from the edge of the orbit to the opposite margins of these cartilages. They are very evident, and of considerable thickness next the orbits, where they appear to be continuous with its periosteum. As they recede thence, they diminish very much in thickness, a few fibres only remaining, which are attached to the tarsi, the intervals being completed by cellular tissue. They are pierced in many places to give passage to vessels and nerves. This fibrous layer is generally most distinct towards the temporal side of the eye-lids, where it is more evidently attached to the tarsi, the fibres decussating each other between the lesser angle of the eye-lids and the opposite angle of the orbit, so as to form a tolerably firm band, connecting them together, similar in some measure to the tendon of the orbicularis on the nasal side. In the upper lid, the ligamentous bands lie between the orbicularis and levator; in the lower, between the first of these muscles and the membrane lining the lid. They scarcely deserve the name of tarsal ligaments, but they form a tendinous arch round the orbit, the contents of which they assist in protecting. The tarsus of the upper lid, when elevated, passes behind its ligament.

The muscles of the eye-lids are two in number; *viz.* one common to both, the *orbicularis palpebrarum*, another belonging to the upper eye-lid only, the *levator palpebræ superioris*.

This last muscle is thin, long, and flat, placed in the upper part of the orbit, from the bottom of which it arises, in front of the foramen opticum, immediately before the origin of the rectus superior. It is tendinous at this point, and soon becomes fleshy, passes forwards, making a gentle curve over the convexity of the globe, spreading as it proceeds. Opposite the globe of the eye it forms gradually a thin tendinous expansion, which turns downwards, and is attached partly to the superior margin of the tarsus, partly to its ligament on the temporal side, by means of which it is connected with the outer angle of the orbit, the remainder of the tendinous fibres passing down in front of the tarsus to its ciliary edge. In this latter part of its course, it is closely connected with the orbicularis in front, adhering by cellular tissue to the tarsus on its posterior surface. The upper lid, from its muscle terminating in a broad diverging aponeurosis, spread over the front of the tarsus, is further strengthened than the lower, which has only its ligament to protect the lower part.

If we now examine the two lids, supposing them closed, we find their temporal side especially defended by a fibrous expansion, supplying the place of the bony orbit, which, by the obliquity of its base, leaves the eye more exposed on

that

that part; we find their nasal side with but little of this fibrous covering, which was less necessary, as the ball is defended by the projection of the nose; we observe, moreover, the upper lid fortified by an additional fibrous layer, formed by the tendon of its levator muscle, a construction the more required here, as it executes almost alone the motion by which the lids are closed, and is more directly in the way of external injuries.

Externally to the parts we have hitherto described is a thin, broad, oval muscle, formed of concentric fibres, with a line of division in the middle, corresponding to the opening of the eye-lids, placed in front of the opening of the base of the orbit, occupying a great portion of the upper part of the face, and named *orbicularis palpebrarum*. Its fibres on the nasal side have a triple origin: one above, from the nasal process of the superior maxillary and the orbital process of the frontal bones; another, below, from the anterior edge of the lacrymal groove and the neighbouring part of the base of the orbit; a third, between these two, to the two edges and front of a small tendon, which passes transversely from the nasal process of the maxillary bone to the internal commissure of the eye-lids, where it divides, and becomes connected with each tarsus. The tendon in its passage crosses over an aponeurosis which protects the lacrymal groove, and adheres intimately to it; from this aponeurosis also a few muscular fibres are derived. The fibres arising from the two first of these points pass outwards in opposite curves above and below the orbit, and join each other at its temporal angle, after having formed round the lids an oval plane of some breadth, and well defined; a few scattered fibres are intermixed with those of the corrugator and frontalis above, others are lost in the cellular tissue and fat of the cheek below, or sometimes join some of the muscles of the face. On the temporal side of the orbit the orbicularis is very thin, it is much stronger towards the nose. The fibres which are derived from the tendon of the muscle are spread over each eye-lid, following the same direction as the preceding, with which they are continuous, and uniting at the external side of the temporal commissure. These fibres are generally paler than the others, and we sometimes can observe them meeting in a tendinous line at the lesser angle. Close to the edge of the lids we find a stronger bundle of fibres, following nearly a straight course, to which the name of ciliaris has been given. The orbicularis is connected with the integuments in front by cellular tissue. It covers the corrugator supercillii, the margin of the base of the orbit, and some muscles of the face. It is separated from the membrane lining the lids by the ligaments above described, and in the upper by the tendon of its levator.

The sebaceous glands of the eye-lids, known under the name of the *Meibomian* glands, are lodged in grooves hollowed on the posterior surface of the tarsal cartilages. They consist of numerous clusters of follicles, ranged side by side, representing yellow lines, the direction of which is vertical, or transverse to the length of the cartilage. These lines are more numerous in the upper lid, where we may count between 30 and 40; in the lower they do not exceed the lowest of these numbers. They vary somewhat in breadth, and much in length, especially in the upper lid, in a manner corresponding to the breadth of the tarsus; there are often irregular short lines between the longer ones. They are not so long in the lower, its cartilage being much narrower. These lines are generally parallel; some of them may be straight, others tortuous, separated by intervals unequal in breadth. Two of the lines often unite to form one, some with their angle of union turned towards the ciliary edge, others meeting in an arch convex towards the connected edge

of the tarsus. The follicles which form them are exceedingly numerous, disposed in bunches; they communicate with each other, and open near the posterior edge of the tarsus by a row of minute holes, before-mentioned. These follicles secrete an unctuous fluid, which hardens after death, and may be pressed through the holes in a solid form, resembling little worms.

The parts we have described are covered anteriorly by the skin, and on the posterior surface by a membrane continuous with it, called conjunctiva. The skin investing the eye-lids is much thinner than that of the brow or cheek, and becomes more and more sensible as it approaches the ciliary margin of the tarsus. A loose cellular tissue, in which we never find any fat, but frequently an effusion of serous fluid, lies between the skin, and the orbicularis behind it.

As the skin arrives at the anterior margin of the eye-lid, it is perforated by numerous holes, from which the *cilia*, or *eye lashes*, are produced. These hairs form two or more rows, are more numerous, and longer in the upper lid; they are more numerous and longer also in the middle of each, than at the extremities, and we find only a very few fine hairs between the punctum lacrymale and the nasal angle. Each hair is curved in its direction; beginning from a bulb, it is at first very fine, swells in the middle, and terminates in a conical attenuated point. In the upper lid they are first directed downwards, turning up towards the point; in the lower the direction is inverse. They differ in colour in different persons, but are generally, though not always, of the colour of the rest of the hair.

At the line formed by the eye-lashes, the skin becomes changed in appearance and structure, and we observe continued from it a mucous membrane, called, from its office, the *conjunctiva*, which, after investing the posterior surface of the tarsi, is reflected over the front of the eye-ball. Tracing it from the edge of the upper lid, we find it first perforated by the mouths of the Meibomian glands, dipping into the canal of which the punctum lacrymale is the opening, and spread over the lid a short way beyond the convex edge of the tarsus. Abandoning the lid, it turns over the globe, two-thirds of which it covers, below is reflected again to be extended over the lower lid to the ciliary margin. From this disposition the conjunctiva presents two surfaces, one connected with the parts it covers, the other exposed. The latter is smooth, and constantly moistened by secreted fluids. The former is united to the lids and the globe by cellular tissue. On the eye-lids it adheres closely to the tarsi, more loosely to the fibrous membrane, to the orbicularis below, and to the tendinous expansion of the levator above. In quitting the lids to invest the globe, it forms a loose circular fold which corresponds behind to the fat in the orbit, and which, extending further in the upper lid, is lodged during its elevation in a small angular space left for it in the fat behind the margin of the orbit. By this means, transverse folds in the conjunctiva, such as we have remarked in the skin, are prevented when the upper eye-lid is raised. On the globe of the eye the conjunctiva adheres but loosely to the sclerotica, giving to it a smooth and glistening aspect. On the cornea it adheres very closely, and is very thin. In this course the conjunctiva forms at the internal angle of the eye a semi-lunar fold, concave outwards, something like the third eye-lid in birds. This fold, which appears larger when the eye is turned towards the nose, disappears when it is turned far towards the temple. The conjunctiva may be considered as a mucous membrane, from the general character of its structure; it has not, however, a villous surface, neither is the fluid which it secretes of much consistence, in some particular inflammations of this membrane it becomes thick

thick and yellow. Although described under the single epithet of conjunctiva, and obviously a single and continuous membrane, its organization differs very considerably at different parts. Anatomists call that portion which lines the lids, *conjunctiva palpebrarum*; and that which covers the globe, *conjunctiva oculi*. The former contains very numerous red vessels, visible in its natural state, and occasioning the membrane to assume a general redness when injected. The latter has very few apparent blood-vessels, and its whiteness constitutes the white of the eye. But this part under inflammation becomes entirely covered with vessels carrying red blood. That portion of the membrane covering the cornea is again very different from what is connected to the sclerotica, being completely transparent. That the conjunctiva is actually continued over the cornea cannot, however, be doubted. For, although the latter part is insensible, its anterior surface is endowed with the same exquisite feeling as the rest of the conjunctiva. In amphibia, which shed their epidermis at certain seasons, this membrane comes off from the front of the eye with the rest of the cuticle; the same fact may be observed in skinning an eel, and in the *zemni*, or *mus typhlus* of Pallas it is covered with fine hairs. It is very sensible, and irritated by apparently slight causes. The eye-lids are supplied with vessels and nerves in great abundance from the neighbouring trunks.

Such is the structure of the eye-lids. Their use appears to be that of covering the eye during sleep, of protecting it from accidental violence, of excluding the light when offensive, and of keeping the surface of the eye constantly moist, by spreading a fluid, the sources of which we have yet to describe, uniformly over its surface. These purposes are fully provided for by their organization and disposition, and executed by the muscles which enter into their structure. The cartilages, in some measure supported by ligaments, preserve an uniformly smooth surface; the sebaceous glands secrete an unctuous substance, which prevents the adherence of the lids in sleep, or when brought into contact by the rapid and frequently repeated action of winking; which, in conjunction with the cilia, prevent insects, dust, or any small bodies from injuring the surface of the globe; the conjunctiva presents two moistened polished surfaces, which easily glide over each other, and it favours, by the looseness of its attachment, the motions of the lids. With regard to these last, when the eye is opened after sleep, the lower lid does not alter its situation, the opening is made by the upper lid ascending by the action of its levator muscle under the edge of the orbit, where there is space to receive it filled only by loose fat and cellular tissue. If the opening of the eye-lids succeeds a closure of them, effected by the action of the orbicularis, this muscle, by its relaxation, concurs in producing their separation. This will appear evident if we consider that the closure of the eye is produced very differently in the different states of sleeping or waking. In the first case the meeting of the lids is passive, owing to the relaxation of the levator muscle, and the falling down of the upper lid; an effect analogous to what is seen in a paralysis of that muscle, where the eye cannot be opened without external aid. In the last the closure of the lids is active, produced by a contraction of the curved fibres of the orbicularis, which by this action approach nearer to a straight line. In the last case also, the particular motion of the eye-lids, called winking, is caused in a great degree by the relaxation of the levator, and its alternate contraction. We believe this motion to be designed to keep the surface of the cornea clean and moist, fit to transmit the rays of light; but it is also necessary by the disposition of the several parts;

the levator not being able to remain in a state of permanent contraction, since it is a voluntary muscle, is of necessity relaxed at intervals, and causes the motion of winking, which is further assisted perhaps by a slight action of the orbicularis. Further, in closing the eye-lids when awake, the orbicularis acts with less or greater energy. When we wish to defend the eye from a vivid light, it contracts strongly in company with the corrugator supercilii, and collects the integuments of the forehead and cheeks in numerous folds to bury as it were the eye more deeply. The orbicularis and levator are then to a certain point antagonists, one opening, the other closing the eye-lids; in some cases their actions are combined.

Lacrymal apparatus.—The parts which remain yet to be described, and which have been included under the general name of the lacrymal apparatus of the eye, are the lacrymal gland and caruncle, the lacrymal points and ducts, the lacrymal sac, and the common canal leading into the nose. In animals that live in air, the anterior surface of the eye would soon become dry, and be rendered foul by dust, or the numerous small bodies floating in the atmosphere, were it not constantly bathed by a limpid fluid. A part of this we believe to be furnished by the conjunctiva; but its more abundant source is from the *lacrymal gland*. It is usually known by the name of the *tears*.

The lacrymal gland is situated at the superior, anterior, or external part of the orbit. It is somewhat flattened, nearly an inch in length, and half an inch in breadth. It is divided partially into two lobes, of which the internal and upper is the smallest. From its flattened form we shall consider it as having two surfaces. The upper convex side corresponds to an opposite depression in the bony orbit; the concave inferior surface to the globe of the eye, and to the superior and external recti muscles, with which it is connected by cellular tissue. Of its two extremities, the internal, or that turned towards the nose, is thin and narrow; the external and inferior end is broader, and of greater thickness. There is a small ligament, first described and figured by Soemmerring, passing from the external and posterior part of the lacrymal fossa underneath the gland, which it retains in its situation. The lacrymal gland is formed by many small lobes united by cellular tissue, the vessels and nerves being lodged in the intervals. These little lobes are themselves made up of small granules, into the substance of which the vessels penetrate. It is supplied with arteries from the lacrymal branch of the ophthalmic; with nerves from the lacrymal branch of the nerve of the fifth pair. The excretory ducts of this gland are very apparent in the larger animals; in man they are not so readily perceived. Their number is generally seven; they pass out from the anterior edge of the gland, descend in the substance of the upper lid between the ligament and the conjunctiva, on the surface of the last of which they open on the temporal side about $\frac{1}{4}$ th of an inch above the convex edge of the tarsus. The ducts have no communication with each other.

The *caruncula lacrymalis* is a small reddish body situated between the internal angle of the eye-lids, and opposite surface of the globe of the eye. It is oblong and conical in form, its summit corresponding to the eye-lids. It differs much in colour, from a pale pink to a full red in different individuals. It is composed of a number of mucous follicles, united by cellular tissue, and covered by the conjunctiva. On minute examination we may find very fine hairs growing from its surface. It appears to secrete a mucous fluid, and perhaps from its situation may assist the passage of the tears into the lacrymal puncta.

On the outside of the caruncle, at the angle where the curved and straight portions of the eye-lids meet, there is a small papilla in the margin of each lid perforated by a small hole which is always open, called the *punctum lacrymale*. There is a small interval between them and the openings of the most internal of the Meibomian glands, nor are they placed exactly in the same row with them. The puncta are always more visible in the living than in the dead subject. They are not immediately opposite to each other, but when the lids are closed the inferior passes up a little on the outside of the superior; they are both directed a little backwards.

The *puncta lacrymalia* form the openings of two short tubes, named the *lacrymal ducts*, and distinguished by the epithets *superior* and *inferior*, from their situations in the two lids. These canals are formed in the substance of the lids, and are nearest to their posterior surface: they are larger than the area of the puncta, and the superior is rather longer than the inferior. Their direction is nearly inverse; the superior canal ascends for a short space, turns inwards at an acute angle, and descends obliquely; the inferior first passes downwards, makes also an acute angle, and then goes obliquely upwards. The direction of the superior canal must vary as the lid is elevated or depressed: the change, however, can never be very considerable, as the lid describes but a small space at the internal angle in any of its motions. The canals gradually approach each other, following the margin of the lids, and separated by the caruncle; at the internal angle they unite to form a common duct, which is continued for a very little way behind the tendon of the orbicularis, before it opens into the lacrymal sac, somewhat above the tendon. Sometimes these canals are separated throughout by a thin partition, and open in the sac by two distinct mouths; generally, however, this intervening membrane is not continued to the opening into the sac. The lacrymal canals are lined by a fine membrane continued from the conjunctiva.

The *lacrymal sac* is a membranous bag, lodged in a groove formed by the os unguis, and the nasal process of the superior maxillary bone. It is of an oval form below, and a little flattened transversely. It is covered on its anterior surface by a fibrous membrane attached to the circumference of the lacrymal groove, strongly connected with the tendon, and with the muscular fibres of the orbicularis. On its external side are the caruncle and the conjunctiva, and anterior to these the orbicularis and the skin. The inner side is closely adherent to the lacrymal groove. The upper end of the sac is closed, rounded, and extends a little way above the tendon of the orbicularis. The lower end terminates by a contracted portion, which opens into the nasal duct. On the external superior part of its interior surface we remark the openings of the lacrymal canals. The sac is formed by a mucous membrane continuous with the conjunctiva, and the membrane lining the nostrils, the latter of which it much resembles. It is invaginated, where not lodged in the bone, by the fibrous membrane above-mentioned.

The inferior end of the lacrymal sac is contracted by a circular fold of the membrane, through which it communicates with a pretty large tube, called the *nasal duct*, or *ductus ad nasum*, which opens below the inferior turbinated bone in the nostril. It is enclosed in a bony canal, formed by the union of the bones which surround the lacrymal sac, and at the lower end by the inferior turbinated bone. The duct is not quite half an inch in length; it is often contracted about its middle. Its direction is from above obliquely downwards, and a little outwards and forwards, describing

a gentle curve with the convexity in front. It opens in the inferior meatus narium by an oblique slit in the pituitary membrane, which is often so loose as to form a valve over the aperture. The area of the opening is never so large as that of the duct, but it differs much in size, so that in some individuals an instrument has been passed into it from the anterior opening of the nostrils. The membrane of the nasal duct is similar to that of the sac: we can observe mucous crypts here and there on its surface. It adheres to the fibrous membrane lining the bony canal.

We include, under the appellation *tears*, the whole fluid poured out on the surface of the conjunctiva; and produced in part by that membrane, but chiefly by the lacrymal gland. Superficial observation would lead a person to conclude that its ordinary quantity is small, and only sufficient, by lubricating the parts, to facilitate their motions. For we notice no actual fluid in the eye, and observe merely a moist state of the conjunctiva. When, however, the passages which carry off the tears into the nose are obstructed, and the fluids which ordinarily descend into the nostril, where they are evaporated by the constant current of air through that cavity, flow over the cheek, we find that the natural quantity of the tears is very considerable. As the conjunctiva belongs to the class of mucous membranes, its secretion has the properties which belong to those of similarly organized parts. This, when freed by evaporation from the more aqueous portion of the tears, forms the incrustations observable about the eye-lids after sleep; and would constantly agglutinate their margins at that period, were they not defended from its action by the unctuous matter of the Meibomian glands. Hence, when the latter parts do not furnish this greasy substance, or when the conjunctiva, in a diseased state, pours out an increased quantity of mucous fluid, the ciliary margins become adherent in a very disagreeable manner during sleep. The secretion of the lacrymal gland is aqueous, but contains much saline matter. The chemist discovers in it common salt, phosphate of lime, phosphate of soda, and soda in an apparently uncombined state. Indeed the bitterish saline taste of the fluid produced in weeping is a circumstance of common notoriety. It appears probable, that the conjunctiva is the ordinary source of the lacrymal fluid, which constantly lubricates the globe and lids: but when any irritation affects the organ, as when a foreign body, a particle of dust, &c. is lodged within the lids, a large quantity of fluid is suddenly poured out from the lacrymal gland, and often washes off the offending substance. The saline nature of this fluid actually produces a degree of redness in the conjunctiva, which the natural mucilaginous secretion of that membrane does not occasion; and this difference indicates a diversity in the nature of the fluid. The tears furnished in such a case are much more copious than the lacrymal passages can convey into the nose; and they consequently overflow the lids. A similar increased secretion from the lacrymal gland, taking place under various mental affections, constitutes weeping. The lacrymal fluid is spread uniformly over the anterior surface of the eye-ball, by the alternate lowering and elevation of the superior lid, an action so rapid, that although constantly repeated at small intervals, it appears not to impede the functions of the organ. These motions cause it to flow towards the nasal angle, along the triangular canal formed by the posterior edges of the lids. The sebaceous matter of the Meibomian glands probably prevents it from overflowing their margins. It is directed towards the internal angle, when the eye is closed, by the form of this canal increasing in size towards the nose; and by the

action of the orbicularis, which has its fixed point at the same part; when the eye is open, by the inclination of the lower lid, as the external angle is then higher than the internal. The puncta lacrymalia take up the tears by a peculiar vital action, and not by capillary attraction. From these canals the fluid passes into the lacrymal sac, and thence into the nostrils.

The parts above described are very fully developed at the time of birth; corresponding in this respect with the almost perfect state of the globe itself at that period. The eye resembles another organ of sense, the ear, in the forwardness of its evolution, and in the early period after birth, in which its functions are called into exercise. They are both analogous in this point of view to the organ of touch. The mutual assistance which they afford each other, in correcting erroneous ideas formed from the separate use of either, is much favoured by this early and contemporaneous completion of their structure.

A knowledge of the forms, proportions, densities, the refractive and dispersive powers of the humours, as well as the radii of their several curvatures, is essential to understanding rightly the physiology of the organs. Our limits will not allow us to detail the numerous experiments which have been instituted to determine these points. The following admeasurements and calculations are drawn from those given by Petit, Maskelyne, Comparetti, Young, Wollaston, and Cavallo; to all of whom the reader, who wishes for minute information, is particularly referred.

The *axis* of the human eye, measured from the anterior surface of the cornea to the foramen opticum, is about .98 of an inch: of this, the cornea occupies about .04; the aqueous humour .11; the chrySTALLINE .17; and the vitreous .66.

The *diameter* of the eye, measured internally, from the opposite surfaces of the retina, is about .90.

The vertical chord of the cornea is about .47, and the horizontal .49. The radius of its anterior convexity .35; its versed sine .11; its distance from the anterior surface of the chrySTALLINE .13.

The radius of the sphericity of the inner surface of the sclerotica .46.

The aperture of the pupil at a mean .14.

The radius of the anterior convexity of the chrySTALLINE .34; of the posterior .22.

The refractive and dispersive powers of the aqueous and vitreous humours are very nearly, if not exactly, the same as those of water; those of the chrySTALLINE are, for its whole substance, as 14 to 13.

By calculating from the preceding data the progress of rays, supposed to radiate from an object about 20 inches distant, it is found that they will be collected into foci, nearly on the surface of the retina: from the different refrangibility of the rays, perhaps not in exact focal points, but the circle of dispersion is so minute, as hardly to be worth considering in the physiology of the organ.

The axis of the eye is in a line drawn in the axis of the cornea. From the eccentricity of the pupil, and chrySTALLINE lens, with regard to the cornea, their axes are not in the same line with that of the latter; and the visual axis is found to be one twentieth of an inch further from the optic nerve than the point opposite the centre of the pupil; and about 16 hundredths of an inch on the outside of the centre of the nerve.

Description of the Plates in which the Anatomy of the Eye is represented.

PLATE I.

The figures in this plate represent the external parts of the eye in different positions, and exhibit the principal varieties depending on sex or nation, as well as the appearances of the closed eye-lids during sleep.

Fig. 1.—The figures in the upper line exhibit the left eye of an adult male in a front and side view. We begin with the first.

a b c, the eye-brow, or supercilium; *a*, its end next the nose; *c*, that towards the temple.

† *d**, the upper eye-lid, or palpebra; †, the part which has but little motion; *d*, the fold which disappears when the eye-lids are closed; the depth of it may be seen in *Plate IV. fig. 5*; †, the edge fringed with the eye-lashes or cilia.

e r m, the opening of the eye-lids.

e f g b i, the internal, or larger canthus of the eye; *e*, the caruncula lacrymalis; *f*, the semi-lunar fold of the conjunctiva; *g b*, a depression round the caruncle ("lacus lacrymalis"); *i*, the situation of the ligament of the palpebra crossing the lacrymal sac.

k l, an horizontal line, shewing how much the internal canthus is inferior to the external.

m n o p q, the lower eye-lid; *m n*, its margin; *m*, the internal edge or labium perforated by the openings of the sebaceous glands; *n*, the external edge, from which the lower cilia or eye-lashes arise; *q*, a superficial fold, observed when the eye is opened.

r, the external or lesser canthus of the eye.

s t u v w, the iris shining through the transparent cornea; *s t*, the narrower part next the nose; *v w*, the wider part towards the temple; *t v*, the inner, or lesser circle of the iris; *s u*, the outer, or larger circle; *u*, the pupil.

In the side view, we observe some points not distinguishable when the organ is viewed in front. We shall explain the letters only when affixed to different parts from those in the former figure.

d e f g b, the upper eye-lid; *e*, the fold; *f g*, the breadth of its margin; *g b*, the upper eye-lashes, decreasing in number, length, thickness, and curvature, as they approach the external canthus.

i k, the cornea; *i*, its convexity; *k*, its circumference.

l, the iris, which can be seen in the side view, by the alteration in the direction of the rays in passing through the aqueous humour. The iris would not be seen if the eye was viewed in the same manner under water; the cornea alone would appear.

Fig. 2.—The figures in the second line represent the female eye, seen in the same circumstances as the male eye in the line above. The differences between them are sufficiently evident to merit attention. The male eye exceeds the female in the relative size of the eye-ball, in the thickness of the parts which are connected with it, as well as in many other lesser variations of form, all of which are marked with great effect in the beautiful specimens of ancient sculpture. In the male, the skin of the eye-lids is harsh and rough, with a degree of redness not observable in the female, where it is more delicate and smooth, paler, and apparently humid. Viewed generally, the prominent, full-orbed eye of the male has a bolder character than the oblong, depressed, and gentle eye of the female. The skin of the brow is thicker, and has a greater projection; the

eye-brow itself is broader, thicker, and formed of hairs of greater length, and coarseness, not lying so close to the skin as they do in the female. In the male, the upper lid is more elevated, so as to appear smaller; the fold is therefore larger, and nearer the eye-brow. The opening between the eye-lids is wider and rounder, the angle at the corners is greater, and the margin of each is broader. The eye-lashes are thicker, and not so fine. The differences we have been noticing are not equally evident in all eyes, but are sufficiently striking where this feature has its exquisite distinctive form correctly marked.

Fig. 3.—These two figures represent the eye of the male adult negro. In the first:

a b c, the eye-brow, formed of short, scattered hairs.

d e f g, the upper eye-lid, full, puffed, and broad; *e*, a superficial; *f*, the deeper fold.

g h k p, the opening of the eye-lids, rather oblong; *h*, the internal angle, which appears narrow from the thickness of the lids; *i*, the caruncle, which, for the same reason, appears deeper; * the lunated fold.

k l m n o p, the lower eye-lid, comparatively broad; *l*, the outer edge of the margin of the lid, somewhat rounded; *m*, the orifices of the sebaceous glands, appearing as white points; *p* the external canthus.

In the side view of the same eye we observe further differences.

†, part of the forehead.

e f g h i, the upper lid; *g*, its thickness; *i*, the eye-lashes, more curved than in the European.

k to *o*, the lower lid; *l*, its outer edge, rounded; *n*, the lashes, as much curved as the upper.

p, the outer canthus.

*, the root of the nose. From this it appears how nearly the eyes are on a level with its edge, differing much in this respect from the European.

In reviewing the principal differences between the eyes of the Negro and European, we observe, that in the former the eye-brow is thin, and projects but little over the eye lid, so as to throw but little shade on the eye; the hairs are not woolly, but nearly as straight as in the European. The eye-lids are thicker, and denser in their texture, and tumid, so as to give the eye the appearance of being buried more deeply in the skin of the face. Hence many rays, which would fall on the globe at small or acute angles, are averted from it; and the light can affect the eye but little when the lids are closed. The lower lid is broader and more moveable, covering a greater portion of the eye. The opening of the lids is narrower; their margins are tumid, and the outer edge rounded. The eye-lashes are more curved, and thicker; and are so extremely fine and black, as to exclude many rays of light. The conjunctiva is not so white, and the fold at the inner canthus is broader. The cornea appears smaller, and not so convex; the bulb itself larger. The almost uniformly dark colour of the iris is so intense, that, when viewed at a little distance, we can scarcely distinguish it from the pupil, the whole appearing as a dark spot. This much diminishes its brightness. The preceding facts lead us to conclude that the eye of the Negro can bear more light, and is better suited to an African sky, than that of the European, who enjoys, perhaps, a larger field of vision, from the direction of his orbits. The differences are not equally observable in all individuals of the two races.

Fig. 4.—The left eye of a young white negress (*Leucæthiopissa*, or *Albinea*) is here represented. The character of the female eye is strongly marked in these figures; which

however differ remarkably from the preceding ones of the male subject, as well as from those of the European female. The eye-brow is soft, of a yellowish or pale white colour, and straight, with the hairs scattered. The lids are puffed, and possess rather the colour of chalk than of flesh; and the skin is fealy instead of being smooth. The upper lid appears comparatively very narrow. The opening of the eye-lids is narrow, particularly when the light is at all strong. The eye-lashes are delicate and much curved, especially in the lower lid, where they are excessively close; they are of a pale white. The caruncle is not so red; the cornea more convex. The iris, formed of thin, delicate, reticulated fibres, appears of a pinkish white colour, and so transparent, that between the fibres we can see the rose colour of the bottom of the eye; in other words it shines through the iris. The iris itself is in an almost constant state of tremulous motion.

Fig. 5.—The eye of an adult female, drawn in a state of tranquil sleep.

a b c, &c. the eye-brow; *o d e f*, the upper eye-lid, smooth and stretched; *g*, the eye-lashes, decussating each other.

b i, a line drawn horizontally, shewing the external canthus to be the lowest.

l l, the situation of the iris, or rather of the cornea, projecting under the lid.

m n o, cutaneous veins, shining through the delicate skin.

g, the fold of the lower lid.

In the side view of the same eye, *a*, &c. denote part of the forehead; *b*, the root of the nose; *c*, the eye-brow; *d* to *g*, the upper lid; *k*, the middle part, which is folded when the eye-lids are opened. The projection of the cornea is evident in this view. The other letters point out the same parts as in the former figure.

In the state of quiet sleep the eye-lids are gently closed; the upper one smooth and unwrinkled, descends lower on the outer than on the inner side, and hangs as it were obliquely. The cause of this difference is in the structure of the two angles; the upper lid having but little motion at the inner angle, on account of the tendon of the orbicularis muscle, while it descends freely at the external canthus. The bulb of the eye is somewhat turned upwards, as we may observe in drowsy persons; so that when the eye is shut, the cornea, with the greatest part of the globe, is covered by the upper lid alone. This situation of the eyeball is very manifest in children when asleep; the cornea in them shining through the thin eye-lid, appearing as a dark spot, and its convexity being visible when viewed from the side. The lower lid generally retains its fold. The difference in the angular form of the two canthi is still obvious. The eye-lashes decussate each other; and, if the eye be naturally prominent, the cutaneous veins are seen scattered over the upper lid.

PLATE II.

The figures in this plate illustrate the structure of the eye-lids and of the lacrymal apparatus.

Fig. 1.—Exhibits the orbicularis muscle of the left eye in the adult.

a b, the opening of the eye-lids closed; *c*, the tendon, which joins the eye-lids at the internal canthus, and is fixed into the nasal process of the superior maxillary bone; *d*, muscular fibres attached to the bones; *e, f*, fibres intermixed with those of the corrugator supercilii and frontalis; *g*, delicate bundles of fibres covering the upper lid; *h*, fibres covering

covering the lower lid, joining the preceding at the outer angle; *b*, stronger fibres attached to the bone, and the tendon; *i*, fibres passing towards the nose; *l*, *m*, thin fibres towards the temple; *m*, *n*, strips of muscle going over the cheek; *o*, *o*, scattered fibres at the very outer edge; *p*, *p*, close fibres immediately surrounding the edge of the eye-lids, called by Albinus "musculus ciliaris."

Fig. 2.—The eye-lids opened widely, and the margins turned out a little.

a, the eye-brow; *b*, the fold of the upper lid; *c*, the openings remaining after having pulled out the eye-lashes; *d*, the punctum lacrymale; *e*, the upper edge of the internal canthus; *f*, the orifices of the sebaceous glands; *g*, the union of the two eye-lids, externally; *h*, the caruncle; *i*, the semi-lunar fold of the conjunctiva; *k*, the fold of the lower lid; *l*, the openings after having pulled out the eye-lashes; *m*, the punctum lacrymale; *n*, the lower crus of the inner canthus; *o*, the mouths of the sebaceous ducts. The marks left by the cilia are far more numerous in the upper than in the under eye-lid, as well as larger. The openings of the sebaceous glands are placed in a curved line, and rather nearer to the inner edges of the tarfi. The puncta lacrymalia, or openings of lacrymal ducts, are much larger, and placed in a small papilla.

Figs. 3, and 4.—A long and short hair taken from the eye-brow, magnified to four times their natural sizes; *a*, the bulb, buried in the skin, which becomes thinner at *b*; and is continued swelling, cylindrical, and curved, *c*; and terminates in a fine point *d*.

Figs. 5, and 6.—Two hairs from the eye-lashes, magnified. They begin also in a small bulb, *a*; diminish in size considerably at *b*; become gradually thicker, *c*; are thickest about their middle, *d*; again decrease in a conical form, *e*; and end in a very fine point, *f*. These figures point out the differences in the shape of the hairs of the eye-brows and the lashes, or cilia.

Fig. 7.—The eye-lids of the right eye, moderately open, seen from behind, with the lacrymal gland turned a little forwards, covered at its anterior point by the conjunctiva.

a, a portion of the orbicularis palpebrarum, on its inner surface; *b*, the chink between the lids; *c*, the lacrymal gland, on its lower side; *d*, its division into two principal lobes; *e*, its excretory ducts; *f*, the openings of these ducts in the conjunctiva; *g*, the conjunctiva, lining the internal surface of the eye-lids; the part which appears folded has been turned off from the bulb; *h*, the sebaceous glands of the upper lid, shining through the conjunctiva; *i*, the superior punctum lacrymale; *k*, the glands of the lower eye-lid; *l*, its punctum lacrymale, or mouth of the lacrymal duct; *m*, the caruncle; *n*, the semi-lunar fold of the conjunctiva. This is drawn back a little by the other folds of the membrane; its natural situation would be at *i*.

Fig. 8.—The internal or posterior surface of the eye lids, to shew the structure of the sebaceous glands. The figure is magnified to twice its natural size, which may be seen by comparing it with the preceding one.

a, the orbicularis palpebrarum; *b*, the opening of the eye-lids, through which the cilia of the upper lid are discernible; *c*, the levator palpebræ superioris; *f*, the openings of the excretory ducts of the lacrymal gland; *g*, the conjunctiva; *h*, the sebaceous glands shining through it; *i*, the portion of the conjunctiva reflected, and the glands exposed; *k*, the openings of these glands; *l*, the sebaceous glands of the lower lid wholly exposed, so as to shew their disposition in rows made up of small bunches united with each other.

Fig. 9.—This may be considered as the reversed appear-

ance of *fig. 2*. The true relative situation of the lacrymal gland, and of the lacrymal ducts, is particularly pointed out.

a b, c d, the upper and lower lacrymal canals as contained in the eye-lids; *a, a*, the openings or puncta lacrymalia; *b, b*, the blind pouches formed by each; *c c*, the continuation of the canals; *d, d*, their openings in the lacrymal sac; *e f g*, the lacrymal sac; *e*, the blind sinus at its upper end; *g*, its termination below in the nasal part of the lacrymal canal; *h i*, the termination of the duct in the nostril.

Fig. 10.—The lacrymal duct on the left side, viewed from the side next the nose, to give an idea of its direction, breadth, and of the opening in the nostril. It will be seen to be much wider on this, the internal, than on the anterior side.

a b, the palpebral portion; *c d*, the lacrymal sac; *e f*, the nasal portion; *f*, the natural appearance of its opening in the nose, not disturbed by the introduction of any instrument.

Fig. 11.—The lacrymal canal laid open, and halved, to shew its internal capacity, its thickness, and its structure.

a b c d, as in the preceding figure; *d*, a doubling, or fold of the internal membrane, which marks the end of the lacrymal sac; *e f g*, the nasal portion of the duct; *f*, a fold in the inner membrane, sometimes observable; *h*, mucous follicles, or cryptæ, which may be seen scattered up and down the membrane, especially after a successful injection.

PLATE III.

The figures of this plate exhibit the muscles of the globe, and the nerves belonging to them; together with the more intimate structure of the globe itself.

Fig. 1.—The muscles of the bulb of the left eye, with the levator of the upper lid, in their relative situation to each other, and to the bony orbit in which they lie.

1 2 3, the out-line of the left orbit; *1 3*, the internal; *1 2*, the external side; *3 2*, the inferior margin; *4*, the cartilaginous pulley for the tendon of the obliquus superior; *5*, the bulb of the eye; *6 7*, the optic nerve; *6*, the part which lies on the fella turcica; *7*, the part which enters the orbit.

a—e, the levator palpebræ superioris; *a*, its posterior tendinous extremity, adhering to the dura mater at the upper margin of the foramen opticum; *b*, its connection with the rectus superior; *c d*, its muscular part; *e*, its anterior tendinous end at the margin of the upper lid.

f g, the rectus superior, almost wholly covered by the levator palpebræ.

h i k, the rectus externus; *l*, the anterior attachment of the obliquus inferior; *m*, the rectus inferior; *n o*, rectus internus; *p—s*, obliquus superior; *q r*, its fleshy fibres, arising partly from the tendon, *p*; partly from the orbit; and terminating in the tendon, *s s*, which passes through the pulley *4*, and spreads over the bulb.

Fig. 2.—The same parts; the levator palpebræ, rectus and obliquus superior, optic nerve, and globe of the eye having been removed.

a b c, the rectus internus; *d e f*, rectus inferior; *g h i* rectus externus: it is split at its posterior tendinous end, *g*, to allow of the passage of nerves; *k l m*, the obliquus inferior; *k*, its attachment to the periosteum of the superior maxillary bone.

Fig. 3.—The trunks of all the nerves belonging to the eye, in their relations to the cranium, the orbit, the muscles, and the other parts of this organ. As this figure, exclusively of the nerves and lacrymal gland, is precisely the same with

with *fig. 1*, the letters of reference to the muscles are entirely omitted, to prevent obscurity.

2, the optic nerve; its final distribution will be seen below; 3, the third nerve of the brain or motor oculi; 4, the fourth nerve, or trochlearis; 5, the fifth nerve; A the contracted portion next the brain, which swells considerably at B; C, the first branch of the fifth entering the orbit; D, the second branch which passes through the foramen rotundum G; E, the third branch, which enters the foramen ovale F F.

The first branch of the fifth, after giving off a filament, *a*, which joins the fourth, divides into the ramus frontalis *b—i*, and the nervus lacrymalis, *k*. The ramus frontalis sends a small twig, *c*, to the neighbourhood of the trochlea; another, *d*, which joins the nervus infra trochlearis, *t z*. The proper frontal branch, *c*, is stretched over the levator palpebræ superioris, without sending any twig to it, and is distributed over the forehead *b b*, *i i—k*, the lacrymal nerve, the branches of which separating and re-uniting, may be divided into two principal parts, an internal, *l*, and an external, *m*. The inner branch, communicating with the external, *n o*, goes towards the lacrymal gland, in which it is partly distributed, a few filaments running on in conjunction with some from the external branch *r*, to the orbicularis, and skin of the upper lid, *s s*. The external branch is scattered in the substance of the lacrymal gland, and communicates by different filaments with the inner branch, *w*; with the third branch of the fifth, *v y*; and is finally lost on the upper lid; *y*, a small twig which enters the orbit from the facial nerve.

6 6 6, the sixth nerve of the brain. It is covered by the fifth, as far as D, entering the orbit with it. It is distributed on the rectus externus.

Fig. 4.—This figure exhibits more particularly the distribution of the third nerve, and the structure of the lenticular, or ophthalmic ganglion. It corresponds with *figs. 1*, and 3, the fourth, and most of the branches of the fifth are removed. The levator palpebræ and rectus superior are turned a little aside.

AA, the rectus superior turned off, so as to exhibit a part of its lower surface; B B, the levator palpebræ in the same situation.

3 *a*, &c. the third nerve. At its very entrance into the orbit, a small branch, *b*, is seen going off, which is joined by a small filament from the first branch of the fifth, *u*, and then divides into a branch for the levator palpebræ, *d*, and another, *e*, for the rectus superior; *e*, the greater branch, passes under the optic nerve on the outer side of the latter. It divides into an inner twig for the rectus internus; a middle one, *f*, for the rectus inferior; and an inferior, *g*, which again subdivides a short but rather thick portion, *h*, joining the ophthalmic ganglion, and a longer, and thinner, *i i*, passing to the obliquus inferior. From the ophthalmic ganglion two fasciculi of the ciliary nerves proceed. The smaller and superior fasciculus splits into three filaments, *k, k, k*, which pursue a serpentine course near that of the optic nerve, dividing into six or more unequal portions, *l, l, l*; three of these may be seen entering the sclerotica. The inferior fasciculus, rather the largest, generally divides into six filaments, two only of which, *m, m*, are here apparent.

5, the fifth nerve; *n*, the first branch of this nerve; four of its twigs are cut off; *o* corresponds to *a* in *fig. 3*; *p* to *b*; *q* to *c*; *r* to *k*; *s*, a fifth twig from this nerve, dividing, into a nasal twig, *t*, which is cut off, into another, *u*, communicating with that twig of the third which goes

to the rectus superior; and into a small filament which joins the ophthalmic ganglion.

6 *w*, the sixth nerve, or abductor, passing to the rectus externus at *w*.

The remaining figures represent minutely the structure of the globe of the eye.

Fig. 5.—The anterior half of the left eye, after the organs had been divided perpendicularly; the other half forms *fig. 6*; *a*, the cut surface of the sclerotica, of nearly uniform thickness all round; *b*, the dark-coloured substance between the sclerotica and choroidea; *c*, the tunica choroidea, appearing in folds from being cut; it is really spread uniformly smooth over the retina; *d*, the pigmentum nigrum, between the choroidea and retina; *e e f f*, the retina; *e e*, its cut margin, folded and turned in; *f f*, its anterior termination, seen more distinctly in *figs. 7, 9, 10*; *f g b*, the ciliary body, shining through the remains of the vitreous humour. From the great quantity of pigment covering it, its folds can be seen distinctly only towards the margin of the crystalline lens. It is manifestly not covered by the retina; *h*, the space between the ciliary processes and the lens, shewn by *z z* in *fig. 7*; *i k l*, the crystalline lens, included in its capsule, seen through part of the vitreous humour; *i k*, the iris, broadest at the outer side; *l*, the pupil.

Fig. 6.—The posterior half of the preceding section; *a b c d*, as in the foregoing figure; *e—k*, the retina, on its inner surface; the margin *e f* much wrinkled; *l*, the round spot, shewing the entrance of the optic nerve; *g b i*, branches of the central artery, and vein of the retina, filled with blood; *h, i*, two branches, which surround in a circle the foramen centrale, or centre of the retina; *k*, edged by a yellow ring, concealed in this view by the folds of the retina.

Fig. 7.—The lower half of the eye-ball divided horizontally, or at right-angles to the section exhibited in the two preceding figures. Its axis lies between the points 3, *d*.

a—d 6, the sclerotica; *b*, its thinnest part, under the tendons of the recti muscles; *c*, its middle portion, thicker; *d*, its thickest part, united with the sheath of the optic nerve; *6*, an hemispherical rising in the sclerotica, pierced by holes, through which the medulla of the optic nerve passes, to be expanded in the retina; *e—r*, the iris; *s*, its posterior surface, covered by pigmentum nigrum; *u u w*, the retina; *u*, its anterior margin, or termination; *w*, its internal surface, seen through the vitreous humour; *1 2—8*, the optic nerve divided; *4 5*, the sheath of the nerve, consisting of two laminae; *8*, marks of the central vessels of the retina perforating the optic nerve. The nerve diminishes very much in size at 6.

Fig. 8.—The posterior surface of the retina of the left eye, drawn from behind; the true centre of the retina falling exactly in the middle of the figure.

a, the retina spread over the vitreous humour, so placed as to suit the position of *fig. 5*; *b*, the foramen centrale; *c*, the yellow ring surrounding it; *d e f*, the place where the optic nerve perforates the sclerotica, the situation of the central vessels of the retina, improperly so called; *g, h, i*, three principal branches of these vessels, filled with blood.

Fig. 9.—A view of the retina and vitreous body, with the lens, seen from the front; it is the reverse of the preceding figure, exhibiting the anterior limits of the retina, the space between it and the lens, the anterior surface of the latter, and the foramen centrale, seen through the crystalline and vitreous bodies.

a b, the retina; *b b b*, its termination in front; *c b*, the corona ciliaris, formed by the membrana hyaloidea round the

the edge of the lens, corresponding to the ciliary processes; *c d e*, the lens; *d*, the foramen centrale; *e, e*, vessels of the retina.

Fig. 10.—The outer surface of the retina in the left eye; *a a*, its anterior margin; *b*, its central foramen; *b, i*, blood-vessels surrounding the latter; *c d*, the optic nerve, deprived of its investments; *e f g*, the corona ciliaris, not covered by the retina; *e f*, the distance of the ciliary body from the lens; *g*, remains of pigmentum nigrum; *k l*, the lens; *l*, the part projecting above the corona ciliaris.

Fig. 11.—The choroid coat of the left eye with the vessels injected; seen on the side towards the nose.

a b, the optic nerve; *c—f*, the remaining part of the sclerotica; *g—w*, the tunica choroidea; *g h i m*, the annulus gangliformis; *m*, the internal long ciliary artery; *n*, the internal long ciliary vein; *o*, the internal long ciliary nerve; *p, p*, the long and short arteries of the choroid; *q, q*, the ciliary nerves; *r*, a trunk of the vena vorticosæ superior; *s*, a trunk of the vena vorticosæ inferior; *t*, another of the same; *g b*, the margin which marks its separation from the iris.

Fig. 12.—The anterior surface of the choroid, and iris of the left eye, being a front view of the preceding figure.

a b c, tunica choroides; *b c*, the annulus; *d—g*, the iris; *d h*, the margin connected with the choroides; *d e*, the outer or larger ring; *e f*, the inner or lesser ring of the iris; *g*, the pupil; *d f*, the narrow side of the iris next the nose; *g h*, the broader side towards the temple; *n, n*, ciliary nerves, forming plexuses on the annulus; *r*, the external long ciliary artery; *s*, the internal long ciliary artery.

Fig. 13.—A view of the crystalline lens of a child newly born, shewing its rounded form.

Fig. 14.—The lens of a child of six years old, increased in circumference, not in thickness.

Fig. 15.—A side view of the lens of an adult. The difference between the anterior and posterior segments is less than in either of the preceding.

PLATE IV.

Fig. 1.—A segment of the choroides and iris of a newborn child, seen on its internal surface, magnified twenty-five times. The vessels are filled with injection.

a, the true size of this segment; *b—g*, the part belonging to the iris; *b c*, the margin of the pupil; *f g*, the margin next to the circumference of the cornea; *b—e*, part of the lesser ring of the iris; *h, h*, trunks of blood-vessels supplying this network; *d—g*, part of the greater or outer ring. The difference in the distribution of the vessels on these parts is very evident; *i, k, l*, three larger arteries arising from the circle formed by the long ciliary vessels round the iris; *m—s*, a segment of the corpus ciliare; *n, o, p*, three entire plicæ or folds; *m, q*, two segments of folds; *t v*, the projecting margin of the fold, which dips into a corresponding depression in the vitreous body; *v w*, a deeper part of the margin, where the plicæ join each other; *r s x y*, a striated part of the choroides between the ciliary body or processes, and the anterior margin of the retina, seen in *Plate III. fig. 5*; *x y z 1*, part of the choroid corresponding to the retina; *x y*, that opposite the termination of the retina; *2—8*, trunks of the venæ vorticosæ.

Fig. 2.—The anterior part of the choroides, with the iris, and membrana pupillaris, in a fœtus of seven months, magnified quadruply, and the vessels filled with injection.

A, the true size of this segment; *a b*, the proper choroid of the bulb; *c*, the annulus gangliformis; *c d*, the iris; *d e*, the membrana pupillaris, its vessels continuous with those of

the iris; *f*, the long internal ciliary artery; *g*, the long external artery. These arteries, by their divisions, form a ring round the iris; *1—5*, five venous vortices in the choroid.

Fig. 3.—The posterior part of the crystalline lens, enclosed in its capsule, from a fœtus of seven months, with the vessels injected, magnified to four times its natural size.

A, the true size of the lens; *b*, a blood-vessel from the central artery of the retina, which has passed through the middle of the vitreous humour, and is scattered over the capsule.

Figs. 4 and 5.—Views of the left eye, after a plane perpendicular section passing antero-posteriorly through the orbit, and the parts it contains, dividing them into two equal portions, an internal and external, the former of which is here represented. Every part is seen in its natural situation, nothing having been disturbed or removed. The explanations are given in the following plate, where the figure is magnified to three times its natural diameter, in order to avoid confusion, and express the objects more distinctly. In *fig. 4*, the eye is shut; in *fig. 5*, it is open. Some parts also which were exhibited in *fig. 4*, having been removed, others are brought into view in *fig. 5*. In *fig. 5*, we observe the fold of the upper lid, and the cilia vilage passing under the fold back into the orbit. The retina and lens being removed, the choroid is brought into view, with its ciliary processes, venæ vorticosæ, and long internal ciliary artery. It shews also the situation of the central artery of the retina.

PLATE V.

A magnified outline of *fig. 4*, of the preceding plate. As this is a most important view, the references are given very fully. The words "cut surface of" should be understood throughout; they are omitted to avoid the tedious repetition of the same phrase.

A—Q, the bony orbit; *A—H*, the upper plate of the orbit; *A B*, the smooth surface towards the eye; *C C G H*, the convex surface, uneven, corresponding to the brain; *A D E F*, the frontal part of the os frontis; *C C G*, the orbital part of the os frontis; *E E*, the medullary cells of the frontal part; *F*, the left frontal sinus; *F F*, the medullary cells of the orbital part; *G*, the future between the frontal and sphenoidal bones; *G B H*, a part of the upper or lesser ala of the sphenoidal bone, which forms the upper part of the canal for the optic nerve; *Q—M*, the inferior plate of the orbit; *I I*, the superior maxilla; *K L*, the orbital fissure occupied by tendinous fibres, fat, vessels, and nerves; *M*, part of the lesser ala of the sphenoidal bone, forming the lower part of the foramen opticum; *L*, the perosteum; *B H M*, the canal in the ala minor of the sphenoidal bone for the optic nerve, or foramen opticum; *N*, the perosteum of the frontal bone; *O*, a continuation of the perosteum towards the upper lid, forming a kind of ligamentous arch, the ligament of the superior tarsus; *P*, the perosteum of the superior maxilla; *Q*, a continuation of this perosteum, towards the lower lid, in the form of an arch, the ligament of the inferior tarsus; *† †*, the axis of the orbit; *R—V*, the dura mater; *R*, the external, *S*, the internal layer; *T U V*, the place where the dura mater is united partly with the perosteum of the orbit *T*, partly with the sheath of the optic nerve *U*, partly with the origin of the levator palpebræ *t*, and the rectus superior *4*; *W—Z*, the forehead; *W*, the thickness of the skin of the forehead; *X*, the fat between the skin and the frontalis; *Y*, the frontalis; *Z*, the fat between the frontalis and the perosteum of the frontal bone.

a—d, the brow, or supercilium; *a*, corrugator supercilii;

cilia; *b*, mouth of the frontal vein; *c*, mouth of the frontal artery; *d*, hairs of the eye-brow; *e-w*, the upper eye-lid; *e*, skin; *f*, fat between the skin and orbicularis, gradually disappearing towards the eye; *g*, orbicularis palpebrarum; *h*, fat beneath the orbicularis, terminating in a thin edge below; *i*, the tendon of the levator palpebræ superioris; *k*, cellular tissue between it and the conjunctiva; *l*, the cartilage of the upper lid; *m*, marks of the sebaceous follicles; *rrst*, conjunctiva of the upper lid; *rr*, where it invests the cartilage and sebaceous glands; *rs*, where it is connected with the tendon by cellular tissue; *rkst*, where it becomes reflected on itself; *st*, where it is spread over the globe of the eye; *yrz*, the superior bursa, or fold of the conjunctiva; *ke*, the space between the two layers, represented by the black line, as the two surfaces are in contact; *opq*, the margin of the upper lid; *q*, the part where the skin of the face becomes inflected, and continued into conjunctiva; *u*, the cilia or eye-lashes of the upper lid; *n*, the opening of the coronary artery of the upper lid.

a-g, the lower eye-lid; *a*, skin; *b*, fat beneath it; *c*, orbicularis; *d*, fat under the orbicularis; *ge*, cartilage of the lower lid; *fgb*, margin of the lower lid; *h*, a groove between the two edges; *y*, triangular hollow left between the edges of the eye-lids, and the eye-ball, when shut; *k-n*, conjunctiva of the lower lid, disposed as in the upper; *y, l*, the inferior bursa of the conjunctiva; *p*, lower eye-lash; *q*, a quadrangular space between the cilia and the margins of the eye-lids.

1—11, muscles of the eye; 1 2 3, levator palpebræ superioris; 4 5 6, rectus oculi superior; 7 8 9, rectus inferior; 10, the tendon of the obliquus superior; 11, the fleshy part of the obliquus inferior.

12—18, the optic nerve, curved, somewhat like an italic *f*; 12 13, the sheath of the optic nerve; 12, its internal, 13, its external layer; 14, the thin membrane immediately investing it; 15, the fibres of the nerve cut and exposed; 16, part of the nerve as it passes the bony canal, appearing compressed from above below; 18, the contracted extremity of the nerve in the sclerotica; 19, the principal trunk of the ophthalmic artery; 20, the principal trunk of the ophthalmic vein; 21, some branches of the nerve of the fifth pair.

22—43, the bulb of the eye; 22 22, the axis of the bulb; 23, the greatest transverse diameter of the bulb; 24—26, the cornea; 25 26 26, the space between the cornea and lens, divided into the anterior chamber, 25; and the posterior chamber, 26 26; 24 *r*, and 24 *r*, a double groove between the cornea and sclerotica; 27—29, the sclerotica; 27, its anterior limit, with the double groove, to which the annulus of the choroid is firmly fixed; 32; 28, the thinnest part of the sclerotica; 30, the pigmentum nigrum between the sclerotica and choroidea; 31—37, tunica choroidea; 32 33, the annulus gangliiformis; 34, 35, ciliary processes; 34 39 39, part of the choroid not covered by retina, and which is generally of greater brightness than the rest; 36 37, the iris; 36, the margin by which it adheres to the annulus and ciliary processes; 37 26, the margin of the pupil; 38, pigmentum nigrum between the choroides and retina; 39 40 41, the retina. Its anterior termination pointed out by the line 39 46 39; 40—46, the crystalline lens; 43 42, the long diameter; 44 45, the short diameter; 42—44, its anterior convexity; 42 45 43, its posterior convexity; 46 26, the capsule of the lens; 34, 42, the distance of the lens from the ciliary body.

In this outline the forms and proportions of the several

parts are preserved with the most scrupulous exactness, so that any calculations made from it will be founded correctly.

Physiology of the eye.—To estimate correctly the powers of the eye requires an acquaintance with the nature of light, and with the laws by which it is regulated; an exact knowledge of the organ; and of the forms, proportions, densities, refractive and dispersive powers of the transparent parts, as well as of the radii of their curvatures. Since many of these points are hitherto but imperfectly elucidated, we cannot expect to determine the functions of the eye accurately in all their detail. Generally, indeed, in investigating this delicate organ, the mathematicians have been deficient in correct anatomical knowledge; while anatomists have been unacquainted with the science and with the method of calculating accurately the results of their observations.

Experiment and calculation prove that the luminous rays proceeding from any object to the eye undergo certain changes in their passage through the transparent parts of the organ; that these changes ultimately collect the rays, proceeding from the several points of the object, into opposite corresponding focal, or nearly focal points on the retina; and that the impression thus produced causes the perception of the object. A simple but interesting experiment will prove the point. Let an eye, from which the back of the sclerotica and choroid have been carefully removed, and their place supplied by oiled paper, or by the membrane which lines the shell of an egg, be placed in a room with a single candle, with the cornea towards the luminous object. The image of the candle will be represented on the paper, diminished in size and inverted. Without attempting to calculate precisely the refraction or dispersion of the rays in the different parts, we shall trace them from the anterior surface of the cornea to their collection into foci on the retina, giving the change of direction in general terms.

The pencils of rays radiating from any object, when they arrive at the surface of the cornea, form cones, the points of which are at the object, and the bases on the cornea. Those which impinge on the opaque sclerotica are reflected, and have no concern in the production of vision; and those which, falling very obliquely, make a very considerable angle with the cornea, are also reflected without penetrating into the aqueous humour. The rays, which fall within an angle of about 48 degrees, pass through this membrane, undergoing a certain refraction, by which they are brought nearer to the line of the axis of the cornea; and, if produced, would converge into a focal point beyond the bottom of the eye. From the cornea the rays pass into the aqueous humour. They are divided by the dispersive powers of this fluid, so that, if continued in the same medium, they would not only converge beyond the back of the eye, but on account of the aberration caused by their different refrangibility, would produce a confused and coloured image.

The rays collected by the cornea pass through the pupil. Those which come in an unfavourable direction are either reflected by the iris, or absorbed by the pigmentum on its posterior surface. The pupil admits only those rays which are the nearest to the axis of vision. They then meet with the crystalline, which, by its refractive powers, collects them, and brings them into foci, after passing through the less refractive medium of the vitreous humour on the concave surface of the retina.

They do not impart a correct perception of the body which reflects them, unless they fall on the retina precisely in the order in which they are detached from that body.

To produce this effect, it is necessary that all the rays, which proceed from any one point, should be collected in one point of the retina; and that all the points of union thus formed should be disposed in the same manner as in the body, of which they form an image.

The cone of rays which proceeds from any luminous point to the cornea forms another cone, the apex of which falls on the retina. These two cones have their axes almost in a straight line. That which is perpendicular to the middle of the chryalline proceeds directly to the bottom of the eye; that which comes from above falls inferiorly; that on the left proceeds to the right, and so on with respect to the others: thus an inverted image is formed on the retina.

Among the obvious advantages derived from the actual disposition of the several parts of the eye, we may remark, "that the surface of the cornea only, if it had been more convex, could not have collected the lateral rays of a direct pencil to a perfect focus, without a different curvature near its edges; and then the oblique pencils would have been subjected to a greater aberration, nor could have been made to converge on any focus on the retina. A second refraction performs both these offices much more completely, and has also the advantage of admitting a greater quantity of light.

The iris, by altering the diameter of the pupil, in the manner we have already noticed, will influence immediately the quantity of light admitted into the eye. If one eye is closed, and we continue to look at the same object, the pupil of the open eye dilates evidently, and contracts again, as the other is opened, to its former diameter. The iris also intercepts such rays as would fall on parts incapable of refracting them regularly, or such as are directed so obliquely on the cornea as to be too much refracted, admitting only the smaller pencil which enters the eye more in the direction of its axis. This reasoning applies, however, but partially, and only in cases where the opening of the pupil is circular, and where the confusion which would arise from the aberration of the extreme lateral rays may possibly be prevented: it will not hold good where the opening is very much extended, oblong, vertical, and, in some circumstances, almost linear, as in the cat. The eccentricity of the pupil mentioned in the description of the iris can only so far influence the pencils of rays as to make them fall on the anterior vertex of the chryalline, with which it corresponds; the axes of the pupil, and the lens, do not correspond with that of the cornea. From observing that the pupil changes, when objects are brought nearer to or removed farther from the eye, physiologists have fancied that alterations in its diameter are the principal means of adjusting the organ to different distances. But it has appeared from careful experiments that this contraction and dilatation are irregular and limited; that by bringing the object nearer to the eye, within a certain distance, the pupil not only ceases to contract, but becomes again dilated; and, that beyond a few yards distance, it also ceases to dilate. In viewing the sun, instead of dilating according to the distance, it contracts most closely, obeying the quantity and intensity of the light, rather than the distance of the object. In viewing a less luminous object, the pupil dilates, when it is more distant, a greater quantity of light being necessary to produce a clear impression; as the object is brought nearer, we require a less degree of light, and the iris contracts to exclude what is superfluous. Thus far the iris may be useful in accommodating the eye to different distances; it may regulate the quantity of light, but it cannot alter the direction. In frequent vision, the pupil preserves its diam-

eter with readiness, when the proportion of light necessary to be admitted is once determined. By its contraction, when a nearer object is viewed, it lessens the confusion which would arise, in such eyes as cannot accommodate themselves sufficiently by powers hereafter to be examined, from the magnitude of the imperfect focal points on the retina.

Some inflection of the rays may have place in passing the edge of the pupil; but its great mobility, the wideness of the opening, and its very small distance from the chryalline, prevent any apparent confusion. Where from any cause the opening is very narrow, and the iris has but little motion, a confusion may certainly take place from this cause.

The alterations of the pupil accommodate the eye to various states of disease, by regulating the quantity of light. When a great number of rays would occasion pain in an inflamed organ, the contraction of the aperture excludes the light; while a proportionate enlargement of the pupil provides against the inconveniences of diminished sensibility, by admitting the greatest quantity of rays.

As the chryalline lens differs in density gradually in every direction, approaching the vitreous humour on one side, and the aqueous on the other, Mr Rutherford supposes that its refractive power must be the same with that of the two contiguous substances. Its principal use appeared to him to be that of correcting the aberration arising from the spherical figure of the cornea, where the principal part of the refraction takes place. From the constitution of the chryalline he inferred, that it will refract the rays of light without reflecting any of them; so that, although we have two surfaces of the aqueous, two of the chryalline, and two of the vitreous humour, we have only one reflected image, and that being from the front of the cornea, there can be no surface to reflect it back, and dilate the image on the retina. If the surfaces of the chryalline had been abrupt, there must have been a reflection at each, and an apparent haziness would have interfered with the distinct view of every luminous object. The smaller density of the lateral parts will not only correct the aberration of the spherical surface of the cornea, but will cause also the focus of each oblique pencil of rays to fall either accurately, or very nearly so, on the concave surface of the retina, throughout its extent. Had the refractive power been uniform throughout the whole substance of the lens, it might have collected the lateral rays of a direct pencil nearly as well, but it would have been less adapted to the oblique pencils of rays. Also, the gradual increase of density in approaching the centre makes the chryalline equivalent to a much more refractive substance of equal magnitude.

The principal use of the vitreous humour appears to be that of giving a ready passage to the rays of light, as they are converging into foci on the retina, and of keeping at the same time the surface of the latter uniformly spherical. It would allow a change of figure in the eye, or in the lens, or even a change of place in the latter, supposing there were powers in the living organ adequate to the purpose.

Some have conceived that the retina is not equally sensible in all parts, and that a certain portion only, near the axis of the eye, is capable of conveying distinct impressions of minute objects. Comparetti says that distinct vision is effected only in the optic axis, which is moved most rapidly over every point of the object; and that what is seen apparently out of the axis is caused by the direction of the first impression in the axis. We believe, however, that the limits of distinct vision are far more extensive. Dr Young, speaking of his own eye, says, that the visual axis being fixed in any direction, he can see at the same time a lumi-

nous object placed at considerable distances from it; the angle, however, differs. Upwards it extends to 50 degrees, inwards to 60, downwards to 70, and outwards to 90 degrees. These internal limits of the field of view nearly correspond with the external limits formed by the different parts of the face, when the eye is directed forwards and somewhat downwards, which is its most natural position; and both are well calculated for enabling us to perceive the most readily such objects as are the most likely to concern us. The extent of the retina is every way greater than the limits of the field of view. The whole extent of perfect vision is little more than ten degrees; or, more strictly speaking, the imperfection begins within a degree or two of the visual axis, and at the distance of five or six degrees becomes nearly stationary, until, at a still greater distance, vision is wholly extinguished. The imperfection may be owing partly to the unavoidable aberration of oblique rays, but principally to the insensibility of the retina; for, if the image of the sun itself be received on a part of the retina remote from the axis, the impression will not be sufficiently strong to form a permanent spectrum, although an object of very moderate brightness will produce this effect, when distinctly viewed. The motion of the eye has a range of about 55 degrees in every direction, so that the field of perfect vision, in succession, is by this motion extended to 110 degrees.

It appears from some experiments of Haldat's, made by producing an artificial strabismus, that the opinion, which limits the position in which an image can be seen distinctly to a point at the bottom of the eye, is by no means reconcilable with actual observation. For, in an artificial strabismus, one of the impressions falling on a part without the visual axis, ought not to produce any perception of the object; this we know not to be the case. From this fact alone we may conclude that the place of the image is not necessarily confined to the axis, but that many points of the surface of the retina are capable of conveying an impression of it. As the angle is increased, the perfection of the image may be lessened; but we do not lose the perception of it until its position is such, that none of the rays proceeding from it directly can be brought to converge on the posterior hemisphere of the globe. This would appear to conform also with our ideas of the use of the extent of the retina, for which, if the field of vision was so extremely limited, we could assign no reason. The points of it, at a distance from the axis, may be less favourably disposed, but are not perhaps less susceptible of being affected. "The whole of the retina is of such a form as to receive the most perfect image on every part of its surface, that the state of each refracted pencil will admit; and the varying density of the chrysaline renders that state more capable of delineating such a picture than any other imaginable contrivance could have done." To illustrate this, Dr. Young has given an excellent diagram, representing the successive images of a distant object filling the whole extent of view, as they would be formed by the successive refractions of the different surfaces. In opposition to the observations given above respecting the decreasing sensibility of the retina remarked by Dr. Young, it has been observed by others, that, on comparing the impressions produced by rays parallel to the optic axis with those by rays much inclined to this axis, they have appeared to differ in intensity only in a degree corresponding to the diminution in the extent of the opening of the pupil, produced by the obliquity of its plane to the luminous rays, and by the obliquity of the rays themselves to the refracting substances through which they pass. At the most, the difference of the clearness of the impression

is not such as it would be, if it depended on a diminution of the sensibility of the retina, proportionate to its distance from the optic axis. Notwithstanding the influence of the causes just mentioned, the light of a candle passing into both eyes, when their axes are artificially inclined, so that the images make angles of 15 to 25 degrees with the optic axis, suffers no apparent diminution of brightness. This fact certainly gives to the field of distinct vision a more considerable extent than that usually assigned it. The point of the retina, which corresponds to the optic axis, may possibly be the place of most perfect vision; not because it is endowed with a greater sensibility than other parts of the retina, but from its being in the exact focus of the refractive powers of the eye, and the only point where the image can be impressed with every perfection.

In considering the sensibility of the retina, the effects of the pigmentum must not be overlooked. In the human subject the pigment varies in colour; but is always more or less dark. In animals, where the pigmentum is more than of one colour in the same eye, the lighter portion is always placed at the bottom of the eye, including the entrance of the optic nerve in its sweep; the colour varies in different animals, but has always a brilliant surface. Probably the light has a greater effect on the retina, in eyes which have a white pigmentum, than in such as possess a dark one. Hence all animals see more or less distinctly in the dark, according as their laeud tapetum approaches nearer to a white or black colour. Man, in whom it is dark, sees very imperfectly in a light where a cat, or dog, would perceive objects with tolerable clearness. We may observe, that when either of the latter look at us in the dark, the whole pupil is enlarged and illuminated; but in a full light there is no such appearance. Here there must be a reflection of light from the bottom of the eye to produce the effect; and the reflected light is always of the same colour with the tapetum. Those individuals of our species who have a light pigmentum, see much better with less light than those who have it dark. In the Albino, where the colouring matter is exceedingly thin, or wholly deficient, the common day-light is far too powerful to admit of distinct vision. When he attempts to examine the qualities of an object with precision, the eye-brows are knit, and the eyelids kept almost shut. In the twilight he can see more plainly, as the luminous rays are then not too intense for the very sensible retina. The ferret is destined, from its mode of life, to see in dark places; and its pigmentum is naturally white.

The rays which pass through the transparent retina are disposed of according to the reflecting powers of the pigmentum. In man, who requires distinct vision in a moderate light, rather than the power of seeing where light is almost wholly wanting, the pigmentum is dark, and the rays are absorbed, and entirely lost; therefore, in such eyes, it can add nothing to acuteness of vision, and a considerable quantity of light is required to produce an adequate impression on the retina. The rays are then lost in the pigmentum, and the accuracy of the image is no way impeded. In animals, who require a great acuteness of sight, the rays, reflected from a light and brilliant surface, again impress the retina, and increase the power of vision. The interval of time is too short, and the distance between the points they may strike in their double passage too minute, to occasion any indistinctness of the image.

Distinct vision requires that the object should be fixed, and not allowed to move over the surface of the retina. To accomplish this object, the muscles of the globe are employed in the manner above described. We believe the

impression made on the retina by the luminous rays to be in some degree permanent, and the more so as the light is stronger. The duration may vary probably from 100th of a second to nearly a second. Hence the well-known phenomenon of the circle of light in revolving a lighted stick. If the object is painfully bright, the sensation is more permanent, and vanishes at last gradually.

It is very difficult to ascertain the proportions of the eye so exactly as to determine with certainty the magnitude of the image on the retina, as the situation, curvature, and constitution of the lens will make a very material difference in the result. It is proportionate to the magnitude and distance of the object, and is measured by the angle which each end of the object makes with the retina. The more remote therefore the object, the smaller the image, as it is included in a smaller angle: when the distance is so great as to put an end to distinct vision, we suppose the angle on the retina to be too acute to convey any precise idea of the size of the object. By ascertaining the least possible object that the eye is capable of discerning, we may thus form some conjecture as to the smallest possible image. The power varies no doubt in different individuals, and has been variously estimated. The eye of almost all persons can perceive distinctly two points subtending an angle of a minute; in some persons it can distinguish the difference of objects subtending an angle of 20 seconds. A single object, if bright, and at the proper distance for distinct vision, (about eight inches,) may be discerned, though not subtending an angle of two seconds and an half. Haller says even less than this. In the section of a gilded silver thread, the gold may be distinguished from the silver, when not exceeding $\frac{1}{100000}$ th of a line in thickness. According to the rule above-mentioned, the image of distinction in this case must form on the retina a point almost incalculably small, and yet such is the sensibility of the latter, that the difference of the objects is accurately determinable. This far exceeds the common opinions concerning the powers of the eye in discerning minute objects.

Experiment has shewn that there exists in the retina an insensible spot, about an inch in diameter: if the image falls on this, no perception is produced. Two pieces of white paper are fixed on a wall somewhat darkened, about level with the eyes, two feet distant from each other, the left eye is then shut, and the right eye directed upon the left object; if the observer moves slowly backwards, the object, although four inches in diameter, will disappear at the distance of nine or ten feet. The experiment may be made more simply with the two thumbs, or two candles. The latter are placed, say at ten inches from each other; at a distance of 16 feet, if the eye is directed to a point four feet to the right or left of the middle of the space between them, they are lost in a confused spot of light; but any inclination of the eye brings one or other of them into the field of view. The object is supposed to vanish, or become obscure, when it falls directly on the spot occupied by the entrance of the optic nerve. Different experimenters have varied in their estimate of the diameter of the insensible spot, from the fortieth part of an inch, to a seventh part of the diameter of the bulb; the first we believe to be too small, the last certainly too great. Since the discovery of the central foramen in the retina, a question has been started, whether the want of the retina at this spot does not account more satisfactorily for the vanishing of the object, than any supposed insensibility at the entrance of the optic nerve? The answer is, that the situation of this foramen in the retina does not correspond with the part opposed to the object, when rendered invisible; and that the entrance of

the optic nerve is found to be precisely in the part opposed. The orifice itself is placed just at the end of the visual axis, and must, we should conceive, have some material office attached to it, and have a considerable effect on vision. The saturation of the yellow ring around it appears by observation to be connected with the acuteness of the organ. Mr. Home says, "it is probably too small to produce any defect in vision:" that it produces no defect we readily admit, but that it is too small to influence vision, is not, we think, at all probable. Its use has not been as yet ascertained. Blumenbach advances the following conjecture on this point. Man, and such animals as have the two eyes placed with the axis parallel, thereby gain the advantage of seeing objects with both eyes at once, and therefore more acutely. But at the same time they are exposed to this inconvenience, that in a strong light both eyes become dazzled at once; and this happens so much the sooner, because the light falls on the corresponding principal focuses of both eyes at once. This inconvenience seems to be obviated by the foramen centrale; since that part which forms the principal focus of the eye opens in a dazzling light, so as to form a kind of small pupil, through which the concentrated rays pass, and fall on the pigmentum beneath.

Since the images are pictured inverted on the retina, many disputes have arisen as to the cause of our perceiving the objects erect. If it be allowed that we judge of the situation of each luminous point by the direction of the rays it transmits, it follows, that we must see bodies as we really do see them, in their proper position. The opinion that we really see objects reversed, and correct the sensation by experience and judgment, derived from the other senses, is liable to very numerous objections. The chick just hatched knows where to direct its bill; and persons born blind, who have suddenly gained their sight, see objects in their proper position. We do not see the picture on the retina, but the object itself in the direction of each of the rays which conveys to us the sensation, or, to speak more correctly, in the direction of the axis of that pyramid, which a pencil of divergent rays forms in proceeding from any point of an object to the eye. Berkeley explains the supposed difficulty in another way; he does not allow that we can estimate the situation of parts or objects by the decussation and direction of the rays of light, as the mind neither perceives the interfections of the radius pencils, nor pursues the impulses they give in right lines: without perceiving them it cannot form a judgment, and it cannot perceive them without a consciousness of such perception. The situation of visible objects must be entirely relative, and depend on the place which they occupy with regard to each other. And as all visible objects are inverted at the same instant, each will be in the same relative situation on the retina as it is in actually. Thus the terms of above and below are arbitrary expressions, by which it is agreed to call upper, what corresponds to the heavens, and lower, what corresponds to the earth. Now it is evident, that at the bottom of the eye the situation of these is inverted, the earth is above, and the heavens below. We call that the lower end of an object which is nearest the ground; and the image of a man's feet, being in contact with the image of the earth on the retina, we naturally infer that they are in contact with the actual earth; the head being more remote from the earth, we suppose that it is higher. The conclusion has arisen from mixing the ideas derived from the different sensations of sight and touch. You say, (to use the words of Dr Berkeley,) the picture of the man is inverted, and yet the appearance is erect. I ask you what mean you by the picture of the man, or, which

is the same thing, the visible man's being inverted? You tell me, it is inverted because the heels are uppermost, and the head undermost. Explain me this; you say, that by the head being undermost, you mean that it is nearest to the earth; and by the heels being uppermost, that they are farthest from the earth. I ask again, what earth you mean? You cannot mean the earth that is painted on the eye, or the visible earth; for the picture of the head is farthest from the picture of the earth, and the picture of the feet nearest to the picture of the earth; and accordingly the visible head is farthest from the visible earth, and the visible feet nearest to it. It remains therefore that you mean the tangible earth, and so determine the situation of visible things with respect to tangible things, which is absurd, and perfectly unintelligible. The two distinct provinces of sight and touch should be considered apart, and as if their objects had no intercourse, no manner of relation to one another, in point of distance or position.

Two distinct images are painted, one upon each eye, and yet we only perceive a single object. Many very different explanations have been given of this phenomenon; the most satisfactory is, that in the two eyes there are corresponding parts of the retinae which are probably susceptible of the same impression in equal degree, and convey it to the sensorium in that equal degree: hence, as long as similar points of the images fall upon the corresponding points of the retinae, the perception of the same object is single. It is double for the same reason whenever the disposition of the visual axes is deranged. Every object which produces two distinct images on the retinae is necessarily placed at the point of intersection of the optical, or visual axes, and is painted consequently on corresponding points of the retinae. By an artificial pressure on one of the eyes we may so displace its visual axis, or point of most perfect vision, that the two images shall not fall on those parts of the retinae of the two eyes usually impressed simultaneously; a double image is the consequence. The optical axes are so nearly parallel to each other, that they naturally meet at a great distance; but, in order to preserve the simplicity of the perception, when we look at an object brought nearer to us, we make them converge towards it by means of the external muscles of the eye, which is further adjusted to the decreasing distance by some other of its powers, so as to convey a single and distinct image of the object. This opinion is confirmed by some observations of Mr. Home's on double vision as the consequence of a want of correspondence, produced by some change in the refracting media of one of the eyes, or else by a want of similar actions in the muscles of both eyes respectively. The former takes place after the chrySTALLINE lens has been extracted, and the convex lens made use of to produce the requisite focal adjustment is not properly placed. Yet, when objects are in rapid motion, or when brought very much nearer to the eye than the point of distinct vision, may not the impressions be made on points not exactly symmetrical, or in the visual axis, without producing double vision? It appears from experiments that it is not absolutely necessary that objects should fall on the visual axis in order to produce single vision, but that there are many points at different distances from the axis on which, if the images fall, they will appear but as one. In the transverse plane the optical axes must be much inclined (about 15 degrees), in order to produce a double image; in the vertical, a very slight inclination is sufficient to cause it. It is inferred from these experiments, that the limits of the field of single vision, or of the area of the points of correspondence, will form an ellipse, of which the long axis corresponds to the transverse axis of the globe, and the short to the verti-

cal axis: the first of these is about three lines and a half in length, the last scarcely one. It has been a matter of doubt, how far the judgment is concerned in the perception of the single image. Objects appear single, it is said, although there is a double image, because the touch which corrects the impression produced by vision teaches us that the same object we see double is actually single. Experience and custom have so well established our judgment, formed from these two sensations, that we cannot derange it by the will. An argument against this is, that in cases where persons born blind have obtained their sight, the object is at once seen single.

As double vision is produced by a moderate derangement of the optic axes, squinting is produced by a much greater derangement. It does not follow that the squinting person sees every object double, for the apparent improper direction of the eye may be owing to the unusual situation of the parts of the eye, so that the image may yet fall on corresponding parts of the retinae. The more probable explanation is, that the object is not seen by both eyes; but that one eye, more or less perfect, is directed to the object; while the other, which in such cases is imperfect, is drawn aside by habit, in order that its operation may not disturb the impression received by the other eye. The greater strength, shortness, and straightness of the rectus internus muscle, may be the reason that the deviation is made towards the nose. Squinting takes place in three different circumstances; when one eye has only an indistinct vision; where both eyes are capable of seeing objects, but the one is less perfect than the other; and where the muscles of one eye have, from practice, as in the case of frequently looking through telescopes, acquired a power of moving it independently of the other.

The superiority of vision with one eye over that with two has been the subject of many discussions. It is commonly supposed that the first produces the most distinct perception; the opinion, however, is not correct. If we place a sheet of white paper directly before the eyes, and bring any opaque body, a book for instance, before the right eye, so that half the paper is concealed from it, while the whole is visible to the left; on regarding the surface alternately with one, or both eyes, we may observe distinctly that the part visible to both eyes is brighter and clearer than that which is visible only to the left: the first is of its usual whiteness, the last is obscured by a slight shade. The superiority of telescopes with two eye glasses, over those with one, is universally acknowledged. In vision, with two eyes, therefore, we believe the impression to be stronger, the sensation more vivid, and the perception clearer; not doubly so as the impression is, because we can with difficulty distinguish coincident similar impressions. If we look at any object through fluids of two different colours placed one before each eye, the object will appear of the colour resulting from the mechanical mixture of the two employed. If the colours were yellow and red, the perception would be as from orange, &c.; proving that a double impression produces in this case a compound or mixed sensation, from which a simple perception arises. There are many other phenomena attendant on the separate vision of different objects producing different combinations of them, which our limits will not allow us to discuss. The reader will find this subject very amply considered by Dr. Haldat in the *Journal de Physique*, t. 63, and illustrated by numerous apparently accurate experiments. The conclusion to be drawn from them is, that in many circumstances vision with both eyes will produce a simple perception, an apparent combination of objects varying in colour and form when they are viewed separately by each eye. And that

objects are not increased in their apparent dimensions when seen with both eyes, although their brightness is rendered more intense under the same circumstances.

The image of the object is supposed to be painted on the retina, free from any prismatic colours produced by the different refrangibility of the rays, which might render it confused. The transparent parts of the eye are so disposed as to correct the aberration of the visual rays, and to prevent their final dispersion. These effects are principally effected by the curvatures and constitution of the chryalline already insisted on, which produce the same effect that in an achromatic object glass we obtain in a less perfect manner, by proportioning the radii of curvature of different lenses. In the eye it has been generally supposed that the correction is perfect, the regular diminution of the density of the chryalline, redressing the errors caused by the cornea and aqueous humour. The perfection of the achromatic powers of the eye has been called in question by many able men, especially in consequence of experiments related by Maskelyne, Comparetti, and Dr. Young. Dr. Maskelyne, by calculating the refractions of the mean, most, and least refrangible rays at the several humours of the eye, inferred a diffusion of the rays, proceeding from a point in an object, at their falling on the retina. The circle of dispersion, however, would be too small to occasion any confusion; and he shews that the picture of objects on the retina is relatively, if not absolutely, perfect, and fitted for every useful purpose.

The experiments and observations of Comparetti are ingenious; he supposes that the chryalline lens cannot, under all circumstances, correct the dispersion of the rays, although he conceives it to be susceptible of certain alterations of position directed solely to that purpose. His experiments are too numerous, and complicated to be introduced here in any shape. He proves, perhaps, a slight imperfection, under certain circumstances. Dr. Young does not think that the structure of the chryalline, or any other provision, has the effect of rendering the eye perfectly achromatic. He adduces the colour bordering the image of an object seen indistinctly; the colours perceived on viewing an object through small openings, such as those of his optometer; and the following experiment mentioned by Dr. Wollaston. He looks through a prism at a small lucid point, which of course becomes a linear spectrum. But the eye cannot so adapt itself as to make the whole spectrum appear a line; for if the focus be adapted to collect the red rays to a point, the blue will be too much refracted, and expand into a surface; and the reverse will appear if the eye be adapted to the blue rays; so that in either case the line will be seen as a triangular space. He concludes also by another experiment, that the red rays, from a point of twelve inches distance, are as much refracted as white or yellow light, at eleven. The inference is, that the eye is not capable of uniting at the same point all the elementary colours of light. These observations have been examined with much ingenuity by Haldat, who draws from them arguments highly in favour of the achromatic powers of the eye. The slight appearances of the decomposition of light at the edges of minute bodies are not owing to any inequality in the refractive powers of the eye on the different rays; but to the attraction which these bodies have for the luminous rays, which strike on their surfaces, after being reflected from the plane on which these small bodies are placed. When placed on a black wall, or table, no reflection takes place, and no colours are visible at their edges. It is evident, that if differently coloured rays are unequally refracted by the eye. Spots of different colours should produce penumbrae of unequal extents, proportionate to the refrangibility of the rays they

may reflect. But circular pieces of card, equal in size, and about a line and a half in diameter, painted red, yellow, blue, green, viewed on black, or white walls, at equal distances, and at the same time, offer penumbrae of equal extents. The colour observed on viewing objects through the optometer is caused by the luminous rays, by which we perceive them, being necessarily acted on by the narrow opening through which they pass; and no further decomposition of the light takes place than can be readily accounted for by principles well established in optics. If this were not the case, why should the eye be supposed to decompose rays which come through narrow apertures, and not those which arrive without any external obstacle to their natural radiation. In bodies seen indistinctly, the rays which glance on their margins are decomposed; and this dispersion, not visible at a distance from the mixture with the undecomposed rays which are in the greatest number, is plainly seen when the object is brought close, because they arrive at the retina almost without any intermixture. The colours, therefore, seen at the edges of such bodies, do not arise from any supposed imperfection in the refractive powers of the eye, when the object is brought close to it. In order to draw a conclusion that the humours of the eye are not achromatic, luminous rays should be brought to bear on them, such as they are when radiating from a luminous body, and without undergoing any decomposition in their passage from causes external to the eye; it should then be proved that they undergo a decomposition in passing through the humours, and that this dispersion cannot be corrected. In the case of the prism, the separated rays may appear to be refracted unequally, because the spectrum is not linear in its whole extent. But on account of this very extent, they arrive at the transparent cornea with different inclinations, in unequal proportions, and impinge on a refracting medium, the curvature and density of which are unequal: we cannot therefore expect an equal refraction. The eye is capable of preserving the natural mixture of the elementary rays which arrive at its surface; its not having the power of recomposing those rays, which artificial external causes have dissipated, is not sufficient to induce us to conclude that its achromatic powers are not perfect. The perfection of the achromacy of the eye is further proved, by there being no diminution whatever in the distinctness of the image, when, by an artificial dilatation of the pupil, by means of belladonna, the anterior surface of the chryalline is almost wholly exposed. Again, when the greatest possible inclination has been given to the rays, no colour is perceptible.

The luminous rays, which arrive at the eye from an object at some little distance, will unite into a focus at a certain distance behind the chryalline lens. Rays, which pass from an object closer to the eye, as they diverge more considerably, will unite into a focal point at a greater distance behind the chryalline, and indistinct vision would be the necessary consequence, if the eye had not the power either of elongating its axis, or shortening its focal distance; so that in these very opposite conditions the rays should converge equally into a point on the retina. This power of adjustment to distance is one of the most important to the perfection of the organ, and has excited the attention of every writer on the mechanism of vision; all allowing that some change must be produced, but few agreeing as to its nature or mode. The subject has been particularly agitated in this country, and has called forth many excellent observations on the mechanism of vision, which, if they have not finally proved the means by which the accommodation is brought about, have, at least, proved the fallacy of most of the theories adopted to account for it. To us,

Dr. Young's opinion, of the change of the focal distance by some alteration in figure of the chryſtalline, appears the moſt ſatisfactory, and ſupported by the moſt decisive proofs in the manner in which this alteration is effected, is a point not perhaps as yet demonſtrated, however conclusive the arguments may be in favour of ſuch alteration actually occurring. There is a certain point at different diſtances in different perſons, from which luminous rays, paſſing to the eye, will be brought to a focal point on the retina, without any apparent exertion of any part of the organ. This is called the point of perfect indolent viſion. In perſons who are near-ſighted, or in whom this point is pretty cloſe to the eye, owing to the too great refractive powers of the organ, the rays from objects at a moderate diſtance are brought to a focus at a point anterior to the ſurface of the retina. In ſuch caſes the divergence of the rays is increaſed, by means of a concave lens, and a confuſion of the image is prevented. In thoſe who are long ſighted, where this point is at a greater diſtance, the rays from near objects cannot be brought to focal points ſoon enough to impreſs a diſtinct image, and the defect depends on cauſes the converſe of thoſe which produce the myopic or near-ſighted eye. It is remedied by a convex lens. We poſſeſs, however, in the perfect eye, the power of ſeeing diſtinctly objects much nearer to the eye than this ſuppoſed point of diſtinct viſion; and this exiſts in very different degrees in different individuals. It is equally true, on the other ſide, that we cannot, by any volition, accommodate the eye to view objects at a diſtance greater than that of indolent viſion, a circumſtance eaſily experienced by any one. In the year 1793 Dr. Young made ſome obſervations on the ſtructure of the eye, and its proviſions for adjustment, among which are accounts of the theories of adjustment, propoſed by various earlier writers. Of theſe we ſhall ſay nothing, as a reference to the anatomical deſcription of the eye, and other remarks already detailed, would at once refute the greater part of them. It was the opinion of Dr. Young that rays of light, paſſing from objects at a ſmall diſtance, could only be brought to foci on the retina by a nearer approach of the chryſtalline to a ſpherical form: this change, he believed, was effected by the muſcularity of the lens. In the following year, ſome obſervations of John Hunter on this ſubject were published by Mr. Home, from which it appears, that he had for many years entertained a notion, that the chryſtalline humour was enabled, by its own internal actions, to adjust itſelf, ſo as to adapt the eye to different diſtances. Mr. Hunter had inſtituted ſome experiments, but died before he had made ſufficient progreſs to draw any concluſion. In the ſame year, Dr. Hoſack, in a paper on viſion, controverts Dr. Young's deductions with regard to the muſcularity of the lens, and attributes the effects produced in adjustment to the actions of the muſcles. He aſſumes, as the neceſſary conſequence of contraction in theſe muſcles, that the axis of the eye will be elongated, and the elatic cornea rendered more convex; both which circumſtances would tend to preſerve diſtinctneſs of viſion with regard to near objects. In order to prove that the eye is capable of having its focal adjustment conſiderably varied by external preſſure, he applied the common ſpeculum to his own eye, and by increaſing the preſſure of it conſiderably, was enabled to ſee objects diſtinctly, though placed much nearer than the natural focal diſtance. The means here made uſe of to aſcertain the fact do not appear to us very accurate. In the Croonian lecture for 1795, Mr. Home relates a ſeries of experiments and obſervations made by himſelf and Mr. Ramſden, from which he concludes, that the eye has a power of adjusting itſelf to different diſ-

tances, when deprived of the chryſtalline lens; and that, therefore, the ſuppoſed fibrous, and laminated ſtructure of that lens, is not intended to alter its form, but to prevent reflection in the paſſage of the rays through the ſurfaces of media of different denſities, and to correct ſpherical aberrations; that the cornea is elatic, capable of being elongated $\frac{1}{4}$ th of its diameter; that the tendons of the four ſtraight muſcles terminate in forming a lamina of the cornea; and, that in changing the focus of the eye from ſeeing with parallel rays to a near diſtance, there is a viſible alteration produced in the figure of the cornea, rendering it more convex; and when the eye is again adapted to parallel rays, the alteration by which the cornea is brought back to its former ſtate is equally viſible. The exertion required to adjust the eye to near diſtances, and the eaſe with which it is adapted to remote objects, proves that the firſt was a poſitive action, and the ſecond a relief. The defect of elaticity in the cornea, inferred to ariſe from age, is applied to explain the changes of viſion which take place in advanced life. By ſome further experiments Mr. Ramſden and Mr. Home were induced to abandon the opinion that the adjustment is produced ſolely by the alteration of the convexity of the cornea, which might probably be ſufficient when the lens was removed, but not when the eye is entire. Mr. Home aſſumes that the action of the ſtraight muſcles will elongate alſo the axis of the eye, and produce an effect upon the chryſtalline lens, and ciliary proceſſes, pushing them forward in proportion as the cornea is ſtretched. Granting theſe two laſt changes, Mr. Ramſden computed that the increaſe of the curvature of the cornea may be capable of producing one-third of the effect, and that the change of place of the lens, and elongation of the axis of viſion, ſufficiently account for the other two-thirds of the quantity of adjustment neceſſary to make up the whole. We muſt here obſerve, that it is not yet demonſtrated that the actions of the ſtraight muſcles can produce the effect aſcribed to them. They have been ſuppoſed by others to flatten the eye, and ſhorten its axis, upon arguments equally plauſible. We believe they have but little effect, except that of directing the axis of the eye to the object, and doubt if they can exert any preſſure on the globe. Neither is it aſcertained what effect ſuch preſſure would have in elongating the axis, pulling forwards the lens, or increaſing the curvature of the cornea. The opinion that the chryſtalline lens is moved forward by the action of the ciliary proceſſes, is equally gratuitous. In the year 1800 was published an excellent paper by Dr. Young, on the mechanism of the eye, in which he examines, with great acuteness and accuracy, the different opinions on this ſubject. It is impoſſible to give an abſtract of his obſervations in the compaſs of this article; we muſt refer the reader to the paper itſelf, for the detail of all the proofs by which he endeavours to eſtabliſh his opinion of an alteration in the figure of the chryſtalline, and give here only the general concluſions drawn from his investigations. "The arguments in favour of an increaſe of the convexity of the chryſtalline lens are of two kinds; ſome of them are negative, derived from the impoſſibility of imagining any other mode of performing the accommodation, without exceeding the limits of the actual dimensions of the eye, and from the examination of the eye in its different ſtates by ſeveral teſts, capable of detecting any other changes if they had exiſted: for example, by the application of water to the cornea, which completely removes the effects of its convexity, without impairing the power of altering the focus, and by holding the eye, when turned inwards, in ſuch a manner as to render any material alteration of its length utterly impoſſible. Other arguments are deduced from poſitive evidence of the change

change of form of the chryſtalline, furniſhed by the particular effects of refraction and aberration, which are observable in the different ſlates of the eye; effects which furniſh a direct proof that the figure of the lens muſt vary; its ſurfaces, which are nearly ſpherical, in the quieteſt form of the lens, aſſuming a different determinable curvature, when it is called into exertion. The objections which have been made to this concluſion are founded only on the appearance of a ſlight alteration of focal length in an eye from which the chryſtalline had been extracted; but the fact is neither ſufficiently aſcertained, nor was the apparent change at all conſiderable: and even if it were proved that an eye without the lens is capable of a certain ſmall alteration, it would by no means follow that it could undergo a change, five times, or ten times as great."

The means whereby we are enabled, by ſight, to determine the diſtance, magnitude, and ſituation of objects have not been ſufficiently explained to allow us to ſpeak with confidence. It is acknowledged that the eſtimate we make of the diſtance of objects conſiderably remote, is rather an act of judgment grounded on experience than of ſenſe. When we perceive a great number of intermediate objects, which we have experienced to take up a conſiderable ſpace, we conclude that the object we ſee beyond them is at a great diſtance. When an object appears faint and ſmall, which at a near diſtance we have experienced to make a ſtrong and large appearance, we conclude it alſo to be far off. It is ſuppoſed by ſome that when an object is ſo near that the interval between the eyes bears any ſenſible proportion to it, the two optic axes meeting at the object, make a ſenſible angle, by means of which, according as it is greater or ſmaller, the object is perceived to be nearer or further off. This does not depend on judgment formed from experience, but reſults from a ſuppoſed neceſſary connection between the idea of an obtuſe angle and a near diſtance, and an acute angle and a farther diſtance. There is another way mentioned by others, by which we are ſaid to perceive diſtances when we look only with one eye. And that is, the greater or leſs divergency of the rays which fall on the eye, that point being judged neareſt which is ſeen by the moſt diverging rays, the apparent diſtance increaſing as the divergency of the rays decreaſes, until the diſtance is ſo great that the rays which fall on the eye are to ſenſe parallel. This mode of judging is not derived from experience, but from the difference of angular impreſſions made by diverging and nearly parallel rays; it being a certain neceſſary truth, that the nearer the direct rays falling on the eye approach to paralleliſm, the farther off is their point of interſection, or the viſible point from which they ſeem. Such are the common opinions concerning our perceiving diſtances by ſight. Thoſe which make no allowance for the interference of judgment formed by experience, appear to us inadmiſſible. With all the advantages derived from experience, our judgment of diſtances is ſtill imperfect, owing to the deceptions ariſing from the apparent magnitude compared with the real, from the uncertainty attending the intensity of the colours, the appearance of the minute parts of the object, and its relative ſituation with regard to others. Theſe are the principal means of directing our judgment, and if they be imperfect, or any of them deficient, an error in judgment will be the probable conſequence. If we judged of diſtance by magnitude only, we ſhould be led into numerous errors; it is by conſidering the other qualities of the object, and its ſituation with regard to others, that we are led to form a correct judgment as to its real diſtance. We know that a man equal to us in ſize, appears ſmaller a hundred yards off, and ſmaller ſtill at five hundred. Here, being certain of the

real ſize, we can make uſe of it with tolerable accuracy in determining the diſtance. We are deceived, when unacquainted with the real magnitude, we draw concluſions from the apparent only. We know by experience that objects become paler, and more indiftinct, in proportion as they are remote. We know by a number of objects being interpoſed between ourſelves and the object to which we particularly direct our attention, that the latter is at a certain diſtance. Hence diſtances at ſea appear much ſhorter than on land. It is only by combining the different ſenſations, and the judgments ariſing from them, that we can form an opinion anywiſe correct. It is equally neceſſary to have a recollection of the diſtance of an object, when forming a judgment of its ſize. It is poſſible that we may judge of magnitude by the viſual angle, or by the ſize of the image on the retina. But we muſt take into the account the connection between the magnitude or extension of the viſible object, and the ſize as aſcertained by the touch; the confuſion or diſtinctneſs of the image; the faintneſs or intensity of the rays, and their direction; the figure, number, and ſituation of objects; and other circumſtances that have been obſerved to attend greater or ſmaller tangible magnitudes. Experience is equally required to aid our judgment of magnitude as of diſtance. By ſight we can diſtinguiſh the quantity, the colour, and the direction of the luminous rays which ſtrike our eye: it is yet a matter of doubt how far the ſight alone can convey ideas of magnitude or diſtance. When judging from viſible appearances only, we are liable to many deceptions, which are extremely intereſting, as they illuſtrate the theories of our different ſenſations; and there are many other circumſtances, connected with the theory of viſion, which will be better conſidered under the different heads of phyſical optics.

The phenomenon of accidental colours, or ocular ſpectra, obſerved long ſince by Buffon, who gave an account of it in the Memoirs of the Academy of Paris, has ſince been conſidered at length by Dr. R. Darwin, and by many other writers. When a perſon, after looking long and attentively at a ſmall bright object, removes his eyes, or closes them, an image is ſtill viſible to him, reſembling in form that which he was attending to, but of a colour oppoſite to the firſt, that is, of ſuch a colour as would be produced by withdrawing the firſt from white light. Thus if a perſon look ſtedfaſtly, and for a conſiderable time, at a ſmall red ſquare painted upon white paper, he will at laſt obſerve a kind of green-coloured border ſurround the red ſquare. If he now turn his eyes to ſome other part of the paper, he will ſee an imaginary ſquare of a delicate green, bordering upon blue, and correſponding exactly in point of ſize with the red ſquare. This imaginary ſquare continues viſible for ſome time, and indeed does not diſappear till the eye has viewed ſucceſſively a number of new objects. To this imaginary image the name of accidental colour was given by Buffon, and ocular ſpectrum by Dr. Darwin. If the object be yellow, the ſpectrum is blue; if green, red; if blue, yellow; if white, black; and if black, the accidental colour is white. We may therefore ſay, generally, that the reverſe ſpectra are ſimilar to a colour formed by a combination of all the primitive colours, except that with which the eye has been fatigued in making the experiment. The theory deduced from this remark is ingenious, and has much probability. The aſſigned reaſon of the oppoſite appearance is, that the portion of the retina that is affected has loſt a part of its ſenſibility to the light of that colour with which it has been impreſſed, and is more ſtrongly affected by the other conſtituent parts of the white light; ſo that if we then regard a colour which admits in its compoſition that which has
fatigued

fatigued the eye, the latter will cease to be visible. Dr. Darwin divides ocular spectra into four kinds: 1st, such as are owing to a less sensibility of a defined part of the retina, or spectra, from defect of sensibility; 2dly, such as are owing to a greater sensibility of a defined part of the retina, or spectra, from excess of sensibility; 3dly, such as resemble their object in colour as well as in form, or direct ocular spectra; and 4thly, such as are of a colour contrary to that of their object, or reverse ocular spectra. He believes the retina to be in an active state during the existence of these. In the first case, the retina is not so easily excited into action by less irritation, after having been lately subjected to a 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, somewhat greater than natural, excites the retina into spasmodic action, which ceases in a few seconds, or which ceases and recurs alternately. In the last, the retina having been excited into action much greater than natural, falls into opposite spasmodic action, or into various successive spasmodic actions, or into a fixed spasmodic action, which continues for some days, or a temporary paralysis is produced, the effects mentioned being successively proportionate to the increased stimulus. He adds many miscellaneous remarks on the subject in question, which tend further to illustrate the phenomena by the contrast of the sensations. Dr. Young thinks that the phenomena of the direct spectra may be better understood from the analogy of coloured shadows. There are many instances related of an imperfection in the sight respecting colours, some individuals being only able to tell black from white; others mistaking orange for green; others to whom full greens and full reds appeared alike, while yellows and dark blues were nicely distinguished. This has been ascribed to an insensibility of the retina to particular colours. There are many other imperfections of sight which are not introduced here, as not immediately connected with the theory of vision.

The reader is referred for further information to a most excellent catalogue of authors in the second volume of Dr. Young's Natural Philosophy. The list of references is too long to be introduced here, and is too complete to permit us to curtail it. The authors we have been principally indebted to are Zinn, Haller, Hunter, Soemmerring, Cuvier, Home, and, more particularly Young; to some papers by Petit in the Memoirs of the French Academy, and to some papers in the Gottingen Commentaries, by Wrisberg and Blumenbach. Zinn's description of the eye, with the supplement of Wrisberg; Soemmerring's most exquisite plates and his explanations, with Haller's rich collection of facts and references to authors in the fifth volume of his *Elementa Physiologiae*, are particularly worth consulting. Portal, in his *Tableau Chronologique d'Anatomie*, &c. tom. vi. has given a long and very full descriptive catalogue of authors who have written on the subject of the eye, which contains much information.

The comparative structure and anatomy of the eye are very curious; the situation, number, conformation, &c. of this organ in different animals, being finely and wonderfully adapted to their different circumstances, occasions, and manners of living.

In man, and some other creatures, an ingenious author observes, the eye is placed chiefly to look forward; but withal is so ordered as to take in nearly the hemisphere before it. In birds, (See BIRDS) and some other creatures, the eyes are so seated as to take in near a whole sphere, that they may the better seek their food and escape danger. In others they are seated so as to see behind them, or on each

side, whereby to see the enemy pursuing them; thus, in hares and conies, the eyes are very protuberant, and placed so much towards the side of the head, that their two eyes take in nearly a whole sphere; whereas in dogs that pursue them, the eyes are set more forward in the head, to look that way more than backward.

Generally, the head is contrived to turn this and that way chiefly for the occasions of the eyes; and generally the eyes themselves are moveable upwards, downwards, backwards, and sidewise, for the more commodious reception of the visual rays. Where nature deviates from these methods, she always makes use of very artful expedients to answer the same end.

Thus, in some creatures, the eyes are set out at a distance from the head, to be moved here and there, the one this way, and the other that; as in snails, particularly, whose eyes are contained in their four protuberances, like atramentous spots fitted to the ends of their horns, or rather to the ends of those black filaments or optic nerves sheathed in the horn. Power, *Exper. Phil. Obs.* 31.

And in other creatures, whose eyes or head are without motion, and in divers insects, that defect is sometimes made up by their having more eyes than two; as in spiders, which having no neck, and consequently the head being immoveable, the defect is supplied by the situation and multiplicity of their eyes; some having four, some six, and others eight, all placed in the fore-front of their head, which is round like a locket of diamonds. The reason Dr. Power gives, is, that being to live by catching so nimble and shy a prey as flies, they ought to see every way, and so take them *per saltum*, without any motion of the head to discover them.

Again, men, and most quadrupeds, are found to have several muscles belonging to their eyes, by help whereof they can turn them any way, and so obvert the organ of sense to the object. But nature not having given that mobility to the eyes of flies, she in recompence furnishes them with a multitude of little protuberant parts, finely ranged upon the convex of their large bulging eyes; so that by means of these numerous little studs numberless rays of light are deflected from objects placed on either hand, above or beneath the level of the eye, and conveniently thrown upon that organ, to render the objects they come from visible to the animal; and by the help of a good microscope, and a clear sight, some hundreds of these little round protuberances may be discovered, curiously ranged on the convexity of a single eye of an ordinary flesh-fly.

So scorpions are found to have above a hundred eyes; and Swammerdam has observed no less than two thousand in the little insect called *ephemeron*.

In other creatures the like deficiency is supplied by having their eyes nearly two protuberant hemispheres, each consisting of a prodigious number of other little segments of a sphere.

The eyes of a camelion, Dr. Goddard observes, resemble a lens, or convex-glass, set in a versatile globular socket, which he turns backward and forward without stirring the head, and ordinarily the one a contrary way to the other.

Lastly, the mole, which the ancients, Aristotle, Pliny, Alb. Magous, &c. supposed to have no eyes at all, is now found to furnish a notable instance of the diversity of the apparatus of vision; for that animal living altogether under ground, sight would generally be useless to it, and so tender a part as the eye troublesome. It has therefore eyes, but those so exceedingly small, and withal situated so far in the head, and covered so strongly over with hair, that they cannot ordinarily be of service or disservice to it. Yet to
guide

guide and secure it a little when it chanced to be above-ground, Borrichius, Blasius, Schneider, Dr. Derham, and others, observe that it can protend, or put them forth beyond the skin, and again draw them back at pleasure, somewhat after the manner of snails.

In the eyes of nocturnal animals is a part not yet mentioned, *viz.* a sort of tapetum at the bottom of the eye which gives a kind of radiation on the pupil, enabling them to see and catch their prey in the dark. Thus, Dr. Willis, "Hujus usus est oculi pupillam quasi jubare infuso illuminare—quare in fele plurimum illustris est; at homini avibus & piscibus deest." De Anima Brutor.

He adds, that in some persons the iris has a faculty also of darting out light; and instances in a man of a hot head who, after a plentiful drinking of generous wine, could see to read in the darkest night. Ibid.

The like Pliny tells us of Tib. Cæsar, that upon his first waking in the night he could see every thing for a little while as if in broad day-light. (Nat. Hist. lib. xi. cap. 37.) and Dr. Briggs gives a parallel instance of a gentleman in Bedfordshire. Ophthal. cap. v. § 12.

Frogs, besides the parts of the eye which they have in common with men, and most quadrupeds, have a peculiar membrane or cartilage, which is not commonly perceived, wherewith they can at pleasure cover the eye without too much hindering the sight; because the membrane is both transparent and strong, so that it may pass for a kind of moveable cornea, or occasional safeguard to the eye. A like membrane is also found in many birds, as also in the crocodile.

Naturalists relate wonders of the sharpness and accuracy of the eyes of some animals, as the eagle, &c. beyond those of men.

Yet do those of men seem improveable to a surprising degree. Mr. Boyle instances in a major of a regiment of king Charles I. who being afterwards forced abroad, ventured at Madrid to do his king a piece of service of an extraordinary nature and consequence; which being there judged very irregular, he was committed to an uncommon prison or rather dungeon, having no window belonging to it, only a hole in the wall, at which the keeper put in provisions, and presently closed it again on the outside, but not perhaps very exactly. For some weeks this gentleman continued utterly in the dark, very disconsolate; but afterwards began to think he saw some little glimmering of light; and this from time to time increased so, that he could not only discover the parts of his bed, and other such large objects, but at length, amidst this deep obscurity, could perceive the mice that frequented his chamber to eat the crumbs of bread which fell upon the ground, and discern their motions very well.

The author just mentioned, in his Observations on Vitiated Sight, gives us some uncommon phenomena that regard the eyes. He furnishes several instances of nyctalopies, or people whose eyes in the day-time were quite dark, or at least so dim that they could hardly discern their way; who yet, soon after sun-set, and during twilight, saw very clearly.

EYE, Artificial, is the resemblance of a natural eye, formed either for the purpose of supplying the appearance of an eye in a person who wants one of those natural organs; or for the purpose of illustrating the construction, together with certain defects, of the natural eye, described in the next article.—The latter part of an artificial eye is a little machine which exhibits the principal parts, and the principal offices of a natural eye.

From the description of the camera obscura, and from

the anatomical description of the eye, it plainly appears that the latter is a most excellent camera obscura, having all the necessary properties of it, to a most admirable nicety. It is a globular dark room, with one aperture for the admission of light, with a lens and other media fit to form a picture of external objects on the hind part of its cavity, which is lined with a membrane called the retina. It has likewise all the necessary adjustments within certain limits; such as the power of adapting itself to the view of near as well as of distant objects, the power of admitting more or less light, according to circumstances, and so on. (See VISION and SIGHT.) If the eye of an animal, especially of a large size, as that of an ox, be taken out soon after the death of the animal, and the skin, fat, &c. be carefully scraped off from the back of it, until a thin semi-transparent pellicle remains, which is the retina, the eye so prepared may then be used as a little camera obscura; *viz.* if it be turned towards any objects, the figures of those objects will be seen depicted on the thin membrane just mentioned, so that the observer being placed behind the prepared eye, may see that picture very distinctly.

In old persons the humours grow thicker, and the parts less pliable, hence their eyes lose in great measure the power of adjusting themselves. But, independent of old age, the eyes of certain persons can be adjusted for viewing distant objects easier than for near objects, and *vice versa*. When the eye is defective, and in consequence of its size or of other peculiar conformation, parallel rays form their foci before they arrive at the retina; then the person, who is possessed of such eyes, will be able to see near objects only; and such persons are said to be *near-sighted*, or *myopes*. When the eye is flatter than ordinary, then the foci of rays proceeding from pretty near objects, are formed beyond the retina; and such persons as are possessed of eyes thus formed, are said to be *long-sighted*, or *presbytes*; for they can only adjust their eyes for viewing objects situated beyond a certain distance; the latter is generally the case with persons advanced in age.

These imperfections may in great measure be corrected by the use of proper glasses or spectacles; for since in near-sighted persons the rays of light converge to a focus before their arrival at the retina, a concave lens, placed before the eye, will remedy that imperfection, because a concave lens diminishes the convergency of the rays of light, and, of course, will prolong the pencil so as to enable it to converge exactly on the retina. And for those who can see distant objects only with distinction, that is, in whose eyes the rays of light do not converge soon enough, convex lenses, which increase the convergency of the rays, will remedy the imperfection.

Now the artificial eye we are treating of, serves to illustrate the above-mentioned defects, together with the corrections by means of lenses. In its most improved state of construction, it also serves to exhibit imitations of the principal parts of the human eye.

The artificial eye is formed principally of glass, and its parts are kept together by a brass cell; but the shape and formation of such a machine is, in some measure, varied by almost every workman. The part which represents the globe of the eye, and its humours, is fixed in a socket, where it may be moved in any direction. The fore-part of the socket forms a screen to prevent the concurrence of superfluous light; but it has a hole in its middle, which is painted round so as to represent nearly a human eye. If this artificial eye be turned towards objects that are at a moderate distance, their picture will appear very distinct, but inverted, upon the back part of the machine, where the rough surface of the glass performs the office of the retina. The

parts of this artificial eye may be examined in the following manner: unscrew the socket which confines the ball of the eye and its parts; then the outermost coat represents the sclerótica, the more protuberant part of which is the cornea. Next to this there is a plano-convex glass lens to represent the first chamber of the aqueous humour, under which there is a perforated flat piece of tortoise-shell to represent the iris with the pupil, and under this there is another plano-convex lens which represents the second chamber of the aqueous humour. On removing the second coat, which represents the choroides, a small double and unequally convex lens will be found which represents the crystalline humour, and under this is a large piece of glass which occupies the remaining space of the machine, and represents the vitreous humour. The back part of the last mentioned piece of glass is made rough, so that the pictures of objects may be formed upon it, as upon the retina of a real eye.

In order to represent the nature of vision in long-sighted persons, the usual plano-convex lens, which represents the first chamber of the aqueous humour in front of the artificial eye, must be removed, and another similar lens, but less convex, must be placed instead of it. With this alteration, if the artificial eye be turned towards the same objects, which before the alteration were represented distinctly on the back of the machine, they will now form an indistinct image upon the same place, because now the rays converge to a place more distant than the back of the artificial eye. But if in this state a proper convex spectacle lens be placed before it, the image on the back of the artificial eye will be rendered perfect, which shews the use of that kind of spectacles to long-sighted persons. In order to represent the imperfection of short-sighted eyes, the plano-convex lens, representing the first chamber of the aqueous humour, must be more convex than the original one. In this case then the focus of rays will fall short of the retina, in consequence of which an imperfect image of objects will be formed on the back of the artificial eye; but by placing a proper concave spectacle lens before it, the above-mentioned image may be rendered perfect. And this shews the use of concave lenses to short-sighted persons.

A simpler construction of an artificial eye consists of a globular brass box, having a small rough glass on its back, and a convex lens in front. This convex lens is set in a brass socket, which may be screwed farther into, or farther out of the brass box; by which means the picture of objects on the rough glass may be rendered imperfect either by screwing the socket with the lens farther out, which imitates the short-sighted eye, or farther in, which shews the imperfection of long-sighted people; and the image may be rendered perfectly distinct by placing a concave spectacle lens in the first case, or a convex one in the latter case, before the artificial eye.

EYE, Artificial, in Surgery. When suppuration takes place in the eye, the matter at length makes its way through the cornea, and escapes together with the aqueous, and some of the vitreous humour; the transparent cornea is in part destroyed, while the rest continues in a state of opacity; the pupil becomes closed, the iris is adherent to the cornea, and the whole eye-ball shrivels up in a greater or less degree. A total loss of vision, and great deformity of the countenance, are the evils necessarily arising from all this mischief. The first of these consequences is quite incurable; the second may be obviated by the use of an artificial eye.

Artificial eyes are concave little plates, adapted to the anterior half of the eye. Upon the middle of their front, convex, white surface, the transparent cornea, the pupil, and

the iris, are imitated in the best possible manner. When they are applied, what remains of the natural eye-ball lies in their posterior excavated surface. They may be made either of glass or enamel. Though such as are made of glass answer tolerably well, yet they are apt to break. The enamel ones are not subject to this objection, and, as we shall hereafter explain more fully, their back edges may be made with the file better than glass ones, for lying conveniently in the orbit. In the choice of artificial eyes, for every kind of case, the surgeon should take care, that the contrivance resembles the natural healthy eye as much as possible, in regard to the colour of the iris, the greater or lesser convexity of the cornea, the greater or lesser projection of the whole eye-ball from the orbit, and the more or less considerable breadth of the globe of the eye between the external and internal canthus.

Artificial eyes are constructed of various shapes and depths. Some are made of a long oval form, and these are found the most eligible for persons, whose eye-lids have a long fissure between them. Other artificial eyes are of a rounder shape, and are proper in cases, in which the interspace between the two eye-lids is short. Deep concave plates are to be chosen for patients, whose eyes make a considerable projection forward; but flat ones are to be preferred when the eyes are naturally small and deeply situated in the sockets. Deep plates are also to be employed, when only a small part of the eye-ball is left; but flat ones, when a considerable portion remains. A principal object always consists in endeavouring to render the resemblance between the artificial and natural eye, as complete as possible, so that the artifice may not be discovered.

When what remains of an eye, which has been destroyed by suppuration or disease, is of middling size, the artificial eye can be applied with the greatest convenience. There is now sufficient room, consequently, no painful pressure is excited, and the instrument does not lie too deeply in the orbit. Besides, the remaining part of the natural eye, which always retains some degree of motion, and lies in the hollow of the artificial one, communicates to the latter a certain motion; so that, in this case, the deception becomes more difficult to detect than in any other examples.

When what remains of the natural eye is too small, or large, it does not enter into the hollow of the artificial one, and, consequently, the latter lies quite immoveable under the eye-lids, and the patient has the appearance of squinting in a much greater degree, than in the foregoing case. When the remaining portion of the natural eye has lost so little of its original size, that there is not room enough for an artificial one, an opening may be made into the eye-ball, a part of the vitreous humour let out, and thus sufficient room made for the artificial eye. This operation is free from pain and danger; but, it occasionally happens, that the vitreous humour collects again in its original quantity, so as to destroy the space for the artificial eye, and render a repetition of the puncture proper.

When, from any cause, the whole of the eye-ball has been quite destroyed, as, for instance, when it has been extirpated on account of some cancerous affection, the use of an artificial eye is hardly admissible. For although the orbit, in this case, usually becomes more or less filled up with flesh, which would serve as a support to an artificial eye, yet the eye-lids generally lose their natural power of motion, and shrink up to the edges of the orbit, so as not to be capable of covering the artificial eye. Perhaps, however, this kind of contraction of the eye-lids might be prevented, by filling the inside of these parts with lint, immediately

diately after extirpating the eye, and keeping them approximated with strips of adhesive plaster.

The application and removal of an artificial eye are so easy, that the patient commonly soon acquires the art of putting it on and taking it off himself. The edge of the upper eye-lid is to be taken hold of with the thumb and index finger of one hand, and drawn a little outward from the eye-ball, while the artificial eye, which is to be previously moistened, must be pushed under the eye-lid with the other hand. This can be accomplished with most ease when the little corner of the artificial eye is first pushed under the eye-lid. It then lies transversely, and pushes the upper eye-lid so high, that the lower edge of the artificial eye is situated higher than the upper margin of the lower eye-lid. The lower eye-lid is now to be drawn a little outward with the finger, while the artificial eye is allowed to glide downward behind the part.

When the artificial eye is to be taken off, it is only necessary to draw the edge of the lower eye-lid a little outward with one of the fingers, and to introduce the blunt end of a needle under the lower margin of the artificial eye, which is now to be somewhat raised and pressed outward. When this is done, it immediately slips out of the orbit.

The front surface of what remains of the natural eye is often uneven, forming a prominence in one place, and a depression in another; consequently the glass eye fits closer on some parts than on others, and creates such painful sensations as oblige the patient to remove it. This inconvenience may be obviated by taking off some of the border of the artificial eye at the parts which fit too close, and make too much pressure, by means of a file. When the whole circumference of the eye smarts after the application of the glass one, the plate employed is probably too deep, and the whole circumference of its edge makes too strong pressure. In this circumstance a flat plate must be applied. When, notwithstanding this plan, the eye continues painful, there is reason for apprehending that the organ is in an irritable state. In this instance, the best way is to take off the instrument again, and bathe the eye well with cold water, or some astringent collyrium. After a time, the eye-ball generally becomes capable of bearing the pressure of the artificial eye, without any uneasiness. However, some patients are so irritable, that they can never wear an artificial eye without suffering pain, and such persons ought to be advised to give up the intention altogether.

It is obvious, that, in every example in which the eye has been destroyed by suppuration, no idea should ever be entertained of using an artificial eye, before all inflammation and tenderness of the organ have been quite removed. Also, the use of the artificial eye must always be discontinued, whenever an inflammation is brought on by any accidental causes.

Persons should be recommended always to keep by them more than one artificial eye of the same kind, in case one should ever happen to be lost. It is also advisable to take off the artificial eye once every day, and cleanse it, and particularly the orbit, from all kinds of dirt, mucus, &c. Want of attention of this kind is frequently the cause of such inflammations, as compel the patient to discontinue the use of an artificial eye for a considerable time. See Richter's *Anfangsgrunde der Wundarzneykunst*; Band 3.

Eye, Cancer, and Extirpation of. It becomes indispensably necessary to remove the eye-ball in several kinds of cases, as, for instance, when the organ protrudes from the orbit, and cannot be reduced. The operation is also requisite for some ulcerated staphylomas, and for every kind of

case in which the coats and humours of the eye are so diseased, as not to admit of being restored to a natural state, and in which the affection, if left to itself, would be likely to be communicated to the orbit.

Cancer of the eye, however, is the chief disorder, which creates a necessity for the performance of the operation.

The eye may become affected with cancer in three different manners. Sometimes the globe of the eye acquires an irregular knotty shape, and enlarges to the size of an apple. The sight is gradually destroyed, the blood-vessels in the white of the eye are varicose, and the whole of the internal and external structure of the organ is so altered, that the part looks like a piece of flesh, and no vestiges of the original organization are any longer perceptible. Sometimes, a small remaining portion of the transparent cornea is externally observable; and, in certain cases, a little aperture may still be seen within, through which the remainder of the vitreous humour and choroid coat is discoverable. Sometimes a fetid fluid is discharged from the diseased organ, an ulcerated opening into the part having occurred. Occasionally, no ulceration whatever can be noticed, and the eye-ball resembles a firm piece of flesh. The patient commonly experiences at first burning pains in the eye, which, however, are not in an insupportable degree; but, at last, they become of a violent darting nature, and shoot all over one-half of the head. The causes of this distemper are involved in considerable obscurity. A German surgeon, named Vogel, mentions, that the disease is sometimes brought on by the small-pox. The foregoing form of cancer of the eye is the principal, and most frequent one.

Sometimes excrescences make their appearance upon the front surface of the eye, and most frequently upon the transparent cornea. Such tumours often admit of being eradicated with the knife, ligature, or caustic. In certain instances, however, they always grow again after the employment of these means, and become larger, more malignant, and even cancerous. At length, they change into a tumorous growth, which is extremely painful, covers all the anterior part of the eye, and renders the operation of removing this organ absolutely necessary. Such is the second form in which cancer of the eye prefers itself.

On several occasions ulcers are produced upon the fore-part of the eye, and although a great many of them may be cured by the use of external and internal remedies, they are often exceedingly obstinate, destroy vision, and acquire so malignant a state, that they may very well be called cancerous. This is the third species of cancer, which makes the extirpation of the eye requisite.

With regard to the treatment of every cancerous kind of disease, affecting the eye, we have a choice of three different methods. We either plainly discover some particular determinate cause, and employ measures calculated for its removal; or the malignant character of the symptoms leads us to have recourse to the remedies usually prescribed for carcinomatous diseases; or else, when both these plans fail, we proceed to put in practice the extirpation of the eye. What is commonly called a cancer of the eye does not seem to be nearly so malignant as the same sort of disease in the breast; for the operation almost always accomplishes a radical cure, as long as the distemper is confined to the globe of the eye, and the eye-lids, cellular substance, and bones of the orbit continue unaffected. The knowledge of this circumstance should lead us to undertake the operation in good time, and we can the more readily make up our mind to perform it, since the power of seeing is, in all these cases, irrecoverably lost. When the patient suffers violent

head-achs, and pains in other parts of the body, when his glands in different situations are in an indurated state, when the eye-ball has burst, and it discharges a fœtid matter, and when the eye-lids are red, swollen, and painful, the event of the operation must be considered, as at least very doubtful.

In the performance of the operation there are two important circumstances, to which attention ought to be paid. The first is to remove every particle of the disease, and leave none of the affected parts behind. The second is to avoid doing any injury to the periosteum and bones of the orbit. The periosteum, in this situation, lies so near the dura mater, that the consequences of any mischief done to the first membrane, may easily extend to the last; and the bones of the orbit are in most places so thin, that they cannot be pierced, or broken, without a risk of injuring the brain, which is situated immediately behind them. It is on this account that some surgical writers have recommended, for the performance of this operation, instruments which have no points. A man, endued with a very moderate share of dexterity, however, may certainly use a pointed knife for the purpose both with safety and advantage.

In order to be able to separate the eye-lids far enough from each other, it is sometimes recommended, in the first instance, to make an incision through them at their external commissure. An assistant is to raise the upper eye-lid as much as possible towards the fore-head. Some authors also advise us to introduce through the eye-ball a ligature, with which the part may be drawn to one side, or the other, during the operation. We cannot conceive, however, that there can be any real occasion for this painful proceeding, nor for the employment of any kind of hook, with a similar intention, since any operator possessing common adroitness may easily succeed in drawing the globe of the eye forward with his fingers, as soon as it is detached, from its connections within the orbit.

In this operation, surgeons have sometimes made use of a scalpel curved sideways, and a pair of scissars of a similar shape, with which instruments it has been supposed that the parts behind the globe of the eye can be more conveniently cut, than with any straight ones. But many of the best operators prefer a straight instrument, and find no inconveniences attending its use.

The surgeon should first divide the conjunctiva connecting the eye-lids with the eye-ball, and this ought to be done both above and below. Then the nerves and muscles of the eye are to be cut on all sides of the organ; a part of the operation sometimes effected with crooked scissars, though, as we have already observed, it may be as well done with a common straight scalpel. When a ligature is introduced through the front of the eye ball, or when a hook is used, the surgeon, by such means, is always to draw the globe of the eye in that direction which will give most room on the side where the parts are to be cut. But we consider the employment of a ligature, or hook, for the purpose of pulling the globe of the eye in this manner, quite unnecessary, and therefore improper.

Richter takes notice, that as the enlarged eye for the most part lies close to the cheek, and it is frequently very difficult to make an incision into the orbit, between the eye-ball and lower eye-lid, the operation may often be more easily accomplished by first separating the upper eye-lid from the diseased organ; then cutting from above downwards more deeply into the orbit, so as to divide the muscles above and at the sides of the eye; and, lastly, detaching the eye-ball from its connection with the lower eye-lid. This mode of operating is, according to Richter, the more

easy, because the globe of the eye can always be more readily inclined downwards, so as to make room above, than it can be pushed in the direction upward for the purpose of making room below. Until the optic nerve has been divided, the operator must avoid drawing the eye-ball too forcibly forward.

As soon as the eye has been completely detached, all the inside of the orbit should be very carefully examined with the finger, and whatever indurated parts are discovered ought to be diligently removed.

In certain instances, it is proper and prudent to cut away one, or both eye-lids, when affected with cancerous disease. Surgical writers also seem universally to agree about the propriety of always removing the lacrymal gland, as it is particularly apt to be the source of such fungous excrescences as are to be apprehended after the operation.

Let the parts, however, be taken away with the utmost skill and caution, still the event of the operation is invariably to be regarded as extremely doubtful, when the adjacent parts participate in the disease with the eye-ball.

The bleeding is seldom of any importance, generally stopping as soon as the orbit is filled with soft lint. The inflammatory symptoms and fever are also seldom so violent as to require any antiphlogistic means, except a low diet, and keeping the bowels well open.

During the suppuration, the orbit becomes filled with healthy granulations, and the process of cicatrization must be regulated by the same principles, which are observed in the treatment of common wounds.

When the cure is complete, an artificial eye can seldom be worn, on account of the manner in which both the eye-lids shrink, and contract, to the upper and lower margin of the orbit. It is true, an attempt may be made to prevent such contraction of the eye-lids, by using a bandage and strips of sticking plaster to keep these parts together, after the orbit is filled with lint. However, notwithstanding our best endeavours, it must be confessed, that an artificial eye can seldom be made use of after the operation.

Sometimes the granulations, which form in the orbit, are flabby and indolent, in which circumstance some mild astrigent should be applied, as for instance, lapis calaminaris, pulvis myrrhæ, alumen ustum, &c. In some examples, the granulations acquire a fungous and malignant nature, in which event they should either be cut away with a scalpel, or destroyed with caustic. Sometimes the fungus is continually reproduced, and at length occasions death. In some cases, as late as half a year, or even later, after the cure has appeared perfect, a fungous excrescence has arisen, and proved fatal. Occasionally head-achs, vomiting, convulsions, &c. followed by death, come on a few days, or weeks, after the operation. It is said, that in cases of this kind the cancerous distemper has been discovered to have spread to the brain, along the optic nerve, and to have excited induration and ulceration in that viscus.

When a fungous malignant excrescence occurs on the cornea, there is no occasion to extirpate the whole eye. It is quite sufficient to cut off the anterior portion of the organ; for the base of the fungus seldom extends beyond the edge of the cornea. The operation may be effected by making a puncture into the eye with a lancet, a little way behind the margin of the cornea, and then enlarging the wound all round by means of a pair of scissars.

Though the basis of the excrescence does not often extend into the white of the eye, yet, it is observable, that the coats of this organ, for a greater or less extent around the

root of the fungus, are preternaturally thick and swollen. Hence, as soon as the operation is finished, we should attentively examine, whether the coats of the eye, in the place where the incision has been made, are in a natural state, and should any part not seem to be so, it ought to be cut away.

EYE, Contusions of the. See OPHTHALMIA.

EYE, Diseases of the, are an ophthalmia, or inflammation of the eyes; the gutta serena, or amaurosis; a suffusion, or cataract; an ectropium; a glaucoma; an amblyopia, or obscurity of sight, including the myopia, the presbytopia, the nyctalopia, and the amaurosis; the strabismus, or squinting; an unguis pannus, or pterygium of the membrane of the eye; the albugo, leucoma, or spot in the eye; a fugillation of the eye; an epiphora, or rheum in the eyes; a trichiasis; and the fistula lachrymalis. See each described under its peculiar denomination. See Warner's Description of the human Eye, &c. with its principal Diseases, &c. 2d edit. 1775.

EYE, Falling out of the. See PROLAPSUS OCULI.

EYES, Running of the, in Infants. See INFANT.

EYES, Scarification of the. See SCARIFICATION.

EYE, Wounds of the. See WOUNDS.

EYE of Birds. See ANATOMY OF BIRDS.

EYE of Fishes. See FISH.

EYES of Flies. Every naturalist has observed, that the eyes of flies are of a reticulated texture; and each reticulated eye of this kind is truly an assemblage of multitudes, often of many thousands, of small but perfect eyes. The reticulated eyes of flies are large, not only in proportion to the size of the creature, but absolutely, and in themselves; but the several small eyes of which they are composed are remarkably minute in comparison of those of the butterfly class.

Many of the butterfly class have in each of their reticulated eyes many thousand small eyes; but the fly class greatly exceed them in number of these, as many of the eyes of these are three times as large as those of the butterflies; and besides, that each smaller eye is vastly more minute than the small eyes of the butterflies.

Mr. Hook computed 14,000 hemispheres in the two eyes of a drone; Mr. Lewenhoeck reckoned 6236 in a silkworm's two eyes in its fly-state; 3181 in each eye of a beetle; and 8000 in the two eyes of a common fly. The pearl-eyes of the dragon-fly appear with a common reading-glass like shagreen; and Mr. Lewenhoeck reckons in each eye of this insect 12,544 lenses, placed in an hexangular position, each lens having six others round it. He also observed in the centre of each lens a minute transparent spot, brighter than the rest, supposed to be the pupil, surrounded with three circles, and in appearance seven times less than the diameter of the whole lens. Mr. Puget counted 17,325 in the eye of a butterfly, which Malpighi concludes to be distinct and separate eyes. The abbé Catalan, and others, have since shewn, that all the eminences discoverable in the cornea of insects have the necessary parts, and perform the offices of an eye. Lewenhoeck discovered the bundles of optic nerves which serve these small lenses; and Reaumur supposes that these supply the place of all that is wanting behind the lenses, for the organization of an eye complete for vision. Baker's Micr. 1743, p. 228. Reaumur, Hist. Inf. vol. i. p. 261, &c. See ENTOMOLOGY.

EYES of Horses, in the Manege, &c. These should be bright, lively, full of fire, pretty large, and full; but not too big, gogling, or staring out of the head: they should also be resolute, bold, and brisk. A horse to appear well,

should look on his object fixedly, with a kind of disdain, and not turn his eyes another way.

In the eye of a horse are discovered his inclination, health, and indisposition. When the eyes are sunk, or the eye-brows are too much raised up, and as it were swelled, it is a sign of viciousness and ill nature. When the pits above the eyes are extremely hollow, it is for the most part a certain sign of old age: this, however, does not hold of horses got by an old stallion; for these have them very deep at the age of four or five years, as also their eye-lids and eye-brows wrinkled and hollow.

Two things are chiefly to be considered in the eye of a horse, viz. the chryalline part, and the bottom or ground. The chryalline, or most transparent part, should, for clearness, resemble a piece of rock-crystal, otherwise the eye cannot be good. When this part is reddish it is a sign that the eye is inflamed, or else, as some pretend, influenced by the moon. When it is of the colour of a withered or dead leaf upon the lower part, and troubled on the upper, it infallibly shews that the horse is lunatic, which distemper continues no longer than while the humour actually possesses the eye.

As to the ground or bottom of the eye, which is properly its pupil or apple, it should be large and full, and ought to be carefully inspected, that there be no *dragon*, as it is called, on it. This is a white spot or speck, which at first appears no bigger than a grain of millet, but grows to such a bigness as to cover the whole apple of the eye: it is incurable, never failing to make a horse blind in the eye where it is found. If the whole bottom of the eye be white, or of a transparent greenish white, it is a bad indication, though perhaps the horse is not as yet quite blind: however, it ought to be observed, that if you view a horse's eyes when opposite to a white wall, the reflection of it will make their apples appear whitish, sometimes inclining to green, though they be really good. When this is perceived, you may try whether his eyes have the same appearance in another place.

In case you perceive above the bottom of the eye, as it were, two grains of chimney-foot fixed thereto, it is a sign the chryalline is transparent; and if, besides this, the said bottom be without a spot or whiteness, then you may infer that the eye is found.

You ought also to examine whether an eye which is troubled and very brown be less than the other; for if it be, it is irrecoverably lost.

All eyes which are small, narrow, and have long pupils, run a greater risk of losing the sight than any others. See BLINDNESS.

The diseases of the eyes in horses proceed either from a defluxion, or from some external hurt. In the former case the eyes are watery, hot, red, and swollen, the distemper advancing by degrees; in the latter the malady comes speedily to a height, and the skin on the outside of the eye is peeled off.

If the distemper take its rise from a rheum or defluxion, it is to be considered whether it proceeds from the eye itself, or from another aggrieved part: in the latter case, the redness of the part will set the eye free; in the former, it is proper to cool the horse's blood with an ounce of sal prunella, mingled every day with his bran; and when it lessens his appetite, to change it for liver of antimony till he recovers his stomach.

For sore eyes, where a skin is growing over them, the following receipt is recommended: to the white of an egg add a little fine powdered salt; then set this on the fire till

till it be reduced to a powder. This, mixed with a little honey, is to be put into the horse's eye with a feather. If it is found insufficient to eat off the skin, the powder alone must be blown into the eye with a quill.

In case of a blow on the eye, take honey, and having added a small quantity of powder of ginger, put it into the horse's eye; or else take hog's lard, with the oil of roses and elder, of each an equal quantity; then, having melted them together, anoint the eye therewith.

Some horses have naturally tender weeping eyes, which void a sharp eating humour; these are easily cured, by washing or bathing them every morning or evening with brandy. See HORSE.

We say also, "a horse unshod of one eye," which is a rallying expression, importing that he is blind of an eye.

EYE of the Branch of a Bridle, is the uppermost part of the branch which is flat, with a hole in it, for joining the branch to the head-stall, and for keeping the curb fast.

EYE of a Bean, is a black speck or mark in the cavity of the corner teeth, which is formed there about the age of five and a half, and continues till seven or eight; and it is from hence that we usually say, such a horse marks still, and such a one has no mark.

EYE-Flaps, those pieces of leather which cover the eyes of coach horses.

EYE, Altitude of the. See ALTITUDE.

EYE, in *Architecture*, is used for any round window made in a pediment, an attic, the reins of a vault, or the like.

EYE, Bullock's, Oeil de bœuf, denotes a little sky-light in the covering or roof, intended to illumine a granary, or the like.

The same term is applied to the little lutherns in a dome; as in that of St. Peter's at Rome, which has forty-eight in three rows. See LUTHERN.

EYE of a Dome, denotes an aperture at the top of the dome; as that of the Pantheon at Rome, or of St. Paul's at London. It is usually covered with a lantern. See DOME.

EYE of the Volute, is the centre of the volute, or that point wherein the helix or spiral whereof it is formed commences; or it is the little circle in the middle of the volute, wherein are found the thirteen centres for describing the circumvolutions thereof.

EYE, in *Gardening*, a term which in the management of fruit-trees signifies the small bud or shoot which is to be inserted into another tree. See BUD and BUDDING.

It also signifies the small pointed knot to which the leaves adhere, and from which the shoots spring forth. The eye of a pear denotes the extremity opposite to its stalk.

EYE, in *Geography*, a town of Norway; 36 miles S. of Bergen.

EYE, a market and borough town of Suffolk, England; is situated in the hundred of Hartismere, at the distance of 20 miles from Ipswich, and 90 from London. It is seated in a valley, and is almost surrounded by a brook, which gives name to the place. As a borough it was first incorporated by king John, from whose charter, and some that have been subsequently granted, it derived several privileges, but many of these have latterly been discontinued. The borough did not return members to parliament till the thirteenth year of the reign of queen Elizabeth, since which period it has sent two. The right of election is vested in the free burgesses, corporation, and those inhabitants who pay "scot and lot;" a number amounting to about 200. The earl of Cornwallis is patron, or pro-

prietor of the borough, and thereby has the power of controlling the elections. In the reign of king William I. a priory for Benedictine monks was founded here, and in the time of king Edward III. an hospital for lepers. The streets are mostly narrow. The church is a large, handsome building. In the year 1801 the town consisted of 300 houses, and contained 1734 inhabitants. There is a weekly market on Saturdays, and an annual fair. It has a small manufacture of bone-lace; and some of the inhabitants are occupied in spinning. Kirby's Suffolk Traveller.

EYE, a river of Scotland, which rises in the north-west part of Berwickshire, and falls into the North sea, at Eyemouth.

EYE is also used among *Jewellers* for the lustre and brilliancy of pearls and precious stones, more usually called the *water*.

EYE, among *Naturalists*, is sometimes also used for a hole or aperture: whence it is that the first of the larger intestines is called *cæcum*, or the blind gut, as having no eye or perforation. For a like reason the chemists call a close vessel, used in distillation, a blind head.

EYE, in *Perspective*. See PERSPECTIVE.

EYE, in *Printing*, is sometimes used for the thickness of the types and characters used in printing; or, more strictly, it is the graving in relief on the top of the latter; otherwise called its *face*.

It is the eye or face that makes the impression; the rest, which they call the body, serving only to sustain it.

The eye of the *e* is the little aperture at the head of that character, which distinguishes it from the *o*. See E.

EYE, in a *Ship*. The hole wherein the ring of the anchor is put into the shank is called the "eye of the anchor;" and the compass or ring which is left of the stop to which any block is seized, is called the "eye of the stop."

EYE of a Stay, is that part of a stay which is formed into a sort of collar to go round the mast-head.

EYE-Bolt, is a long bar of iron with an eye in one end of it, formed to be driven into the decks or sides of a ship for divers purposes, as to hook tackles, or fasten ropes to, as occasion requires.

EYE-let-Hole. See SAIL.

EYES of a Ship, a name frequently given to those parts which lie near the haule holes, particularly in the lower apartments within the vessel.

EYE-Bright, in *Botany*. See EUPHRASIA.

EYE-Brows. See EYE, in *Anatomy*.

EYE-Brows, wounded. See WOUNDS.

EYE-Brow, in *Architecture*. See FILLET.

EYE-Glass, in our *Double Microscopes*, is usually a lens convex on both sides; but Eustachia Divini long since invented a microscope of this kind, the power of which he places very greatly above that of the common sort; and this principally depending on the eye-glass, which was double, consisting of two plano-convex glasses, so placed as to touch one another in the middle of their convex surface. This instrument is spoken of with great credit by Fabri in his *Optics*, and is said to have this peculiar excellence, that it shews all the objects flat, and not crooked, and takes in a large area, though it magnifies extremely much. Phil. Trans. No. 40.

EYE-Glass, in *Telescopes*, is the lens next the eye; and if the telescope consist of more than two lenses, all but that next the object are called eye-glasses.

EYE-lids, Encysted tumours of, in *Surgery*. Encysted tu-
nours

mours frequently form on the eye-lids: indeed, this is so much the case, that some surgical writers assert that such swellings are more often found situated on those parts than any where else in the body.

We shall not stop to refute the opinion which has occasionally started up, that the frequency of encysted tumours on the eye lids arises from the great number of sebaceous glands existing in these parts, which glands have been supposed to swell and enlarge from some cause or another. Scarpa points out, that the glands of Meibomius are only situated at the edges of the eye-lids, and that encysted tumours are not more common on this part of the eye-lids than on others.

Scarpa remarks, that an encysted tumour of the eye-lids, in its early state, does not exceed a millet-seed or a small pea in size, and that it is long before a swelling of this kind becomes as large as a bean or filbert. The tumour is in general unattended with pain; but some uneasiness is experienced as soon as the disease has acquired such magnitude that the free motion of the eye-lid, a partial depression of it, and a degree of pressure on the eye-ball, are produced.

Scarpa expresses a conviction, founded on the observation of numerous cases, that these tumours are, from their first origin, most commonly nearer to the internal membrane of the eye-lids than to the integuments, their bases being so superficially situated on the inner surface of the eye-lids, that, when such surface is turned outwards, the swellings seem quite denuded, and look transparent through the delicate lining of the palpebræ.

Various applications have been tried, with a view of dissolving encysted tumours of the eye-lids; as, for instance, collyria, containing the aqua ammonia in a very diluted state, resolvent gums, mercurial frictions, &c. Scarpa observes, however, that he has found so little success attend the use of these remedies, that, he is convinced, the only effectual mode of cure, particularly when the tumour is of long standing, consists in having recourse to extirpation.

A surgeon, who adopts Scarpa's opinion, naturally decides, that the best way of removing encysted tumours of the eye-lids is, generally speaking, to extract them through an incision made on the inside of the eye lid. The reasons urged by Scarpa, in favour of this practice, are, that the wound need only be a very superficial one, the cyst may be easily separated from the surrounding parts, the place readily heals, and no fear is left to denote either that there has been any disease or operation.

Scarpa allows, however, that there is one case in which this plan of operating should not be chosen. When the encysted tumour is so situated upon either eye-lid that the part cannot be sufficiently turned inside-out, to bring into view the base of the swelling, and to enable the surgeon to cut away the whole of it, the cut should be made from without.

When the encysted tumour is on the upper eye-lid, the patient being seated with his head firmly supported, an assistant is to turn out the upper eye-lid, and press in such a manner as will make the tumour project as much as possible. The surgeon is next to divide, with a lancet, or convex-edged scalpel, the delicate membrane spread over the tumour. He is to observe to make the incision in the direction of the edge of the eye-lid, and of sufficient size to allow the tumour to project and be taken out with ease. The swelling may now be taken hold of with a pair of forceps, or a tentaculum, and detached from all its connections with the knife, or, as some may prefer, with a pair of scissors. The eye-lid is then to be put into its natural position again, and kept wet with linen dipped in the saturnine lotion.

The operation on the lower eye-lid is not materially different from the one already described.

When an encysted tumour is to be removed from the eye-lid of a child, Scarpa advises the child to be laid on a table, with the head raised on a pillow, and the hands and feet firmly held by assistants.

In quadrupeds the lower palpebra is moveable, and is the smaller; in birds, on the contrary, the lower is moveable, and the greater.

Animals that have hard eyes, as lobsters, and the generality of fishes, have no palpebræ, such eyes being sufficiently secured without.

In the generality of brutes there is a kind of a third eye-lid, which is drawn like a curtain, to wipe off the humidity which might incommode the eyes; it is called the nictitating membrane.

The monkey is almost the only one that wants it, as being furnished, like a man, with hands to wipe the eye on occasion.

Eye-lids, Wounded. See WOUNDS.

Eye, *Bull's*, in *Astronomy*, a star of the first magnitude, in the constellation Taurus, by the Arabs called Aldebaran.

Eye, *Cat's*, *Oculus cati*, in *Natural History*, a precious stone, called also *sun's eye*, *oculus solis*, and taken by Dr. Woodward for the asterias of the ancients. See CAT'S-eye.

Eye, *Crab's*, *Oculus cancerorum*. See CRABS-eyes.

Eye, *Goat's*, *Oculus caprinus*, is when there is a white speck on the pupil of the eye, as is seen in the eyes of goats. Physicians call it *ægiæ*.

Eye, *Golden*, in *Ornithology*. See DUCK.

Eye, *Hare's*, *Oculus leporinus*, in *Surgery*, a disease arising from a contraction of the upper eye-lid, which prevents its being able to cover its part of the eye, so that the patient is obliged to sleep with the eye half open, after the manner of hares.

Physicians call it *lagophthalmia*, a Greek word signifying the same thing, being compounded of *λαγυτι*, *hare*, and *οφθαλμος*, *eye*.

EYEABLE, in *Rural Economy*, is a provincial term used to denote the fine appearance of collections of sheep and neat cattle.

EYEMOUTH, in *Geography*, a small fishing town in the shire of Berwick, having a good harbour for small craft at the mouth of the river Eye. In the reign of Elizabeth the French took possession of it for the queen mother, and fortified it, as being a convenient port for landing supplies. But queen Elizabeth supporting the cause of the reformers, the French were soon obliged to quit the country. A considerable herring fishery occupies the inhabitants. In 1791 six buffes only were employed, but there is abundance of room for numbers more, as the coast abounds with various kinds of fish. In 1756 the harbour was improved by the erection of a new pier on the western side, and in 1770 another on the eastern side was added; since which the trade has increased, and much corn and meal are annually exported. It has two annual fairs in June and October, and is situated nine miles north by west of Berwick, and 349 miles from London. Sir John Sinclair's Stat. Acc. of Scotland.

EYERDORF, a town of Germany, in the principality of Wurzburg; five miles S.S.W. of Kullingen.

EYERHEIM, a town of Germany, in the principality of Wurzburg; seven miles E.S.E. of Schwemfurt.

EYLRANDT, an island at the entrance into the Zuyder sea from the German ocean, N. of the Texel, about 2½ miles in length, and half a mile wide; joined to the island

island of Texel by a bank of sand, and overflowed only at high water.

EYESS, in *Falconry*. See EYRIE and FALCON.

EYETON, or AYTON, in *Geography*, a town of Scotland, in Berwickshire, seated on the river Eye; seven miles N. of Berwick-upon-Tweed.

EYFERDING. See EFFERDING.

EYGUEL, a river of France, which runs into the Sarre; five miles N.E. of Sarre Alb.

EYGUIE'RÉS, a town of France, in the department of the Bouches, or Mouths of the Rhone, and chief place of a canton, in the district of Tarascon; 16 miles E.S.E. of Tarascon; the place contains 2925, and the canton 7320 inhabitants, in seven communes and a territorial extent of 245 kilometres.

EYGURANDE, a town of France, in the department of Correze, and chief place of a canton, in the district of Uffel; the place contains 991, and the canton 4667 inhabitants, on a territory of 180 kilometres, in 10 communes.

EYKENHOUTS DOUBLET, in *Conchology*, the name of *Venus macassarica*, in Leer's Catal.

EYLA, in *Geography*, a river of Saxony, which runs into the Wichra, two miles N. of Borna, in the margravate of Meissen.—Also, a town of Sicily, in the valley of Mazara; 25 miles E.S.E. of Palermo.

EYLAND, a river of Brandenburg, which runs into the Oder; two miles S. of Frankfort.

EYLANDEN, one of the smaller Japanese islands. N. lat. $34^{\circ} 45'$. E. long. $139^{\circ} 10'$.

EYLAU, DRUTSCH, a town of Prussia, in the province of Oberland; 42 miles E.N.E. of Culm. N. lat. $53^{\circ} 30'$. E. long. $19^{\circ} 24'$.

EYLAU, *Preussisch*, a town of Prussia, in the province of Natangen; 20 miles S. of Konigsberg; famous for a bloody battle fought near it in February 1807, between the French and the Russians. N. lat. $54^{\circ} 20'$. E. long. $20^{\circ} 42'$.

EYLES'S ISLAND, a small island in the Mergui Archipelago, near the fourth coast of Sullivan's island. N. lat. $10^{\circ} 46'$.

EYLL, a river of France, which runs into the Roer, near Julliers.

EYME, a town of Germany, in the principality of Calenberg; 16 miles E. of Hameln.

EYMET, a town of France, in the department of the Dordogne, and chief place of a canton, in the district of Bergerac; 12 miles S. of Bergerac. The place contains 1332, and the canton 5502 inhabitants, in 14 communes, on a territory of $122\frac{1}{2}$ kilometres.

EYMOUTIERS, a town of France, in the department of Upper Vienne, and chief place of a canton, in the district of Limoges; 18 miles N. of Limoges. The place contains 1521, and the canton 13,159 inhabitants, in 16 communes, on a territory of 370 kilometres. This town carries on a considerable trade in skins, leather, and rags.—Also, a town of France, in the department of the Dordogne; 15 miles N. of Perigueux.

EYNDHOVEN, a town of Brabant, situated on the Dommel; 25 miles W. of Venlo.

EYNON, a river of Wales, which runs into the Dovic, about three miles below Machynlleth.

EYNSHAM, a village of England, in the county of Oxford, six miles N.W. of Oxford, famous for a monastery founded here by Athelner, or Aylmer, earl of Cornwall and Devon, before the year 1005; and also for a council held here by king Ethelred, at which the archbishops and bishops of the realm attended, and many acts, ecclesiastical and civil,

were passed. The number of inhabitants in 1801 was 1166.

EYPEL, a town of Bohemia, in the circle of Konigin-gratz; three miles S.S.E. of Trautenau.

EYPOLTAN, a town of Aultria, on the north side of the Danube; five miles N. of Vienna.

EYRAGUES, a town of France, in the department of the Mouths of the Rhone; eight miles E.N.E. of Tarascon.

EYRE, a town of North Carolina; 48 miles W. of Halifax.

EYRÉ, or Iré, a mountain of Africa, between Fezzan and Cashna.

EYRE, or Eire, in *Law*, signifies the court of justices itinerant.

The word seems formed of the old French, *irre*, *iter*, *way*, *track*.

Hence justices in eyre are those whom Bracton calls *justiciarii itinerantes*. See JUSTICES in Eyre.

EYRE of the Forest, is otherwise called *justice-feat*, which by the ancient customs was to be held every three years by the justices of the forest, journeying up and down for that purpose. See JUSTICES.

EYRECOURT, in *Geography*, a post town of the county of Galway, Ireland; 72 Irish miles west from Dublin, and about 34 east from Galway.

EYRIE, or AYRIE, among *Falconers*, the nest where hawks sit and hatch, and feed their young.

Hence a young hawk, newly taken from the nest, is called an eyef.

EYRON, in *Geography*. See EIRON.

EYSACH, a river of the Tyrolse, which runs into the Adige, near Bolzano.

EYSDALE, or ESDALE, a small island near the west coast of Scotland, celebrated for its quarries of excellent slate; seven miles S.E. from Mull. N. lat. $56^{\circ} 18'$. W. long. $5^{\circ} 38'$.

EYSENERG, a town of Prussia, in Natangen; 20 miles S.S.W. of Brandenburg.

EYSL, a town of Germany, in the principality of Anspach; four miles N. of Thalmessing.

EYSTATHES, in *Botany*, *ωσάβης*; firm and stable, in allusion to the hard and durable nature of the wood. Loureir. Cochine. 234. Class and order, *Ocandria Mouogyia*. Nat. Ord. *Sapindi*, Juss.?

Gen. Ch. Cal. Perianth inferior, of five ovate, concave leaves. Cor. Petals five, ovate, spreading, the size of the calyx. Stam. Filaments eight, awl-shaped, erect, inserted into the receptacle; anthers erect, ovate, of two cells. Pist. Germen superior, roundish, hairy; style thread-shaped, nearly as long as the stamens; stigma obtuse, notched. Peric. Berry globose, fleshy, of one cell. Seeds four, ovate, compressed.

Ess. Ch. Calyx of five leaves, inferior. Petals five, ovate. Berry of one cell, with four seeds.

E. *sylyvestris*. Lour. 235. Native of the lofty mountains of Cochinchina. A large tree, whose wood is reddish, even, firm, of an ample size, fit for the purposes of building. Branches spreading. Leaves alternate, ovate-oblong, pointed, entire, smooth, veiny. Flowers white, in nearly simple oblong clusters, about the ends of the branches. Berry smooth, with a hard skin, pulpy internally, of a middling size, not eatable.

Such is Loureiro's account. We know no described tree to which his description is applicable. The number of seeds which he attributes to this genus, four instead of three, renders its natural order doubtful.

EYSTENEY, called also *Easton-Nest*, in *Geography*, is a remarkable

remarkable head-land in Suffolk, formerly accounted the most eastern point of the island, whence it received its Saxon, or rather British, denomination. But since the latitudes and longitudes of places have been more accurately ascertained by modern discoveries, the statement has been found erroneous; part of the Norfolk coast having a more easterly bearing. This point was the ΕΞΟΧΗ, or *Extensio Promontorium* of the Roman geographer Ptolemy. "And to put it out of doubt," says Camden in his *Britannia*, "that it is the same we call Easton, it is to be observed, that Eysteney signifies the same in British, as ΕΞΟΧΗ in Greek, or *Extensio* in Latin. Though the name in our language may be with as much probability derived from its eastern situation." (Vol. ii. Gough's Edit. p. 76.) The probability, however, is in favour of the British derivation. *Ulsen* or *Eyssen*, in Celtic, means to extend, and *by*, prominent; hence Eystenhy, or Eysteney, will signify the extended protection, or bold promontory. Horsley places it at Gunfleet, in the county of Essex.

EYTIJOU-HOTUN, a town of Corea; 380 miles E. of Peking.

EYWANOUITZ, a town of Moravia, in the circle of Olmutz; 16 miles S. W. of Olmutz.

EZA, a town of France, in the department of the Maritime Alps; 4 miles E. of Nice.

EZAGEN, a town of Africa, in Fez; 60 miles S. of Tetuan.

EZAWEN, a town of Africa, in the country of Sahara; 70 miles N. W. of Tombuctoo.

EZDOUD, a town of Syria, on the site of the ancient Azotus, or Ashdod, famous at present for its scorpions. This town, which was once so powerful under the Philistines, affords no proofs of its ancient importance. Three leagues from Ezdoud is the village of El-Majdal, where they spin the finest cottons in Palestine, which, however, are very coarse.

EZEKIEL, in *Scripture Biography*, one of the inspired prophets, whose predictions are recorded in the Old Testament. He was the son of Buzi of the house of Aaron, and one of the captives carried by Nebuchadnezzar to Babylon with Jeconiah or Jehoiachin. The era at which he commences his prophecies was the fifth year of Jehoiachin's captivity, or the fifth of Zedekiah, or the 593d year B. C. Jeremiah was his contemporary, and prophesied at the same time in Judæa. Ezekiel, after his captivity, inhabited some place on the river Chebar, which flows into the Euphrates about 200 miles northward of Babylon; and this was the scene of his predictions, though he was occasionally conveyed in vision to Jerusalem; and his prophecies were continued for about 22 years. The events of his life, after his advancement to the prophetic office, are interwoven with the detail which he himself has given of his predictions; and the manner of its termination is now where ascertained. Epiphanius, indeed, if he be the author of the life of this prophet that is ascribed to him, informs us, that he was put to death by the prince or commander of the Jews in the place of his exile, because he was addicted to idolatry, and could not bear the reproaches of the prophet. But on this account, which is intermixed with many fables, we can place no reliance. The subjects of Ezekiel's prophecies, contained in the canonical book of the Old Testament, bearing his name, are the dreadful calamities, soon after inflicted upon Judæa and Jerusalem, on account of the idolatry, impiety, and profligacy of their inhabitants; the divine judgments that would be executed on the false prophets and prophetesses, who deluded and hardened the Jews in their rebellion against God; the punishments which should

befal the Ammonites, Edomites, and Philistines, for their hatred of the Jews, and for insulting over them in their distress; the destruction of Tyre, which he places in the 26th year of the captivity of Jehoiachin, and also the conquest of Egypt in the succeeding year, by Nebuchadnezzar; the future restoration of Israel and Judah from their several dispersions, upon their repentance and reformation; and their ultimately happy state after the advent and under the government of the Messiah. The predictions of Ezekiel are distributed by Josephus, and various other writers, into two books, or parts; the first of which extends to the close of the 39th chapter; and the second, in which a new, more elevated, and joyful scene is exhibited, begins with the 40th chapter, and is comprehended in the last nine chapters. Grotius speaks in high terms of this prophet, observing, "that he had great erudition and genius; so that setting aside his gift of prophecy, which is incomparable, he may deserve to be compared with Homer, on account of his beautiful conceptions, his illustrious comparisons, and his extensive knowledge of various matters, particularly of architecture." Bishop Lowth, in his 21st lecture on the sacred poetry of the Hebrews, gives us an admirable description of the peculiar and discriminating characteristics of this prophet. "Ezekiel," says he, "is much inferior to Jeremiah in elegance; but is equal even to Isaiah in sublimity, though their style of composition is very different. For he is bold, vehement, tragical, wholly intent on exaggeration; in his sentiments elevated, warm, bitter, indignant; in his images fertile, magnificent, harsh, and sometimes almost deformed; in his diction grand, mighty, austere, rough, and sometimes uncultivated, abounding in repetitions, not for the sake of ornament or gracefulness, but through indignation and violence. Whatever subject he undertakes to treat of, he pursues it diligently, he remains entirely fixed on it, and rarely deviates from his purpose; so that his reader is scarcely ever unable to discern the sense and connection of his matter. Perhaps he is excelled in other respects by most of the prophets; but none in the whole compass of writers has ever equalled him in the manner of writing, for which he seems to have been singularly qualified by nature, in force, impetuosity, weight, and grandeur. His diction is sufficiently perspicuous; almost all his obscurity lies in his matter: his visions are particularly obscure; and yet, as in Hosea, Amos, and Zechariah, they are interpreted by a narration, which is plain and altogether historical. The greater part of Ezekiel, and what lies in the middle of his book, is poetical, whether we regard the matter or the diction: but he is for the most part so rude and void of composition in his sentences, that I am often doubtful what to determine in this respect." In another place the same learned prelate remarks, that Ezekiel should perhaps be oftener classed among the orators than the poets; and he thinks that, with respect to style, we may justly assign to Ezekiel the same rank among the Hebrews that Æschylus holds among the Greeks. The most learned and elaborate commentary upon this prophet was written by two Spanish Jesuits, Pradus and Villalpandus, in three volumes folio, of which Dr. William Lowth has availed himself in his valuable continuation of Bishop Patrick's commentary on the Old Testament. The latest and best version of Ezekiel is that of the late learned bishop Newcome, in 1788, in 4to. with a preface and notes, which Biblical scholars will peruse with advantage. Prideaux's Conn. vol. i.; Lowth's Comm. Pref.: and Preface to Newcome's Com.

EZEKIEL'S *reed*, or *rod*, a scripture measure, computed by late writers to amount to 1 English foot 11 inches $\frac{1}{2}$ of an inch.

EZRA, or EZDRAS, in *Biography*, a Jewish priest, author of the book that bears his name, and compiler of the Canon of the O. T., was a descendant of Seraiah, the high priest, who was put to death by Nebuchadnezzar at the capture of Jerusalem, in the year 587 B. C. and flourished about the year 458 B. C. He was probably born in the land of captivity, and acquired the respect and confidence of his countrymen by his distinguished learning, acquaintance with the scriptures, and zeal for the religion of his fathers. In the beginning of the 7th year of Artaxerxes Longimanus, or 458 B. C., Ezra received his commission to return to Jerusalem, with as many of his nation as chose to accompany him, for the purpose of restoring and settling the state, and reforming the church of the Jews, and of regulating and governing both according to their own laws. The extraordinary powers with which Ezra was invested seem to have been conferred upon him by the influence of Esther, who was at this time in high favour at the Persian court. At the commencement of his journey he appointed a fast, with a view of recommending himself and his associates to the divine protection, and arrived at Jerusalem on the 1st day of the 8th month, having spent 4 whole months in the journey from Babylon thither. Having delivered up to the temple the rich offerings which had been made to it by the king, the nobles, and the Jews who remained in Babylon, and having communicated his commission to the king's lieutenants and governors throughout Syria and Palestine, he made no delay in the execution of it; and difficult and arduous as it was, he persevered during an interval of 13 years, till Nehemiah arrived with a new commission from the Persian court, to co-operate with him. From the advancement of Esther to the high dignity of queen in the court of Persia, and the protection and patronage thus afforded him, Ezra derived an encouragement to go on with the work of reforming and settling the Jewish church and state in Jerusalem, which he had undertaken.

We shall here observe that the date of the commission granted to Ezra in the 7th year of Artaxerxes furnishes the commencement of the 70 weeks of the famous prophecy, delivered in the 9th chapter of Daniel, concerning the advent of the Messiah, that these 70 weeks are weeks of years, and that the whole number amounts to 490 years, at the end of which the period marked in the prophecy expired; after which the Jews were no longer to be the peculiar people of God, nor Jerusalem his holy city, because then the economy which he had established among them was to cease, and the worship which he had appointed at Jerusalem was to be wholly abolished. All this was accomplished at the death of Christ. Accordingly, the end of these weeks being fixed at the death of Christ, we may easily calculate their commencement. The death of Christ, as most learned men agree, took place in the year of the Julian period 4746, and in the Jewish month Nisan, when the Jewish passover was always celebrated; and, therefore, if we reckon 490 years backward, this will lead us up to the month Nisan, in the year of the Julian period 4256, which were the year and the month in which Ezra had his commission from Artaxerxes, for his return to Jerusalem, in order to restore the church and state of the Jews. According to this interpretation of the prophecy, the words "to restore and rebuild Jerusalem" cannot be understood in a literal sense. If this be the case, they must be understood of that rebuilding of Jerusalem, which was accomplished by virtue of the decree of Cyrus, in the first year of his reign, 536 years B. C.; but from this era to the death of Christ

were 568 years; and, therefore, if the said 490 years be computed from thence, they will expire many years before the cutting off or the coming of the Messiah, both of which events ought to fall within the compass of them according to the words of the prophecy. But to return from this digression.

One of the first objects of Ezra's attention, after he had appointed judges and magistrates, was to induce the Jews to dissolve the marriages, which had been contracted by many of them in direct contradiction to the law of Moses, with wives from the families of their idolatrous neighbours. During the continuance of his government he sedulously employed himself in restoring the discipline and rites of the Jewish church, and the worship of the temple, according to the form in which it had existed before the captivity. But we must not omit to mention a very important measure which engaged the attention of Ezra, and to which he devoted his skill and industry; and this was the correction and revision of the books of the sacred writings. What he did in this respect towards forming a complete canon of the scriptures, has been already stated at large under the article BIBLE. Although Ezra's commission was superseded by that of Nehemiah, in the 20th year of Artaxerxes Longimanus, he continued, in concurrence with the new governor, to perfect the reformation which he had begun. When he had completed his revision of the scriptures, and had them written out in the Chaldean character, he made preparation for publicly reading the law of Moses to the people at Jerusalem. The day appointed for this purpose was the first day of the feast of trumpets, when the commencement of the new year was joyfully celebrated. Having ascended a scaffold, which had been erected in the most convenient part of the city, and being attended by 13 of the principal elders of the people, he began to read the law out of the Hebrew text, and some of the Levites, previously instructed and appointed for this purpose, rendered it into Chaldee, which was then the vulgar language of the people; and he proceeded thus, day after day, during this festival, and also that of tabernacles, till the whole law was finished. Nehemiah and Ezra, at the close of this solemn business, by which the minds of the people had been much impressed, proclaimed a fast, in order to give them an opportunity, and also incitement, for a public and solemn confession of their sins, and for entering into engagements of future obedience to the laws which had been explained to them.

The subsequent events of Ezra's life are not recorded. Josephus says that he died at Jerusalem; but other Jews affirm that he returned to Persia, and died there, in the 120th year of his age. Many fables have been related concerning him in the writings of the Talmudists, and they have been borrowed by the Mahometans; but they are not deserving of recital. Several of them may be found in Herbelot's "Bibliothèque Orientale," under the articles *Ozain*, and *Ben Seraiab*.

The book of Ezra was written by him, partly in Hebrew, and partly in Chaldee, viz. from the 8th verse of the 4th chapter to the 27th verse of the 7th chapter; and contains the history of the Jews from the time of Artaxerxes's, or, as others say, Cyrus's, edict for their return, to the twentieth year of Artaxerxes Longimanus. It specifies the number of Jews who returned, and Cyrus's proclamation for re-building the temple, the obstruction it met with, and the finishing thereof in the reign of Darius. It is canonical, and allowed as such both by the church and the synagogue.

The books of Ezra, called in the English version, "the

First and Second Books of Esdras," though held by some, particularly the Greeks, for canonical, are thrown by the English church into the number of apocryphal books, being only extant in Greek. These have been deservedly rejected from the canon as spurious productions, consisting of combined extracts from the genuine book of Ezra, rabbinical fables, and the dreams of some Christian visionary. The Jews ascribe to Ezra the book of Nehemiah, but this

opinion is contradicted by Nehemiah's own declaration at the beginning of it, and by his always speaking of himself in the first person. Some have also conjectured that Ezra was the author of the book of *Esther*, which see; and many have, with greater probability, attributed to him the compilation of the two books of Chronicles; and others have said that he was the writer of the two books of Kings. Prideaux's Com. vol. ii. Du Pin.

F.

F, The sixth letter of the alphabet, and the fourth consonant.

The letter F may be either considered absolutely, and in itself, or with regard to the particular languages where it is found. In the first view, F is generally placed by grammarians among the semi-vowels, and distinguished in the enumeration of the alphabet by a name beginning with a vowel; though it has so far the nature of a mute that it is easily pronounced before a liquid in the same syllable. Joh. Conrad. Amman (in his *Dissertatio de Loquela*) divides the consonants into single and double, and the single into hissing and explosive. Among those called hissing, there are some pronounced by the application of the upper teeth to the lower lip; and these are the F and *ph*. The reason why some account the F a semi-vowel, and Amman places it among the hissers, is, that one may pronounce a little sound without any other motion of the organs than what is necessary to the pronunciation of the F.

In English its sound is invariable, being formed by compression of the lips, or a junction of the upper teeth with the under lip, and a forcible breath.

This letter is derived to us from the Romans, by whom it was borrowed from the Æolians, who, having no rough breathing, invented this character, or rather borrowed it from the oriental tongues; among the Æolians it is called *digamma*, or *double gamma*, as resembling two I's, (gammas,) one over the other. The Latins used this great F instead of *v*. Hence the Æolians, and the Latins after them, write *Foinos*; for *oinos*, *vinum*, and *Fespera* for *ispera*, *vespera*, and *aFwv* for *avv*, *avum*. (See Letter E.) The aspirate, says the ingenious writer, cited under that article, instead of vanishing on the principle there stated, was changed into a labial letter, *w*, *v*, *b*, *f* or *φ*. The digamma, however, did not always originate in a guttural, but sometimes in consonants allied to our *w* or *y*. The digamma, says the same author, did not belong, as Dr. Bentley and others supposed, to the Æolic dialect only, but to all the dialects of Greece in their more ancient mode of pronunciation; and he observes, in opposition to the opinion of the learned, who say that the digamma at first prevailed, and was afterwards succeeded by the aspirate, that the gutturals at first prevailed, which were softened into mere aspirates, and that these were again changed for a more easy and agreeable letter, which being simply a labial, was diversified by different people into *y*, *w*, *v*, *f*, *b* or *f*. In contradiction to this very plausible theory,

it may be alleged, that the digamma is to be found only in Homer, the most ancient writer of Greece, while the aspirate occurs in all the more recent authors. To this objection it is replied, that the use of the aspirate obtained in the written language, and was, therefore, less susceptible of corruption: on the other hand, that of the digamma prevailed in pronunciation, which was more liable to change, and to deviate from the original terms. Homer, we may naturally suppose, adopted the first in composing and writing his poems, and the last in reciting them to the people. The written form, we may presume, was at first used but little, but prevailed by degrees, while the peculiarities of pronunciation in their turn began to decline. The language, as written by Homer, at length became fashionable in the conversation of polished people; and the aspirate being thus triumphant in the daily converse of learned men, would of course in their writings triumph over oral and temporary corruptions. The preservation of the aspirate in the written poems of Homer, while the digamma was used in reciting them, is a proof that Homer did actually use a written language, and that his works were preserved by a written language; otherwise the aspirate would have been lost, and the digamma alone would have prevailed in all the Greek authors who followed. If an editor of Homer in modern days would insert the digamma, he would corrupt the original orthography of Homer, and substitute, in the room of the original characters, the corruption of pronunciation.

Mr. Jones further observes, that the change of a guttural into an aspirate, or into a long vowel, or into a labial letter, called the digamma, is not peculiar to any one language, but is founded in the structure of the organs of speech; and instances of it prevail in all tongues, both ancient and modern. We may further add, that the digamma seems in its origin to have been no other than the Greek *φ*, which being made at three strokes, degenerated at length into the figure F. For the letter *φ* being compounded of an omicron with a perpendicular drawn through it, if that perpendicular be made first, and the O at two strokes afterwards, viz. first the upper, then the under part, it may happen, especially in writing fast, that the two parts shall not join; and even instead of two arches of circles, haste and convenience may naturally enough make two straight lines.

What confirms this transmutation of the *φ* into F, is, that

that on the medals of Philip, and the kings of Syria, in the words ΕΠΙΦΑΝΟΥΣ and ΦΙΛΑΔΕΛΦΟΥΣ, the *phi* is frequently seen in the form just mentioned; *i. e.* it has no circle or omicron; but across the middle of the perpendicular is a kind of right line, formed only of two dots, the one on the right side, and the other on the left, representing a cross †. Such appears to be the origin of the letter F, which of consequence is no other than a corruption of the Greek φ; and accordingly, on the medals of the Falisci, the F is ordinarily put in lieu of the Greek φ: but it must be added, that though the Greek and Latin letter were thus the same thing, yet the sound was much softer among the Latins than among the Greeks, as was long ago observed by Terentianus.

The Romans for some time used an inverted F Ɱ , in lieu of a V consonant, which had no peculiar figure in their alphabet: thus, in inscriptions we meet with TERMINA Ɱ IT, DI Ɱ I, &c. According to Lipsius, in his Comment on the Annals of Tacitus, lib. xi. Covarruvias and Dausquius, this inverted digamma Ɱ was first introduced by the emperor Claudius. See Tacit. An. lib. xi. cap. 4. and Suet. in Vit. Claud. cap. 41.

It may be added, that the pronunciation of the F is almost the same with that of the V, as will be evident by attending to the manner of pronouncing the following words: Favour, Vanity, Felicity, Vice, Foment, Vogue, &c. The French particularly, in borrowing words from other languages, usually turn the final *v* into an *f*, as chetif of cattivo, nef of novus, nef of navis, &c.

In the latter Roman writers we find the Latin F and Greek φ *ph* frequently confounded; as in Falanx for Phalanx, Filosofphia for Philosophia, &c. which abuse is still retained by many French writers, who write Philosophie, Philippe, Epifane, &c. and even sometimes by the English as in fantasy, filtre, &c.

F, in the Calendar, is the sixth dominical letter.

F, in the Civil Law. Two ff's joined together signify the Pandects: see the reason of this under PANDECT.

F, in our Ancient Customs, was a stigma or brand.

He that shall maliciously strike any person with a weapon in church or church-yard, or draw any weapon there with an intent to strike, shall have one of his ears cut off; and if he have no ears he shall be marked on the cheek with a hot iron having the letter F, whereby he may be known for a fray-maker, or fighter.

F, or FA, in Music, denotes the bass-clef, being placed on the fourth line upwards.

Indeed the character or sign by which the *f* and *c* clefs are marked, bear no resemblance to those letters. Mr. Malcolm thinks it were as well if we used the letters themselves; but custom has carried it otherwise. The ordinary character of the F or bass-clef is F , which Kepler takes a great deal of pains to deduce by corruption from the letter F itself.

F, in the Italian Music, is often used instead of forte.

FF, implies fortissimo, very strong, or loud.

F, in Medical Prescriptions, stands for fiat, let it be done, as F. S. A. denotes as much as fiat secundum artem.

F, among such as give us the numeral value of letters, signifies 40, according to the verse

“Sexta quaterdenos gerit quæ distat ab alpha.”

And when a dash was added over it $\overline{\text{F}}$, signified 40,000.

F, on the French Coins, is the mark of the town of Angers.

FA, in Solmisation, is always the fourth sound of each hexachord, as *do, re, mi, fa*.

F, FA, UT, in the scale of Guido, is the note which occupies the fourth line in the bass, on which the clef is placed: *fa* implies the fourth in the natural hexachord of C, and the *ut* the first note of the molle hexachord.

FA FEINT, in Old Music, implied F ♯ ; and any note not in the regular hexachords, whether flat or sharp, was said to be a feigned or fictitious note.

FA FICTUM, Latin, or *Fa Finto*, Ital. in Old Musical Language, implied F ♯ . See FA FEINT.

FALBORG, in Geography, a sea-port town of Denmark, on the south coast of the island of Funen, situated in a flat but fertile country. Its harbour is not good; it principally trades in provisions. N. lat. 55° 6'. E. long. 10° 16'.

FAAS, a town of Hindoostan, in Dowlatabad; 5 miles S. of Amednagur.

FABA, in Botany, from *φαγω, to eat*, the common or broad bean. Just. 360. Tournef. t. 2. 12. Jussieu separates this as a genus from *Vicia* chiefly on account of the vertical, not lateral, insertion of the seeds, whose scar or *hilum* is terminal. There are several species, and their stout erect habit, so different from that of *Vicia*, countenances the measure. Even Gærtner however, so critical in differences in fruit, has not adverted to this, and the general opinion is in favour of Linnæus who combines the two. See VICIA.

FABA Bengalensis, in the *Materia Medica*, a roundish compressed substance, about an inch in diameter, brought from Bengal, and thought to be a vitiated fruit of the myrobalans kind. It is a very good astringent, and has been successfully prescribed in fluxes and hæmorrhages.

FABA St. Ignatii. See STRYCHNOS.

FABA Purgatrix, the fruit of a species of ricinus. See PALMA Cbrilli and CASTOR-oil

FABACIUM, a word used by the ancients to express a sort of food then in use, which was a kind of cake made of bean-meal.

FABAGO, in Botany, see ZYGOPHYLLUM. The name alludes to the thickness and shape of the leaves, resembling the seed-lobes of a bean.

FABALIS LAPIS, in Natural History, a stone mentioned by many ancient authors of repute as found in the river Nile, of the shape of the common bean, and of a black colour. They say it had the virtue of curing demoniaes, and that dogs durst not bark if it was laid before them. These, and many other like virtues, are attributed to this stone, to the great disgrace of the sober authors who relate them. The stone seems to have been of those extraneous fossils which Dr. Hill has styled ichthyperia, from their having been formerly parts of the bony palates of fishes which feed on the shell-fish kinds; and other authors siliquastri, from their resembling the pod of the lupine or bean.

FABARIA, in Botany, a name given by some authors to the telephium or orpine, and by which it is in some places called in the shops.

FABARIÆ Calendæ, among the Romans, the calends of June, so called because the beans being then first ripe, some of them were offered to the goddess Carna, the wife of Janus.

FABARIS, in Ancient Geography, *Farfa*, a river of Italy, called by Ovid *Farfarus*, which had its source at a small distance to the east of Carperia, at a place now called “Capo Farfa,” and pursuing a westerly course, discharged itself into the Tiber.

FABA-

FABATARIUM, among the ancients, signifies, according to some, a large vessel in which beans were kept; others will have it to have been a kind of dish or plate into which bean-pulse was put and offered to the household gods.

FABER, HENRY, in *Biography*, published an elementary tract on music, (ad Musicam Practicam Introductio, mulhus,) 1571, in which the scale in the harmonic or Guidonian hand is better arranged than in any other book of the kind that we have seen, by placing a clef at the top of the three middle fingers, as beacons or land-marks, and making each finger the representative of a tetrachord. See plate, *History of Music*, vol. ii. p. 95.

FABER, GREGORY, published at Basil, in 1552, "*Musices Practicæ Erotematum*," in two books, octavo, containing 230 pages; which, when they were written, could have been but of small use to a student without the colloquial commentary of a master: its only value, indeed, now is, that it contains compositions of Jusquin, Brunel, Okenheim, and other musicians of that time.

FABER, JACOBUS STAPULENSIS, or JAMES LEFEVRE, born at Étapes in the Boulonnois, and who flourished about the beginning of the 16th century, was an able mathematician, and one of the few writers on music which France could boast of at that early period. He was educated at Paris, and with a view to further improvement, he travelled through various parts of the world, that he might have an opportunity of conversing with the learned. On his return to France, he declared open war against the Scholastic philosophy, and attempted to introduce genuine Aristotelianism, as well as to disseminate a taste for mathematical learning. Besides several theological works, he wrote commentaries upon the dialectics, physics, politics, and economics of Aristotle. Of these commentaries one of his contemporaries says, "Faber has rendered the Peripatetic doctrine so clear, that we have no longer any occasion for Ammonius, Simplicius, or Philoponus." Another says, "Faber was the first among the French, as Cicero among the Romans, who united philosophy and eloquence." The boldness with which he opposed the corruption of philosophy brought upon him a suspicion of heresy, and the persecution of the doctors of the Sorbonne; but he found a secure asylum in the court of Margaret, queen of Navarre, where he is said to have lived to the age of 100 years; and where he died while veering between Protestant and Catholic. His chief works were theological, but his name is preserved by Protestants as a musical writer, and author of an elementary treatise on the art, (*Musica Libris Quatuor Demonstrata*), under the title of "*Jacobi Fabri Stapulensis Elementa Musicalia, ad Clarissimum Virum Nicolaum de Haqueville, &c.*" Paris 1496 and 1552. Zarlino mentions him by the title of "*Il Stapulense*." He is said by Bayle to have died at Nirac (where the king of Navarre held his court in 1537) at near 100. Bayle, who says nothing of his musical work, has been very diffuse on his polemics, calls him a bit of a man, "*e'toit un petit bout d'homme*," with a perturbed spirit, who attacked his friend Erasmus in an unhandsome manner; in which controversy he lost reputation, and proved himself to be neither Catholic nor Protestant.

His musical demonstrations, in a small 4to. of only 44 leaves, begins by a list of the Greek founders and writers on the science, and the wonted wonders of its effects; followed by an eulogium on his masters, Labinius and Turbinius.

He gives a list of all the ancient writers on music, Greek and Roman, from Aristoxenus to Boethius, but appears to have read none of them, except Boethius, whose treatise he

seems merely to have abridged. Salinas says that he understood other parts of mathematics better than music. His tract is solely confined to harmonics, and was admired in his own time, because he had no rivals; but so frequently has the subject of harmonics been treated since by mathematicians of a superior order, that this is only valuable for its age and scarcity. He takes notice of the *Senatus Consultum* against Timotheus, but he has given us no copy of it, nor does he mention any other notation used by the Romans, in the time of Boethius, than that of the Greeks. There are seven or eight musicians and musical writers recorded by Walker in his musical dictionary of the name of Faber, and Lefevre, but as neither music nor precepts of any use are come down to us from their labours, we shall let them go gently down the stream of oblivion, without endeavouring to check their course, or applying to the humane society.

FABER, JOHN, was born at Hailbron, on the Necker, about the year 1500; the circumstances of his early life have not come down to us, but we find him belonging to the Dominican order, and a doctor in theology at Cologne; after which he went to reside at Augsburgh, where he acquired considerable reputation as a preacher and writer against the Protestant doctrines. His writings are chiefly polemical, among which is "*Fructus quibus dignoscuntur Hæretici*," a work highly regarded by the Catholics of his own day on account of the facts, or perhaps fables, which it details concerning Luther. He wrote also in the German language "*An illustration of the Prophecy of Joel*," and a collection of prayers compiled from the scriptures and the works of St. Augustin. Moreri.

FABER, JOHN, surnamed from his own principal work, "*Malleus Hæreticorum*," was born at Leutkirchen, a town of Suabia, towards the end of the 15th century: he was zealously attached to the cause in which he had been educated, and was admitted to the degree of doctor in theology. In 1518 he was appointed by the bishop of Constance his official, and in the following year his vicar-general, and in that character he was appointed to examine the tenets of Zuingli and his fellow reformers in Switzerland. In this business his zeal outstript all sense of moderation and propriety, and he exclaimed at one of the debates in which he was engaged "that the world might very well live in peace without the gospel." This was in reply to those who contended that the scriptures were the only rule of faith and good conduct. The reformers carried their point, an edict was issued favourable to their opinions, against which Faber had the temerity to enter his protest. He was next appointed confessor to Ferdinand, who at that time was king of the Romans, and afterwards emperor, who sent him as envoy to the court of Henry VIII. of England. In the year 1531 he was advanced to the bishopric of Vienna as a reward for his zeal and exertions in the Catholic cause. To this instance of promotion Erasmus alluded when he said "that Luther, notwithstanding his poverty, found means to enrich his enemies." He died in the year 1542, leaving behind works which were published at different times, but which after his death were collected in three volumes folio. Moreri.

FABER, BASIL, another learned German born in the year 1520 at Sorau, in Lower Lusatia he passed through many degrees of church preferment, and died at Erfurt in 1576. He published works sufficient for two volumes folio, but his most celebrated piece was "*Theſaurus Editionis Scholasticæ*," which has gone through many editions, augmented and improved by the labours of the learned. The

best edition is that of the Hague in 1735, in two vols. Moreri.

FABER, HONORATUS, was born in the year 1626, at a period when the scholastic philosophy declined. He was professor of mathematics and philosophy at Lyons, and wrote upon philosophy, logic, and physics. He implicitly followed neither the Scholastics nor the Aristotelians, but borrowed light from modern philosophers, particularly the Cartesians. His innovations, however, brought him under a strong suspicion of heresy, and produced little effect.

FABER, PIERRE-JEAN, a physician of the faculty of Montpellier, and the author of numerous works relative to medicine, surgery, and chemistry, published chiefly between the years 1624 and 1626, at Toulouse. Little more is known respecting him, than that he practised his profession at Castelnaudary, in Languedoc, with great reputation; so that he was frequently sent for to the cities of that province, especially to Toulouse. The titles of his treatises will be found enumerated by Eloy. In one of these, "Insignes Curationes Variorum Morborum, Tolosæ, 1627," he informs us that he succeeded in curing a rich and noble young lady of an hysterical disease, mixed with occasional attacks of epilepsy, and that she married him in reward of his services. Eloy Dict. Hist.

Several physicians of the name of Faber, of less note, are mentioned by Mangetus and Eloy: one of whom, named Albert, after having practised his profession at Lubeck about the year 1641, and subsequently at Hamburgh, became physician to Charles II., to whom he dedicated his only work, written in English. A Latin translation of this work is extant, under the title of "Practica recensio de Auro potabili medicinali, ejusque virtute," printed at Francfort in 1678. He survived his royal master but one year, having died in 1686.

FABER, in *Ichthyology*, the English *Doree*, a species of *Zelus*; which see.—Also, a species of *Chatodon*; which see.

FABIAN, ROBERT, in *Biography*, an English historian, born in London in the 15th century, and brought up to active business. In the pursuits of commerce he was so distinguished as to be chosen sheriff of the city in 1493. His leisure hours were devoted to literature, and particularly to the study of history. He employed himself in compiling a chronicle, which was printed after his death, entitled "A Concordance of Stories." It is divided into seven parts, of which six refer wholly to the history of England previously to William the Conqueror; the seventh brings the English and French histories down to the reign of Henry VII. He is copious in the affairs of London, in which the work is chiefly valuable, and on that account it is called by Stow "a painful labour, to the great honour of the city and the whole realm." To each of his books are prefixed a metrical prologue and other pieces in verse, which led bishop Tanner to style him, "poeta haud infelicis ingenii." His chronicle was printed in the year 1516, four years after the author's death. Biog. Brit.

FABIANE, in *Geography*, a river of Louisiana, which runs into the Mississippi. N. lat. 39° 31'. W. long. 91° 47'.

FABIANS, FABII, in *Antiquity*, a part of the Luperci. Those priests consisted of two colleges, the first of which was called the Fabii, and the second the Quintilii, from their respective chiefs. The Fabii were for Romulus, and the Quintilii for Remus.

FABIANUS, PAPHYRIUS, in *Biography*, an intelligent naturalist, who lived in the reign of Tiberius, and wrote a treatise "On Animals." Pliny calls him "naturæ rerum

peritissimus." He is also mentioned by Seneca and other writers. Le Clerc, Hist. de la Med.

FABIANUS, pope, was a native of Rome, to the bishopric of which he succeeded in the year 236. He presided in that high station till the year 250, when he fell a martyr to the Decian persecution. He is characterized by St. Cyprian as "an excellent man, the glory of whose death had answered the purity, holiness, and integrity of his life." According to Tillemont, and others, a great part of Gaul was indebted to Fabianus for its knowledge of Christianity, which was taught by the bishops that he trained up and sent out in missions for the propagation of religion. Moreri.

FABIO, SIGNOR, in the year 1770 was leader of the opera band at Naples; a musician who knew and performed his business admirably. As his name or his merit can be little known in England, he would not perhaps have been recorded here but to relate a circumstance which did him honour, in our opinion, at Naples, but which in England would have degraded him to the rank of a ticket-porter. Having been invited to dine with a gentleman who loved music, we observed that he was so obliging and so humble as to bring with him his violin. It is very common in the great cities of Italy to see performers of the first eminence carry their own instruments through the streets. This seems a trivial circumstance to mention, yet it strongly marks the difference of manners and characters in two countries not very remote from each other. In Italy, the leader of the first opera in the world carries the instrument of his fame and fortune about him, with as much pride as a soldier does his sword or musquet; while, in England, the indignities he would receive from the populace would soon impress his mind with shame for himself and fear for his instrument.

FABIUS, MAXIMUS Q. an eminent Roman commander, whose history and deeds are incorporated with that part of his country's annals which are devoted to the period in which he flourished. He was master of the horse to the dictator Papirius, who, jealous of the superiority of an inferior officer, sought revenge in the death of Fabius; but having escaped, he was himself made consul five times, and rendered his country very signal services. In the year B. C. 304, he served the important office of censor, and reformed an abuse introduced by Appius Claudius, who, to obtain influence in elections, had distributed a great number of freedmen, and persons of the meanest condition, among the country tribes. These Fabius incorporated into four tribes, and thus nearly destroyed their influence. On this account he received the appellation of "Maximus," which was made hereditary in his family. The victories which he obtained were very numerous, and many of them of the utmost importance to the welfare of Rome; for that over the Gauls and Samnites he obtained a triumph. He afterwards gave a signal proof of the love which he bore his country, by opposing the elevation of his son Fabius Gurges to the consulate, because he deemed him to be inadequate to the office, from habits of intemperance. Gurges was, however, chosen; and, marching against the Samnites, underwent a severe defeat. The father immediately went out as lieutenant to his son, and by his valour rescued him, and obtained a signal victory over the enemy. Farther successes crowned their exertions, for which Gurges, as consul, was decreed a triumph. The joyful parent followed the triumphal car on horseback, and was hailed by the citizens as their great champion and deliverer. This was the conclusion of his military exploits. He was again nominated dictator in the year B. C. 287.

FABIUS, MAXIMUS, Q. surnamed the Cunctator, on account

count of his great prudence in war, was either the grandson or great grandson of the former, and attained the honour of the consulship for the first time in the year B. C. 233, when he obtained a triumph for a victory over the Ligurians. In his youth he had displayed very moderate talents; the meekness of his disposition, and the gravity of his manners were imputed to want of character; it was, however, afterwards discovered that he had been diligently laying up stores of civil and military knowledge. When he was consul the second time he had to contend with the great Hannibal, and to his skill, and well-timed caution, the safety of the state was owing. His plan was to hazard nothing, but to hover round the enemy, watching his motions, cutting off his supplies, and perpetually harassing him with small detachments, while he himself, with the main body, remained in posts of safety. This conduct, though the best that could be adopted, was very displeasing to the Romans, who recalled him to the city, and refused to ratify a convention for the mutual exchange and ransom of prisoners, which he had made with Hannibal. To enable him to make good his engagements, he ordered his own lands to be sold, and thus raised a sufficient sum of money to answer the purpose.

On departing from the army, he gave orders to Minucius, his master of the horse, not to risk a battle; but, regardless of the command, he attacked the enemy, gained some advantages, and was raised to an equal rank with Fabius. In a short time he was attacked by Hannibal, and would have been entirely cut off but for the prompt assistance of Fabius. "On this occasion," says the historian, "whatever honour Minucius might lose as a general, he recovered as a man. At the head of his soldiers he returned thanks to Fabius for his deliverance, called him father, and resigned most willingly his authority into the hands of the dictator." Fabius embraced him as his friend, and continued him in the post of master of the horse. When his dictatorship expired, he left his example and advice to the consul P. Æmilius, who, not being able to restrain the rashness of his colleague, Varro, sustained a defeat at the fatal battle of Cannæ. Æmilius, when at the point of death, requested a friend to acquaint Fabius that he had never ceased to follow his counsel, and was innocent of the misfortune. This disaster justified the caution of Fabius, and gave him a just and high pre-eminence in the state. In the subsequent years of warfare he was thrice made consul; but his most considerable action was the recovery of Tarentum, which had been safely given up to Hannibal. His success here was sullied by an indiscriminate slaughter of the defenders, and by great severity towards the inhabitants, who were sold for slaves, after they had been stripped of their wealth. While Fabius was collecting with great care all the gold and silver for the public treasury, he was regardless of the admirable specimens of the fine arts which abounded in that Grecian colony; and being asked what should be done with them, he replied, "Let us leave to the Tarentines their angry gods." Fabius lived to an old age, and was much disconcerted at the success which attended the measures of Scipio against Hannibal, though he did not live to witness the triumphant close of the war. His son who had been consul died before him, for whom he himself pronounced a funeral oration. By Ennius, Fabius is described as

"Unus qui nobis cunctando restituit rem."

And by Cicero he is represented as not less useful in the toga than at the head of the army. Univer. Hist.

FABIUS, in *Geography*, one of the military townships in

Onondago, New York; in which is a post-office, and containing 844 inhabitants.

FABLE, a tale or feigned narration, designed either to instruct or divert; or, as *Monf. de la Motte* defines it, an instruction disguised under the allegory of an action.

Fable seems to be the most ancient way of teaching: the principal difference between the eloquence of the ancients and that of the moderns consists, according to *Pere Bossu*, in this, that our manner of speaking is simple and proper, and theirs full of mysteries and allegories: with them the truth was usually disguised under those ingenious inventions, called, by way of excellence, *μῦθοι, fabule, fables*; that is, words, as intimating that there was the same difference between these fabulous discourses of the learned and the common language of the people, as between the words of men and the voices of beasts.

At first fables were only employed in speaking of the Divine Nature, as then conceived; whence the ancient theology was all fable. The Divine attributes were separated, as it were, into so many persons, and all the economy of the Godhead laid down in the feigned relations and actions thereof; either because the human mind could not conceive so much power and action in a single and indivisible being; or, perhaps, because they thought such things too great and high for the knowledge of the vulgar; and as they could not well speak of the operations of this Almighty Cause without speaking likewise of its effects, natural philosophy, and at length human nature, and morality itself, came thus to be veiled under the same fabulous allegoric expression; and hence was the origin of poetry, and particularly of epic poetry.

The critics, after *Aphthonius* and *Theon*, reckon three kinds of fables, rational, moral, and mixed.

FABLES, *Rational*, are called also parables: these are relations of things supposed to have been said and done by men, and which might possibly have been said and done, though in reality they were not. Such in the sacred writings, are those of the ten virgins, of *Dives* and *Lazarus*, the prodigal son, &c. Of these rational fables we have likewise about a dozen in *Phædrus*. See *PARABLE*.

FABLES, *Moral*, called also apologues, are those wherein not only beasts, but trees, and other inanimate substances, are introduced as actors and speakers. These are also called *Æsopic* fables; not that *Æsop* was their inventor, for they were in use long before him, viz. in the times of *Homer* and *Hesiod*; but because he excelled in them. Such was *Jotham's* fable of the trees, the most ancient of any that are now extant. See *APOLOGUE*.

The rational differs from the moral fable in this, that the former, though it be feigned, might be true; but the latter is impossible, as it is impossible for brutes or stocks to speak.

FABLES, *Mixed*, are those composed of both sorts, rational and moral, or wherein men and brutes are introduced conversing together. Of these we have a fine instance in *Justin*, lib. xxxiii. cap. 4. made by a petty king to alarm the ancient Gauls against the *Massilians*, who, arriving out of Asia into Spain, charmed by the place, begged leave of the inhabitants to build a city. To this effect: A bitch big with young begged of a shepherd a place to lay her whelps in; which when she had obtained, the father begged for leave to rear them there. At length the whelps being now grown up, depending on the strength of her own family, she claimed the property of the place. So the *Massilians*, who are now only strangers, will hereafter pretend to be masters of this country.

As to the laws of fable, the principal are, 1st. That to every fable there be some interpretation annexed, to shew the moral sense or design thereof. This interpretation, if it be placed after the fable, is called *επιμυθιον*, or *affabulatio*; if before it, *προμυθιον*, *præfabulatio*. 2. That the narration be clear, probable, short, and pleasant. To preserve this probability the manners must be expressed and closely kept to, as in poetry. See PROBABILITY and MANNERS.

M. de la Motte has some fine remarks on the subject of fables, at the beginning of his "Fables Nouvelles, dédiées au Roi, 1719." A fable, according to this polite writer, is a little epic poem, differing in nothing from the great one but in extent: and that in being less confined as to the choice of its persons, it may take in all sorts of pleasure, as gods, men, beasts, or geni, or even, if occasion be, create persons; *i. e.* personify virtues, vices, rivers, trees, &c. Thus, M. de la Motte very happily introduces virtue, talent, and reputation as persons making a voyage together. See EPOPEIA and PERSONIFYING.

That author suggests two reasons why fables have pleased in all ages and places. The first is, that self-love is spared in the instruction. The second, that the mind is exercised by the allegory. Men do not love direct precepts; too proud to condescend to those philosophers who seem to command what they teach, they require to be instructed in a more humble manner; they would never amend, if they thought that to amend were to obey; add, that there is a sort of activity in the mind which must be humoured; it pleases itself in a penetration which discovers more than is shewn; and in apprehending what is hid under a veil, fancies itself in some measure the author of it. The fable must always imply or convey some truth; in other works, delight alone may suffice, but the fable must instruct. Its essence is to be a symbol, and of consequence to signify somewhat more than is expressed by the latter. This truth should for the generality be a moral one; and a series of fictions conceived and composed in this view would form a treatise of morality preferable to any more direct and methodical treatise: accordingly, Socrates, we are told, had a design to compose a course of morality in this way. This truth should be concealed under the allegory, and, in strictness, it ought not to be explained either at the beginning or end.

The truth or idea intended should arise in the reader's mind from the fable itself. However, for the conveniency of the less discerning readers, it may be a good way to point out the truth or moral in precise terms. To have the moral at the end of the fable seems much better than at the beginning; the mind is apt to be forestalled in the latter case; I carry the key along with me, so that there is no room to exercise my mind in finding any thing myself.

The image, M. de la Motte observes, must be just, and express the thing intended directly, and without any equivocal: it must be one; *i. e.* all the parts must be visibly necessary to one principal end; and it must be natural; *i. e.* founded on nature, or at least on opinion.

The writers of fables are not many. If there were any before Æsop, who lived in the time of Solon, about the fifty-second Olympiad, his success has quite effaced their memory; and even occasioned all the good things of that kind to be ascribed to him. His life, as written by Planudes, is itself a thorough fable. It must be owned to be very happily imagined to make the inventor of fables a slave, and his master a philosopher: the slave has his master's pride and ill-humour to deal with throughout. His lessons were all contained in the fables them-

selves, and the readers were left the pleasure of discovering them.

It is generally allowed among the learned, that though the matter and invention of the fables be Æsop's, the turn and expression are not. The Greek is of Planudes; and bad Greek it is, in the judgment of F. Vavassor, De Ludica Diçt. Some authors will have Socrates the author of the fables of Æsop; others attribute them to Solomon, and others to Homer. See ÆSOP.

Phædrus was a slave too, and a freed-man of Augustus; but he had the advantage over Æsop in education: he is only a fabulist, as he translated and copied. Though his fables be generally short, yet he is prolix compared with his author. His style, however, is always florid, his descriptions concise, and his epithets suitable: he frequently adds graces never dreamed of by the inventor, and everywhere enriches the simplicity of Æsop in the most delicate manner.

Pilpay, another fabulist, governed Hindoostan a long time under a powerful emperor; but he was not the less a slave, for the prime ministers of such princes are always more so than the meanest subjects. Pilpay comprized all his politics in his fables; and accordingly his work long continued the book of state, or the discipline of Hindoostan. It was translated into Persian and Arabic, and since into the modern languages. His fables, M. de la Motte observes, are rather famous than good; but he is the inventor, and the merit of invention will always compensate for many faults. His fables are often wild and artless: and the collection is a sort of romantic assemblage of men and geni, composed in its kind like Cyrus or Orlando, where the adventures are continually thwarting and clashing with each other.

We say nothing of the fables of Gabrias, or Babrias, Avienus, who lived towards the end of the fourth century under the empire of Gratian, Abstemius, &c.

Among the moderns, the most celebrated writers are Mess. de la Fontaine and De la Motte: the first of whom has picked out all the best things in Æsop, Phædrus, and Pilpay, and giving them anew in French, with a delicacy and simplicity peculiar to himself: and which, in the judgment of his countrymen, sets him even above Phædrus.

The latter, rather than content himself with what De la Fontaine had left, chose to be an inventor. He has succeeded. His fables are many of them very happy, though some think them too full of thought and reasoning. His versification is infinitely more correct than that of La Fontaine, and more suitable to the subject than that of Le Noble.

We have likewise some fables much esteemed of Mr. Gay and Mr. Moore.

FABLE is also used for the plot of an epic or dramatic poem, or the action which makes the subject of such a poem or romance. See POEM, DRAMA, EPIC, and ACTION.

The fable, according to Aristotle, is the principal part, and as it were the soul of a poem. It must be considered as the first foundation of the composition, or the principle which gives life and motion to all the parts. In this sense the fable is defined, "a discourse invented with art, to form the manners by instructions disguised under the allegory of an action." The fable is perfect or imperfect, as the action which it relates is more or less so. For the requisite qualifications of this action, see ACTION.

The fable of every poem, according to Aristotle's division, is either simple or implex. It is called simple when there is no change of fortune in it; and implex, when the fortune

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tune of the chief actor changes from bad to good, or from good to bad. The latter is thought to be the most perfect; probably because it is more proper to stir up the passions of the reader, and to surprise him with a greater variety of accidents. The implex fable is, therefore, of two kinds. In the first the chief actor makes his way through a long series of dangers and difficulties, till he arrives at honour and prosperity, as we see in the story of Ulysses. In the second, the chief actor in the poem falls from some eminence of honour and prosperity into misery and disgrace. Thus, in the *Paradise Lost*, we see Adam and Eve sinking from a state of innocence and happiness into the most abject condition of sin and sorrow. The most interesting tragedies among the ancients were founded on this last sort of implex fable, particularly the tragedy of *Œdipus*, which proceeds upon a story, if we may believe Aristotle, the most proper for tragedy, that could be invented by the wit of man. Mr. Addison, however, is of opinion, (*Spectator*, N^o 297,) that this kind of implex fable, in which the event is unhappy, although it is the most perfect in tragedy, is not so proper for an heroic poem. Milton seems to have been sensible of this imperfection in his fable, and has therefore endeavoured to remedy it by several expedients, particularly by the mortification, which the great adversary of mankind meets with upon his return to the assembly of infernal spirits, as it is described in a beautiful passage of the tenth book; and likewise by the vision, in which Adam at the close of the poem sees his offspring triumphing over his great enemy, and himself restored to a happier paradise than that from which he fell.

The epic fable, according to Bossu, is confined to the rational kind; *i. e.* the actors and persons are to be gods and men; and yet it admits of great latitude; it may be either grave, illustrious and important, or low and popular; either whole or defective, in verse or in prose; much episodified, or brief; rehearsed by an author, or represented by actors on the stage; all which are so many circumstances which do not make any alteration in the nature and essence of the fable.

The characters that specify the epic fable are these: it is rational and probable; it imitates a whole and an important action; and it is long and related in verse: none of which properties affect the nature of the fable, or make it less a fable than those of *Æsop*.

The fable, according to Aristotle, consists of two essential parts, *viz.* truth, as its foundation; and fiction, which disguises the truth, and gives it the form of fable. The truth is the point of morality intended to be inculcated; the fiction is the action, or words under which the instruction is covered.

To make a plot or fable, the first thing, according to the great critic just mentioned, is to pitch on some moral instruction to be exemplified.

E. gr. I would exhort two brothers, or other persons, who have some common interest, to live in amity, in order to preserve it. This is the end of the fable, and the first thing I have in view. In order to this, I endeavour to impress this maxim on our minds, that "ill understanding ruins families and all kinds of society." This maxim is the moral or truth which is to be the ground of the fable; which moral truth is now to be reduced into action, and a general action to be framed from several single and real actions of such as were ruined by ill understanding.

Thus, *e. g.* I say, that certain persons united together for the preservation of something that belonged to them in common, coming to disagree, their division left them open to an enemy who ruined them: such is the first plan of a fable.

The action presented by this narration has four conditions; it is universal, imitated, feigned, and contains a moral truth under an allegory.

The names given to the several persons begin to specify the fable. *Æsop* uses those of brutes. Two dogs, says he, appointed to watch a flock, fall out, fight, and leave all open to the wolf, who carries off what he pleases.

If you would have the action more singular, and render the fable rational, take the names of men. Pridamant and Orontes, brothers by a second venter, were left very rich by their father's will; but disagreeing about the partition of their effects, they engaged themselves so far against each other that they took no care of their common interest against Clitander, their eldest brother by the first venter; which last, artfully enflaming their quarrel, and feigning he had no view but to some moderate augmentation, which might be made him without oppressing them, in the mean time, gets the judges on his side, and the other persons intrusted with the affair, procures the will to be affirmed, and becomes entitled to the whole estate about which the brothers were at variance. Now, this fable is rational; but the names being feigned as well as the things, and besides, the persons being only of a private rank, it is neither epic nor tragic. However, it may be employed in comedy, it being a rule laid down by Aristotle, that epic and tragic poets only invent things, but comic poets invent both names and things. See COMEDY, &c.

To accommodate this comic fable more to the mode and taste of the town, some Dorinda must be imagined to have been promised to Clitander; but her father, finding him disinherited by the will, changes his resolution, and will have her marry one of the rich, senseless young brothers, whom she despises, &c.

But to return. The fiction may be so disguised with the truth of history that there shall not appear any fiction at all. To effect this the poet looks back into history for the names of some persons to whom the feigned action either really or probably did happen, and relates it under those known names, with circumstances which do not change any thing of the ground of the fable.

As for the fable, it matters but little whether the persons be called dogs, or Orontes and Pridamant, or Robert of Artois and Ralph de Nefse, or Achilles and Agamemnon.

Aristotle observes, that the fable of an epic poem should abound in circumstances that are both credible and astonishing; in other words, the fable should be filled with the probable and the marvellous. If the fable is only probable, it does not differ from a true history; if it is only marvellous, it is no better than a romance. The great secret, therefore, of heroic poetry, is to relate such circumstances as may produce in the reader at the same time both belief and astonishment. This is brought to pass in a well-chosen fable, by the account of such things as have actually happened, or at least of such things as have happened according to the received opinions of mankind. Milton's fable is a master-piece of this kind; as the war in heaven, the condition of the fallen angels, the state of innocence, the temptation of the serpent, and the fall of man, though they are very astonishing in themselves, are not only credible, but regarded by many as objects of faith. Another method of reconciling miracles with credibility is by a happy invention of the poet; as in particular, when he introduces agents of a superior nature, who are capable of effecting what is wonderful, and what is not to be met with in the ordinary course of things. Ulysses's ship being turned into a rock, and *Æneas's* fleet into a shoal of water-nymphs, though they are very surprising accidents, are nevertheless probable, when we are told that

F A B L E.

they were thus transformed by the gods. It is this kind of machinery which fills the poems both of Homer and Virgil with such circumstances as are wonderful, but not impossible, and so frequently produce in the reader the most pleasing passion that can rise in the mind of man, which is admiration. If we look into the fiction of Milton's fable, though we find it full of surprising incidents, they are generally suited to our notions of the things and persons described, and tempered with a due measure of probability. We should, indeed, except the "Limbo of Vanity," with his episodes of "Sin" and "Death," and some of the imaginary persons in his "Chaos." These passages are astonishing, but not credible; they are the description of dreams and shadows, not of things or persons. The appearance of probability is so absolutely requisite in the greater kinds of poetry, that Aristotle observes the ancient tragic writers made use of the names of such great men as had actually lived in the world, though the tragedy proceeded upon adventures in which they were never engaged, on purpose to make the subject more credible. In a word, besides the hidden meaning of an epic allegory, the plain literal sense ought to appear probable. The story should be such as an ordinary reader may acquiesce in, whatever natural, moral, or political truth may be discovered in it by men of greater penetration.

We shall devote the sequel of this article to some remarks on the fable of the Iliad, as being the finest plan of an epic poem in the world, and at the same time the most useful system of the precepts of the art, it being hence that Aristotle was furnished with all his reflections: reserving for other articles observations on the fable of those poems to which we have referred under the article *Epic Poem*.

In every discreet undertaking the end is the first thing proposed; and by this the whole work and all its parts are regulated; consequently, the design of the epopœia being to form the manners, it is with this first view the poet must begin. Now, the philosopher dwelling on virtues and vices in general, the instructions he gives serve equally for all states and all ages; but the poet has a more immediate regard to his countrymen, and the pressing occasions of his fellow-citizens. On this view it is that he chooses his moral, which he is to insinuate into the people by accommodating himself to their peculiar customs, genius, and inclinations. See how Homer has acquitted himself in these respects.

He saw the Greeks, for whom he wrote, divided into as many states as cities, each whereof was a body apart, and had its government independent of the rest. Yet were these different states frequently obliged to unite into one body against their common enemies. Here then were two sorts of government too different to be commodiously treated in one poem; the poet accordingly had recourse to two fables; the one for all Greece, considered as confederated together, only consisting of independent parts; the other for each particular estate, such as they are in time of peace, and without the first relation. The first is the subject of the Iliad, the second of the Odyssey.

For the first kind of government all experience agrees, that the only thing which can render it happy, and its design successful, is a good understanding, and due subordination among the several chiefs that compose it; and that misunderstandings, a desire of sway, &c. are the inevitable bane of such confederacies. The best instruction, therefore, that could be given them, was to set before their eyes the destruction of the people, and even of the princes themselves, through the ambition and discord of the latter. Homer, therefore, for the ground or moral of his fable, chose

this great truth, that the misunderstandings of princes ruin their states. "I sing," says he, "the wrath of Achilles, so fatal to the Greeks, and which destroyed so many heroes, occasioned by a disagreement between king Agamemnon and that prince."

To enforce this truth, he represents divers confederate states first at variance and unprosperous; then reconciled and victorious: all which he thus includes in one universal action. Several independent princes league against a common enemy; he whom they choose as their leader affronts the bravest of all the confederacy; upon which the offended prince withdraws, and refuses any longer to fight for the common cause. This misunderstanding gives the enemy so much advantage, that the confederates are ready to relinquish the enterprise. The disaffected person himself becomes a sharer in the calamities of his allies, one of his chief friends and favourites being killed by the chief of the enemies. Thus, both parties grown wise by their own injury, are reconciled. Upon which the valiant prince, joining again in the war, turns the scale to his own party, and kills the enemy's chief.

Such is the first general plan of the poem. To render this probable and more interesting, circumstances of time, place, persons, &c. are to be added; that is, the poet looks into history or tradition for persons to whom such actions may with truth or probability be attributed.

He pitches on the siege of Troy, and supposes the action to have passed there. The brave, choleric character, he calls Achilles; the general, Agamemnon; the chief of the enemies, Hector, &c. To insinuate himself into his readers, he accommodates himself to their manners, genius, views, and to render his fable more interesting, makes his chief persons, and those who remain victorious, to be Greeks, the fathers of those very people. The course of the work is filled up and extended with other useful lessons and instructions.

That the epopœia in all its glory is justly and strictly a mere fable in the same sense as the fictions of Æsop are, is shewn by F. Bossu, in a parallel between the fable of the Iliad and that of Æsop already mentioned. The moral instruction is visibly the same in both; so is the fiction. All the difference lies in the names and qualities of the persons.

Homer's are kings; he calls them Achilles, Patroclus, &c. and the general good to be preserved, he calls the Greeks. Æsop, after his manner, gives his persons the names of beasts; the dogs are confederated, the wolf is their enemy; and what Homer calls Greeks, Æsop calls sheep. One says, that while the confederate princes were at variance, Hector rushes on the Greeks, and makes them pay dear for the folly of their sovereigns (delirant reges, plectuntur Achivi); but that the allies, brought by misfortunes to themselves again, re-unite, repulse Hector, and kill him. The other, that while the dogs are together by the ears the wolf falls on the sheep; and that the dogs seeing the havoc he makes, join together, drive him away, and kill him.

The two fables were capable of a still nearer resemblance. Homer has extended his by long speeches, descriptions, comparisons, and particular actions; that of Æsop might be amplified after the like manner, without corrupting or altering it. It is necessary only to relate what cause set the dogs at variance, and shew the rise of the fatal wrath in all its circumstances; to make fine descriptions of the plain wherein the sheep fed, and of some neighbouring wood where the wolf was sheltered; to give this enemy wheeps to rear, make them follow their fire in search of prey, and describe

describe the carnage they made at divers expeditions. Nor should the genealogy of the heroes be forgotten; the wolf shall boast himself a descendant of Lycaon, and one of the dogs be sprung in a direct line from Canicula; which last would be the proper hero of the poem, as being hot, and apt to be enraged. He would represent the person of Achilles to admiration; and the folly of some Ajax, his cousin, would afford a good proof of so divine an extraction. Nothing more were required to engage heaven in the cause, and divide the gods; which, no doubt, have as much right in Æsop's republic as in the states of Homer. Witness Jupiter taking care to give a king to the nation of the frogs.

The reader has here field enough for an eposœia; if he have any thing of fancy and expression, and do but take care to repeat as often as Homer does,

Τὸν δ' ἀπαμειβόμενον περισεφὴ πόδας ὠκυς.

See ILLIAD and ODYSSEY.

FABOMIT LAKE, in *Geography*, a lake of Canada. N. lat. 52° 23'. W. long. 88° 15'.

FABRA, a town of Italy; 9 miles N.N.W. of Orvieto.

FBRAGAS, a town of Spain, in Catalonia; 13 miles west of Gerona.

FABRE, JOHN CLAUDE, in *Biography*, a French ecclesiastic, was born at Paris in the year 1688, where he received his education, and was admitted to the degree of bachelor in theology by the faculty of Paris. He afterwards filled the office of professor in several seminaries in France. He died at the advanced age of 85, highly regretted by his brethren and friends for his candour, talents, and learning. He was author of very many works, among which is a Latin and French dictionary, in 8vo. He gave a new edition of the satirical dictionary of Richelet in two vols. fol.: for the execution of some of the articles he was obliged to submit to exile for a few years. On his return he published a continuation of the ecclesiastical history of the abbé Fleury; and a translation of all the works of Virgil, accompanied with notes and dissertations. He gave also a prose translation of the fables of Phædrus, and a summary of M. de Thou's history. Moreri.

FABRETTI, RAPHAEL, a celebrated antiquarian, was born of a good family at Urbino, in 1619. He studied jurisprudence in his native city, and after graduating he went to Rome, and became distinguished for his great erudition, and for his knowledge of state affairs. He was nominated to several diplomatic stations, in which he acquired much reputation. His leisure hours were spent in the study of antiquities, and particularly in the examination and collection of all the inscriptions, and ancient monuments dispersed through Latium, for which purpose he traversed the whole of that province alone, and on horse-back, leaving no part unexplored. In 1680, he published a work, "De Aquis et Aquæductibus veteris Romæ," which obtained for him high credit among the literati. His next work was a dissertation "De Columna Trajani," 1683, which contained the particulars concerning the naval and military establishments of the ancients. In 1699 was published at Rome his great work, entitled "Inscriptionum Antiquarum Explicatio;" of this, it has been said, "that it was the first collection which was not filled with fictitious inscriptions." The author died in the following year, universally regretted. His cabinet of ancient monuments was deposited in the old palace of the dukes of Urbino. Nouv. Dict. Hist.

FABRI, JOHN, a physician of distinction at Rome

during the papacy of Urban VIII., was born at Bamberg in Franconia. He took the degree of doctor of medicine at Rome, where he settled himself, and afterwards became professor of medicine, and botanist to the pope. Faon was particularly distinguished by his knowledge of anatomy and natural history, of both of which sciences he displayed an extensive knowledge, in his "Commentary on the Natural History of Mexico," written by Francis Hernandez. This work contains especially some curious facts relative to the anatomy of monsters, and to comparative anatomy. He is said to have been the first to oppose the generation of certain beings from putrefaction; and he described with great accuracy the stomachs of ruminating animals. He published also an essay "De Nardo et Epithymo," in which he refutes some opinions of Scaliger.

FABRI HONORÉ, an industrious and learned Jesuit, was born in the diocese of Bellay in the year 1606 or 1607. He for a long time held the chair of professor of philosophy in the college de la Trinité at Lyons; but in consequence of his profound knowledge of theology, he was called to Rome, where he was made a penitentiary. He died in that city on the 9th of March, 1683. He was a man of most extensive and universal knowledge, and studied medicine and anatomy with considerable ardour. He assumed the credit of the discovery of the circulation of the blood, and father Regnault, and other credulous persons, have supported his assumption, on the grounds that he had maintained the fact of the circulation in a discussion in 1638; but Harvey had published his discovery in 1628.

The works of this Jesuit consist of an apology for the Peruvian bark, in answer to Plempius, which he published at Rome in 1655, under the title of "Pulvis Peruvianus Febrifugus Vindicatus;" and two other essays, one, "De Plantis, et Generatione Animalium," the other, "De Homine," published at Paris in 1666, and at Neuremberg in 1677.

FABRIANO, GENTILE DA, was a painter who rendered himself famous in the early stage of the art after its restoration. He was born at Verona in 1332, and was a disciple of Giovanni da Fiesole. His most conspicuous work was a picture in the great council chamber of the state of Venice, executed by order of the doge and senate, who regarded the work in so extraordinary a degree of esteem, that they granted him a pension for life, and conferred upon him the privilege of wearing the habit of a noble Venetian; the highest honour in the power of the state to bestow.

Many of his pictures adorn the pope's palace of St. Giovanni Laterano, and the churches in Florence, Urbino, Perugia, Sienna, and Rome. One of them in the church of Santa Maria Nuova, placed over the tomb of cardinal Adimari, representing the Virgin and child, with St. Joseph and St. Benedict, was highly commended by Michael Angelo; whom Vasari represents as being accustomed to say that in painting the hand of Gentile was correspondent with his name. He died in 1412, 80 years old.

FABRIANO, in *Geography*, a town of Italy, in the marquisate of Ancona, at the foot of the Apennines, containing several rich monasteries; called one of the four castles of Italy, and celebrated for its excellent paper; 33 miles S.W. of Ancona.

FABRIC, the structure or construction of any thing, particularly a building.

The word is formed of the Latin *faber*, which originally signifies a smith's shop, or forge.

In Italy, the word *fabrica* is applied to any considerable

building; in France it rather signifies the manner of building.

FABRIC Lands, are lands given towards the maintenance, rebuilding, or repair of cathedrals or other churches, mentioned in the Act of Oblivion, 12 Car. II. cap. 8.

In ancient times almost every one gave by his will more or less to the fabric of the cathedral or parish-church where he lived.

FABRICIA, in *Botany*, (so named by Gærtner in honour of the celebrated John Christian Fabricius, late professor of Rural Economy in the Danish university of Keil, a pupil of Linnæus, from whose manuscript notes professor Giseke derived much and important assistance in his edition of Linnæus's lectures on the Natural Orders of plants, published in Latin at Hamburgh in 1792. This able man is, however, far more known as the founder of a new system in Entomology, in which he pursued the Linnæan idea, with respect to quadrupeds and birds, of making the organs of feeding subservient to the purposes of arrangement. But however this principle may lead to a natural system in those tribes, in insects it often fails, because in their perfect state eating is by no means their primary or necessary occupation. See **ENTOMOLOGY**. Gærtner, v. 1. 175. t. 35. Sm. Tr. of Linn. Soc. v. 3. 265. Willd. Sp. Pl. v. 2. 951. Clafs and order, *Icosandria Monogynia*. Nat. Ord. *Hesperiidae*, Linn. *Myrti*, Juss.

Gen. Ch. Cal. Perianth turbinate, half inferior, attached to the germen, with five deciduous teeth. Cor. Petals five, rounded, concave, equal, sessile, inserted into the rim of the calyx. Stam. Filaments numerous, distinct, awl-shaped, inserted into the rim of the calyx, shorter than the petals; anthers roundish, incumbent. Pist. Germen half superior, turbinate, its base attached to the calyx; style cylindrical, short, erect; stigma capitate. Peric. Capsule orbicular, depressed, umbilicated, of eight or ten cells, opening vertically; partitions from the centre of each valve, meeting at the column. Seeds one or two in each cell, compressed, with a membranous, rounded, terminal wing.

Eff. Ch. Calyx half superior, with five teeth. Petals five, sessile. Stigma capitate. Capsule of many cells. Seeds winged.

Obs. This genus is next akin to *Leptospermum*, from which it differs in having numerous cells to the capsule, and very essentially in having winged seeds, which are only one or two, not many, in each cell. Both were confounded with *Philadelphus* by Dr. Solander, merely because he never happened to have examined the latter, and referred them to it, during his voyage, trusting to future opportunities of investigation, as in many other instances. For such apparent inaccuracies therefore the memory of this excellent man is no way responsible.

The species of *Fabricia* at present known are two.

1. *F. myrtifolia*. Gærtner, t. 35. f. 4. Capsule of ten cells. Calyx-teeth nearly orbicular.—Native of New Holland. Stem shrubby. Leaves scattered, an inch and half long, obovato-lanceolate, entire. Flowers solitary, on short stalks, apparently terminal.

2. *F. lævigata*. Capsule of eight cells. Calyx-teeth triangular.—Native of New South Wales near Port Jackson. It is now not uncommon in green-houses about London, where it sometimes flowers. Stem shrubby. Leaves scarcely an inch long, obovate, obtuse, rather glaucous. Flowers white, axillary, solitary, on short thick stalks.

FABRICIO, GERONIMO, in *Biography*, more commonly known by the name of *Hieronimus Fabricius ab Aquapendente*, was born at the town of this name, in the territory

of Orvieto, in Italy, in the year 1537. His parents were but poor, yet they found the means of procuring him a good education. He was sent to Padua, where he acquired a knowledge of the Latin and Greek languages, and, after having gone through the usual course of philosophy, he began the study of anatomy and surgery under Gabriel Fallopio, one of the most intelligent professors of his time. His progress under this excellent tutor was such as to acquire for him a character not less distinguished than that of his master, whom he afterwards succeeded in the professor's chair, in which he taught the same sciences for nearly half a century, in the university of Padua. During the whole of this long period he maintained an uniform character for eloquence and sound knowledge, and continued to excite great interest in his lectures. He died universally regretted in 1619, at the age of 82 years.

The kindness and disinterested generosity of Fabricio gained him the esteem of the principal families of Padua. The republic of Venice conferred many marks of their attention on him; they built a spacious anatomical amphitheatre, on the front of which his name was inscribed; they also decreed him an annual stipend of a thousand crowns, and the honour of a statue, and created him a knight of St. Mark. But the celebrity which he obtained for the university of Padua by his talents, afforded him a gratification above that which accrued from all those flattering favours.

His attention was chiefly directed to anatomy and surgery, both of which his researches materially contributed to elucidate. He is said to have been the first to notice the valves of the veins, having demonstrated their structure in the year 1574. The honour of this discovery has also been given to Paul Sarpi; but Albinus and Morgagni are of opinion that he was anticipated by Fabricius. These anatomists, however, were ignorant of the use of this valvular apparatus; but Fabricius has given excellent views of its structure in his engravings. He was exceedingly methodical in his writings, first describing the structure of each part of the body, and then its uses. Valuable as his anatomical writings were, however, his surgical works obtained for him a still higher reputation. The improvements which he introduced into the practice of his art, in consequence of his accurate anatomical knowledge, and the consistent form which he gave to it, have, in fact, gained him the appellation of the father of modern surgery. His works are numerous: the first, intitled "Pentateuchus Chirurgicus," published at Fraaefort, in 1592, contains five dissertations on tumours, wounds, ulcers, traictures, and luxations. 2. "De Visione, Voce, et Auditu," Venice, 1600. 3. "Tractatus de Oculo, visusque Organo," Padua, 1601. 4. "De Venarum Ostiis," *ibid.* 1603. 5. "De Locutione, et ejus Instrumentis," *ibid.* 1603. It is said that, in one day, all the Germans deserted the school of Fabricius, because, in explaining the mechanism of the muscles of speech, he had ridiculed their mode of pronunciation. 6. "Opera Anatomica, quæ continent de formato Fœtu, de formatione Ovi et Pulli, de Locutione et ejus Instrumentis, de Brutorum loquela," Padua, 1604. The essay on the language of brute animals, in this work, is curious, and worthy the attention of naturalists. 7. "De Musculi Artificio, et Ossium Articulationibus," Vicentia, 1614. 8. "De Respiratione et ejus Instrumentis, libri duo," Padua, 1615. 9. "De Motu locali Animalium secundum totum," Padua, 1618. 10. "De Gula, Ventriculo, et Intestinis, Tractatus," *ibid.* 1618. 11. "De Integumentis Corporis," *ibid.* 1618. 12. "Opera Chirurgica in duas Partes divisa," *ibid.* 1617. This work, in which all the diseases of the body, which are cureable by manual operation,

tion, are treated, passed through seventeen editions, in different languages. 13. "Opera omnia Physiologica et Anatomica," Leipzig, 1687. 14. The whole of his works were also published at Leyden, in 1723, and in 1737, in folio. We have mentioned only the original editions of the works of Fabricius ab Aquapendente, most of which have been several times reprinted.

FABRICIUS, CAIUS, a Roman commander, distinguished for valour and great integrity, was consul the first time B. C. 282, when he gained a complete victory over the enemies of his country, and gained so large booty, that after liberally rewarding his soldiers he brought four hundred talents to the public treasury on the day he triumphed, and this glory was all the recompence he reserved for himself. He is particularly distinguished for his conduct as ambassador to Pyrrhus, king of Epirus, who attempted to gain him over to his cause by magnificent presents. These the general rejected with indignation and contempt, which excited the surprise of the monarch, who was accustomed to suppose every man venal that approached a court. He was, however, more astonished at the virtue of Fabricius, who, when his opponent in the field, refused the offer of the royal physician to poison his master, and caused the treachery to be made known to the king. Fabricius, in the year 275, served the office of censor, and displayed that rigour against luxury which had been customary among the ancient Romans. What he enjoined by precept and the authority of his office, he gave weight to by his own example. He contemned riches during the whole of his life, and died so poor that a dowry was given to his daughters out of the public treasury. Out of pure respect to his memory, a law of the 12 Tables was dispensed with, which prohibited burials within the city. To simplicity of manners he added consummate skill as a general, and an extensive knowledge of whatever related to public affairs. Univer. Hist. Plutarch.

FABRICIUS, GEORGE was born at Kemptz, in Misnia, in 1516, and entitled to notice in this work on account of his poetical talents. He published twenty-five books of sacred poems, printed at Basil in two vols. 8vo. 1567. He wrote "The art of poetry in seven books;" "A description of Rome and Travels," in plain prose: likewise "Rerum Germaniæ magnæ et Saxoniz universæ memorabilia," 2 vols. fol. "Saxoniæ illustrata seu Origines Saxonica," 2 vols. fol. and "Rerum Misnicarum," fol. He published a collection of the Christian Latin poets, with alterations. He died in 1571; and is much extolled by his countrymen for ease and purity of style; and so nice was he in the choice of language, that in his sacred poems he refused to employ a term which referred to Pagan mythology. Morevi.

FABRICIUS, JOHN ALBERT, who is celebrated for his great erudition, was born at Leipzig in 1688, and left a helpless orphan at a very early age. His education was not neglected, and having borrowed of his school-master the Adversaria of Gaspar Barthens, he was so astonished at the learning displayed in that work, that he determined, though at that time only 16 years old, to rival the author in his erudition. On his return to Leipzig, in 1686, he entered vigorously upon the study of theology, and began to conceive the project of his great work, and made collections for the purpose. His first publication was entitled "Miscellaneous remarks on the seventy Interpreters of the Old Testament." During the next several successive years he distinguished himself as a preacher, a writer, and an able disputant in theology. In 1693 he went to Hamburg, and undertook the superintendance of the Library of John Frederick Mayer, devoting all his leisure to literary pursuits. In 1697 he published the first edition of the "Bibliotheca

Latina," in a single volume 8vo. In 1699 Fabricius was elected to the vacant chair of eloquence at Hamburg, and soon afterwards took the degree of doctor of theology, and married the daughter of a school master at Hamburg, whom he eventually succeeded, and notwithstanding the extent of his private studies, no man was more assiduous in the instruction of his pupils, to whom he devoted ten hours a day for many of the first years in which he was engaged in that occupation. He died in the year 1736 in his 68th year, leaving behind him works that must perpetuate his name so long as learning is in esteem. Of these the principal are:—"Bibliotheca Græca," in 14 vols. 4to. 2. "Bibliotheca Latina," in two vols. 4to. The former is an extensive and accurate account of the works and lives of Greek authors, with extracts from their most rare and curious books: the latter is a similar work with regard to Latin writers. 3. "Bibliotheca Latina Ecclesiastica," or a collection of Latin writers concerning ecclesiastical affairs. 4. "Codex Apocryphus Novi Testamenti," 3 vols. This is a curious compilation of all the false gospels, &c. current in the early ages of Christianity. 5. "Bibliographia Antiquaria," in two vols. containing a notice of all the Hebrew, Greek, Roman, and ecclesiastical antiquities. Fabricius was a very modest man, and mild in his disposition, and it is thought that he was scarcely ever surpassed in a knowledge of books, so that he obtained the title of Bibliothecarius Republicæ literariæ." Morevi.

There is no historian, biographer, or artist, who has been in search of Greek and Roman literature and science but has had great obligations to the indefatigable labours, learning, accuracy, and good taste of this most excellent writer, who is one of the few that can never have been consulted unprofitably. So ample is the information he affords on every subject which he treats, that the enquirer is not only sure of finding what he seeks, but still more sure of its authenticity and exactitude, when found.

FABRICIUS, WILLIAM, better known by his surname *Hildanus*, was born at Hilden, a village of Switzerland, whence he was thus surnamed, on the 25th of July, 1560. Like his predecessor of the same name, Fabricius of Aquapendente, he became one of the most eminent surgeons of his age, and contributed not a little to the improvement of the art. He repaired to Lausanne in the year 1586, where he completed himself in the art of surgery, under the instruction of Grifson, an intelligent teacher in that city. Here he pursued his researches with indefatigable industry, and undertook the cure of many difficult cases, in which he was singularly successful. He combined a knowledge of medicine with that of his own art, and began to practise both at Payerne in 1605, where he remained ten years, and in 1615 settled himself at Berne, in consequence of an invitation from the senate, who granted him a pension. Here he enjoyed the universal esteem of the inhabitants. But in the latter period of his life he was prevented by severe and frequent attacks of the gout from rendering his services to his fellow-citizens with his accustomed assiduity. At length, however, this malady left him, and he was seized with an asthma, of which he died on the 14th of February, 1634, at the age of seventy-four. His works were written in the German language, but most of them have been translated into the Latin. He published five "Centuries of Observations," which were collected after his death, and printed at Lyons in 1641, and at Strasburgh in 1713 and 1716. These "Observations" present a considerable number of curious facts, as well as descriptions of a great number of instruments of his invention. His collected treatises were published in Latin, at Frankfort, in 1646, and again in 1682

in folio, under the title of "Opera Omnia." And a German edition appeared at Stutgard in 1652. Mangetus. Eloy.

FABRICIUS, JAMES, an eminent physician, was born at Rostock on the 28th of August, 1577. Following the advice of Hippocrates, he joined the study of the mathematics with that of medicine, and was a pupil of Tycho Brahé. His medical studies were not confined to his own country; for he travelled through England, Germany, and the Low Countries, in order to obtain the instructions of the most celebrated professors; and afterwards repaired to Jena, where he was distinguished by the extent of his acquirements, and obtained the degree of doctor at the age of 26. He soon gained extensive employment in his profession, and at length received several lucrative and honourable appointments. He filled the stations of professor of medicine and of the mathematics at Rostock during forty years, was first physician to the duke of Mecklenburgh, and afterwards retired to Copenhagen, where he was appointed chief physician to the kings of Norway and Denmark, Christian IV. and Frederick III. He died at Copenhagen on the 16th of August, 1652, in the seventy-fifth year of his age; and his remains were carried to Rostock for interment, by his sons-in-law and daughters.

His works are entitled,—1. "Periculum Medicum, seu Juvenilium Fæturæ priores," Halæ, 1600. 2. "Uroscopia, seu de Urinis Tractatus," Rostochii, 1605. 3. "De Cephalalgia Autumnali," *ibid.* 1617. 4. "Institutio Medicinæ practicam agredientis," *ibid.* 1619. 5. "Oratio Renunciationi novi Medicinæ Doctõris præmissa, de Caulis Cruentantis cadaveris præsentis Homicidæ," *ibid.* 1620. 6. "Dissertatio de Novo-antiquo Capitis Morbo ac Dolore, cum aliis Disquisitionibus Medicis de dislic. nonnul. Materis Practicis," *ibid.* 1640. Eloy. Manget. Biblioth. Med. Pract.

FABRICIUS, PHILIP CONRAD, professor of medicine in the university of Helmstadt, was the author of several useful works on the subjects of anatomy and surgery, which have obtained for him the praise of the judicious Haller. His first treatise was entitled "Idea Anatomies Practicæ," Wetzlaræ, 1741, and contained some new directions respecting the art of injection, a description of several branches of the portio dura of the seventh pair of nerves, &c. 2. "Sciagraphia Historia Physico-Medicæ," Wetzlaræ, 1746, in which are some good observations relative to the abuse of the operation of trepanning. 3. "De Cognitionis Anatomicos Vasorum insigni Usu," Helmstadii, 1750. 4. "Observationes nonnullæ Anatomicæ," 1754. 5. "Sylloge Observationum Anatomicarum," 1759. Haller. Bibl.

FABRICIUS, JOHN LEWIS, a learned Swiss divine, was born at Schaffhausen in the year 1639. Great care was taken of his education, and he obtained the usual degrees. In 1656 he was admitted to the exercise of the ministry, and created professor extraordinary of the Greek language at Heidelberg. In these characters, and as tutor to the baron de Rothenchild, and to the electoral prince, he displayed so much integrity and wisdom, that he was, in 1664, nominated to the honour of ecclesiastical counsellor to the elector, who made use of his great talents in a political embassy to Schaffhausen. He was afterwards employed in Switzerland by William III. king of England, and the States General, to assist the English envoy to the cantons, and to watch over the interests of the Dutch republic. He was likewise successfully engaged in other diplomatic business, and having completed the work which he undertook he returned to Heidelberg, and from thence he went to Frankfort, where he died in the year 1697. He acquired much reputation for

political talents; and for theological learning; but he was destitute of that Christian charity which his religion should have taught him, and was active in the persecution of the Unitarians who were driven out of Poland, because they refused to renounce their principles. His works are numerous, and written in the Latin language; they are entitled, "De Viis Dei, an et quosque sint similes Viis Hominum;" "De Ludis Scenicis;" "De Controversia circa Personam Christi," &c. Moreri.

FABRICIUS, CHARLES, a painter of portrait and pieces of perspective, born at Delft in 1624. His promising talents had raised considerable expectations, which were unhappily frustrated by his sudden and early death in 1654, which happened by the blowing up of the great powder magazine situated near his house.

FABRICO, in *Geography*, a town of Italy, in the principality of Corregio; nine miles N. of Corregio.

FABRIS, LUCCA, in *Biography*, a young singer of Naples with a soprano voice, who, at the age of twenty-four, the last of his life, was the delight and wonder of the Italian theatre. His voice and manner of singing were equally perfect, and he was able to contend with the celebrated Guadagni when at the summit of his glory; till a fatal effort to sing a very high and difficult passage, which a Neapolitan composer had injudiciously and cruelly given him to execute in the great theatre of San Carlo, cost him his life. It is asserted that this master, merely to encourage him to try to surpass another singer, composed an air beyond his natural compass and powers of execution; and though the unfortunate Fabris protested to him that he could only attempt it at the risk of his life, the master insisted on his performing it; by which he burst a blood-vessel, that brought on a hæmorrhage, which all the art of medicine and surgery being unable to stop, soon put an end to his existence! "Essai sur la Mus. tom. iii. p. 317. This melancholy catastrophe is related here, not without a hope that it may a little alarm and assuage the ambition of our fair country-women who never hear a musical phenomenon, without trying night and day to rival those powers which nature gives to so very few, and at which art can never arrive without endangering the health and existence of those who aspire at impossibilities.

FABRIS, in *Ancient Geography*, an island of Greece, over-against Attica.

FABRISTAN, in *Geography*, a town of Persia, in the province of Mazanderan; 50 miles E. of Casbin.

FABROT, CHARLES ANNIBAL, in *Biography*, a learned jurist, was born at Aix, in Provence, in the year 1581, and after a liberal education he took the degree of doctor of laws in 1606, and was admitted an advocate in the parliament of Provence. He was afterwards elected professor of law at Aix, and from thence he went to Paris, where he printed his notes on the Greek paraphrase of Justinian's Institutes. This work obtained for him the patronage of the chancellor Seguier, with a pension. He remained in the metropolis for the purpose of translating the Basilics or collection of Roman laws in use in the eastern empire, which he finished in seven vols. folio, with the title of Basilicon. He edited other learned works, which he enriched with valuable notes. His application was almost incessant, and is said to have shortened his days, though he did not die till he had attained his 78th year. Moreri.

FABULINUS, in *Mythology*, the god of speech, was the tutelary deity of children, and invoked by them, when they began to speak.

FABULOUS, denotes something that has a relation to fable. Varro divides the duration of the world into two

earlier states or periods, called the dark and fabulous. See AGE.

FABULOUS Philosophy of the Greeks was introduced among them by the first founders of their states. Having observed, in countries already settled, the effect of that mode of delivering the doctrines of religion to the people under the disguise of fable, which universally prevailed in Egypt, and which was not unknown to the Phœnicians, Thracians, and other barbarous nations, they found it particularly suitable to their design of bringing states newly formed under the yoke of authority. "It was not possible," says Strabo, (l. i.) "to lead a promiscuous multitude to religion and virtue by philosophical harangues; this could only be effected by the aid of superstition, by prodigies and fables. The thunderbolt, the ægis, the trident, the spear, torches and snakes, were the instruments made use of by the founders of states to terrify the ignorant vulgar into subjection." Indeed, it cannot be doubted, that the first authors of the Grecian fables intended them to be vehicles of instruction. But it is now become almost impracticable to decipher their meaning; because we are imperfectly acquainted with the history, opinions, manners, and other circumstances of the times, when Grecian mythology was formed, and from what a variety of sources it was derived. Of these the two principal were, the custom of ranking public benefactors, after their death, among the gods (Plin. Hist. Nat. l. ii. c. 17.) and the practice of applying allegories and fables to natural objects and appearances. (Dion. Halic. Antiq. l. i.) The origin of the world, and the production of natural bodies, were very early clothed in fable, in the cosmogonies of the Egyptians, Phœnicians, Thracians, and other nations; and these were afterwards imitated by the Greeks. (See COSMOGONY.) Another custom, which has very much contributed to cast a veil of obscurity over the fabulous philosophy of the Greeks, is that which prevailed among them in early times, of giving their mythological doctrines a poetical dress. These were commonly chosen as subjects of verse, and every poet enlarged and moulded the ancient fables, according to the fertility and luxuriance of his own fancy. See the articles PROMETHEUS, LINUS, ORPHEUS, MUSÆUS, AMPHION, MELAMPUS, HESIOD, EPIMENIDES, and HOMER. See also CHAOS and THEOGONY.

FABURDEN, in *Music*, is an old English term, and used at the beginning of discant, to express what has since been styled *counterpoint*. If this species of harmony had its admirers, it had likewise its enemies, when it was introduced independent of the Gregorian chant, or when this chant was corrupted by it; and if many statutes remain for celebrating festivals "cum cantu, et discantu, à haute voix, à chant et à dechant," there are others to censure the art, and keep it within certain bounds. It was thought so licentious at the beginning of the fourteenth century, that the use of it was prohibited in the mass by a bull of pope John XXII. 1322. However, there is at the end of it this favourable clause: "It is not our intention wholly to prevent the use of concords in the sacred service, particularly on great festivals, provided the ecclesiastical chant or plain-song be carefully preserved." The Abbé Lebeuf observes, that those who drew up this bull, which is inserted in the body of canon laws, erroneously confined discant to fourths, fifths, and eighths, from the perusal of ancient authors on the subject of music, particularly Cassiodorus, where they had found the following definition: "Symphonia est temperamentum sonitus gravis ad acutum, vel acuti ad gravem, modulamen efficiens, sive in voce, sive in percussione, sive in flatu. Symphoniae sunt sex: prima,

diatessaron: secunda, diapente: tertia, diapason: quarta, diapason et diatessaron: quinta, diapason et diapente: sexta, diapason et diapason." "Symphony, or music in consonance, is the mixing grave sounds with acute, or acute with grave, either in singing or playing upon stringed or wind instruments. Symphonic concords are six; the fourth, fifth, and eighth, with their octaves." It is hardly possible to read this passage, and not give up the contest concerning ancient counterpoint; or, at least, reduce it to that meagre kind, of which an example has been given in the first volume, (Hist. Music by Barney, p. 145.)

It is easy to suppose, says the Abbé Lebeuf, that the design of those who first permitted chants in faburden to be sung in the churches of France, was to distinguish festivals and holy times, by the ornaments and graces with which they were sung; as, in others was done by allowing particular portions of the service to be performed in faux-bourdon, or counterpoint. *Traité Historique sur le Chant Eccles.* See FALSO-BORDONE.

FAC, in *Italian Music*, is an abbreviation of *facciata*, a side, or page. See CARTA.

FACADE, in *Architecture*. See FACE.

FACADE Cliff, or Mural Ascent, in *Geology*, is a term for the precipitous face of a rock; these, in some few instances, are occasioned by the strata below having sunk down at a fissure or fault, in others, on the sea shore, they are occasioned by the waves having undermined and let down the strata, and successively washed away the fame; but more commonly facades are occasioned either by the violent excavation which vallies have undergone, or by the *abruption* of the strata in certain districts, as Dr. W. Richardson calls it (Phil. Trans. 1808), but which had previously been called in our work *denudation*, which see. According to the observations of Mr. Farey, nearly all the lime-stone facades in the Derbyshire mountains appear to have been the skirts of veins, and their being coated with the spars peculiar to vein-skirts, seems to have preserved them from mouldering down or decay, in most instances.

FACATA, or **FUCATE**, in *Geography*, a sea-port of Japan, in the island of Ximo, where the Jesuits had formerly a considerable establishment, and a church; 27 miles W. N. W. of Taifero.

FACAUT, a town of Asiatic Turkey, in Caramania; 63 miles N. N. W. of Cogni.

FACE, the surface or first side which a body presents to the eye. See SURFACE.

FACE, in *Anatomy*, denotes the same part of the body as the same term signifies in common language. Our arrangement of the anatomical department of this work has rendered it necessary to describe the various parts of the face in different articles. The mouth, lips, and cheeks are described in the article DEGLUTITION; the eye-brow, eye-lids, and eyes in the article EYE; and the nose in the article NOSE.

FACE is particularly used for the visage of an animal, and especially of a man, as being in him the only part of the body that ordinarily appears to the eye.

The Latins call it *facies, vultus, os, &c.*

The great variety observable in men's faces, voices, and hand-writings, furnishes a noble argument of a Providence.

The human face is called the image of the soul, as being the seat of the principal organs of sense; and the place where the ideas, motions, &c. of the soul are chiefly set to view. Pride and disdain are shewn in the eye-brows, modesty on the cheeks, majesty on the forehead, &c. It is the face which shews the sex, age, temperament, health, or disease, &c.

The face, considered as the index of the passions, habits, &c. of the person, makes the subject of physiognomy.

FACE, or *Façade*, in *Architecture*, is sometimes used for the front of a building, or the side on which the chief entrance is; as also for the side it presents to a street, garden, court, &c. and sometimes for any side opposite to the eye.

FACE, *Facia*, or *Fascia*, also denotes a flat member having a considerable breadth, and but a small projecture.

Such are the bands of an architrave, larmier, &c. See FASCIA.

FACE of a *Stone*, is the surface or plain part which is to lie in the front of the work. The face is easily known when the stone is scalped, as being always opposite to the back, and the back going rough as it comes from the quarry.

The workmen generally choose to make one of those sides the face which, when in the quarry, lie perpendicular to the horizon, and consequently the breaking, and not the cleaving way of the stone.

FACE of a *Gun*, in the *Artillery*, the surface of the metal at the extremity of the muzzle of a piece.

FACE, in *Astrology*, is used for the third part of a sign. Each sign is supposed to be divided into three faces: the ten first degrees compose the first face; the ten following ones the second; and the last ten the third. Venus is in the third face of Taurus; that is, in the last ten degrees thereof.

FACE of a *Plant*. See HABIT.

FACE of a *Bastion*, in *Fortification*. See FACE, in a *Military Sense*, and BASTION.

FACE of a *Place*, denotes the interval between the points of two neighbouring bastions, containing the curtain, the two flanks, and the two faces of the bastions that look towards one another.

This is otherwise called the *tenaille* of the place.

FACE *Prolonged*, is that part of a line of defence rasant, which is between the angle of the epaule or shoulder of a bastion and the curtain; or the line of a defence rasant diminished by the face of the bastion.

FACE, *External*, *Facies externa*, in *Ichthyology*, is used to express a general form or figure in certain fishes, by means of which they agree with some and disagree with others; and according to which likeness or dissimilitude some authors of the late ages have arranged them into genera. This general figure in fishes consists in the shape of the head and body, and the shape, size, and proportion of the fins and tail, and though very obvious, is very indistinct; it being in many cases, where two fishes have the same general external face, yet hard to say, on a close examination, in what it is that the likeness consists. The authors who founded the distinction of the genera of fishes on these external resemblances ran into very great errors; for it is not enough in a generical distinction for the character to be obvious, but it must also be precise and determinate. What this facies had in the first of these requisites is often wanted in the last; and, in general, it has been found to be no true basis of distinction.

Many fish have the facies externa, or general appearance so much alike, as to be easily coupled at sight into the same genus; and that justly, as they really belong to the same when more precisely referred to it, according to their natural and more essential character. Of this kind are the gadi, the clupeæ, the salmones, the petromyzæ, the coregones, the pleuronectæ, the rays, and many of the cyprini. In these the facies externa is of real use, as it is an obvious mark, and leads to the road of truth; but there are beside

these many other fishes which, though they are truly of the same genus, yet differ extremely in their several external appearances, so that any method founded on the facies externa must separate them, though nature had really joined them in their real characters. The tench and the trutta lacustris, or lake-trout, are in regard to their facies externa extremely alike one to the other, yet here this obvious character deceives us; for the tench is a species of the cyprinus, and the other a true and genuine salmon, two genera of fishes essentially and very widely different, though this method of judging by the external appearance would have coupled together fish belonging to them both. In the same manner the scorpena and cottus are very like one to the other in their external appearance; but when nicely examined, according to the rules of ichthyology, they are found to belong to two very different genera, and to have very little real likeness. From these, and numerous other examples of a like kind, it evidently appears, that as the facies externa cannot be depended on for establishing the genera of fishes, some more essential characters must be acquired after for the regular and natural completion of this necessary business. Therefore, the generical characters of fish are to be sought after in their external and invariable parts, and they are to be arranged into families and genera, according to the agreement of these in number, situation, figure, and proportion. Among all these, the characters taken from the number of the parts, where that is certain and invariable, are most valuable, as they most readily offer themselves to the eye, and are least of all liable to errors.

FACE, in the *Manege*. See CHANFRIN.

FACE, in a *Military Sense*, means that front which is shewn by a body of troops, or the general bearings of any particular defences in a fortified place: in the former instance, reference is had to the line of front, and not to any change of individual position, whether by turning (*i. e.* facing) to the right or to the left, for the purpose of marching by files; nor does an echelon movement in any wise alter the meaning, it being even understood that the line of pivots, on which the wheel was made, denotes the true front or face of that part of a line; though to an enemy there will be presented an equivocal definition, or display, in consequence of the tendency of an echelon movement to produce a rapid change of front. For a further insight into this part of our subject, we refer our readers to ESCHELON and EVOLUTION.

The face of any lines, or fortified works, is to be ascertained by a consideration of what proportion of any real figure, or of any imaginary one, the several defences may occupy. Thus, in a square, there will be four distinct faces; in a pentagon, (or figure of five sides,) there will be five; in a hexagon, (or figure of six sides,) there will be six; and thus of any number of portions into which a circle, an ellipsis, (or oval,) or any other perimeter, or circumference, may be divided. In all these we judge by the chords, subtending the several portions respectively, without adverting to their being either equal or similar, as they should properly be in all works coming under the designation of "regular fortification," of which an ample description has been given under the head of CONSTRUCTION, *Military*. It may be proper in this place to observe, that our best engineers make it a rule not to extend a face beyond certain limits, proportioning the width of the curtain to the magnitude of the area to be enclosed. Consequently, large areas, which give a greater circumference, are necessarily defended by more faces than those of smaller compass, whereby the flanked angles of the bastions become

some more obtuse, it being evident, that the angles of a triangle inscribed in a circle will be more acute than those of a square, (under similar circumstances,) those of a square more acute than those of a pentagon, and thus, *ad infinitum*.

The first system of Monsieur Vauban is that generally acted upon: it divides fortification into three classes, namely, the little, the mean, and the great. The exterior side of the little gives from 120 to 175 toises (or fathoms); that of the mean includes from 175 to 185 toises; and that of the great ranges from 185 to 260 toises. Hence, we readily estimate the number of faces into which the circumference of an area should be divided, observing, that whenever any portion of that circumference imposes on us a long side, that is, above 280, but not exceeding 340 toises, there must be formed two faces, covering such long front, or face. This is done by adopting each extremity of the latter as a centre, and describing from them respectively an arc, having 180 toises for the radius: the intersection of those arcs opposite the centre of the front will be the point of union of two faces, of which the ends of the front, whence the arcs were drawn, will be the other extremities.

If the front should exceed 360 toises, it should be divided into as many portions, from 175 to 185 toises each, as the ground may permit; each such portion being considered a separate face, and to be defended by flat bastions. It has, however, been always considered expedient to protect all such disproportioned faces, by means of whatever outworks may be most applicable to local circumstances. Thus, if there be three such conjunct faces, the centre one should be covered by a horn-work, of which the flanks ought to be thrown at such an angle as might not admit of their acting in behalf of the besiegers, should they succeed in wresting them from the garrison. If only two conjunct faces are to be defended, the central bastion should be well covered by exterior defences; such as a counter-guard, well flanked by lunettes, tenailles, a fleche, &c.; so as to give full effect to the defences, but without subjecting them to become obnoxious thereto, when possessed by the enemy.

The faces of any particular work, such as a raveline, or a bastion, are those parts which form an angle projecting outwards from the place, towards the esplanade, or country: consequently, the faces of works that are mutually parallel, must have the same line of fire, or aspect; and, in the same degree, flank all other works standing at an angle of not less than 60° nor more than 120°.

FACE of the Measures, in Mining, is that part of a mine bounded by the length-way or principal vertical joints, or natural cracks of the measures. In coal mines, these principal joints are called *sline back*, or *face joints*, and are generally parallel to each other; and, according to the recent observations of Mr. Farey in Derbyshire and Nottinghamshire, these seem to tend towards the same point of the compass, without regard to the direction in which the measures may dip or incline; so that the face of the work in the collieries there, is generally towards the two o'clock sun, or its opposite direction, which seems a curious circumstance, and may prove of importance, if more extended observations should shew it to be a general fact: the lesser joints which cross the slines, almost at right angles, are called *end-joints*, or *cutters*, which see.

FACE, Fr. in Music, is used to distinguish the different forms of the triad, or ways of taking the common chord; as 1st face $\frac{9}{8}$, 2^d face $\frac{3}{2}$, and 3^d face $\frac{3}{4}$; or, as we should

say, first *stage* or *station* of a chord, &c. A chord has as many faces or forms as it has notes. The chord of the 7th to G, for instance, may be played four several ways on a keyed instrument, placing the thumb on the lowest note, as $\frac{5}{7}, \frac{3}{5}, \frac{5}{7}, \frac{7}{9}$.

FACE, the Human, to the painter and sculptor is an object of the utmost importance among their various studies. In endeavouring to convey in their representations of the human figure the influence of those emotions of the mind which arise from the subject adopted, and which are supposed to occupy the bosoms of the persons represented, much is done by the general action of the figure; but it is the expression or action of the features of the face which identify the passion, convey the fullest idea of its influence, and literally "give to airy nothing a local habitation and a name." A regard of the eye, a motion of the lip, or of the nostril, sometimes speaks a language more forcible than words. An intimate acquaintance therefore with the structure of those silent monitors, the features of the face, with the best proportions either for their expression or beauty, appears to be absolutely necessary to obtain excellence in the art of representing the different expressions caused by their variations.

It will be necessary, in order to treat this subject fully, to trace the growth of the human face from its stage of childhood to its maturity and decline, each stage having its peculiar variations, and the knowledge of each being requisite for the exhibition of the painter's and sculptor's art.

That kind of character which marks the years of childhood is so clearly discernible, that it admits of no dispute. The form of the faces and features of children is as peculiar to themselves as the simplicity of their minds; yet we frequently observe, even in very young ones, certain indications of genius or stupidity, which ripening time afterwards justifies. The form of the faces of children inclines to the circle, in contradistinction to that of the adult, which is oval, or rather egg-shaped, with the apex downwards. The features, when young, are also round and softened: the iris of the eye is very large in proportion to the face. Mr. Hogarth, in his "Analysis of Beauty," observes, "that it ever continues the same size, so that you may sometimes find it in a new-born babe as large as in a man six feet high:" it serves, therefore, as a standard to measure the growth of the other parts of the face. The nose is flat, the cheeks plump and round, making the mouth appear flattened in the face; the ears are large, and the whole expression heavy. During infancy the faces of boys and girls have no considerable difference, but as they grow up the features of the boy take upon themselves more marks of peculiar character, and grow faster in proportion to the iris of the eye than those of the girl, thus shewing the distinction of sex in the face. A manly featured boy therefore has his features larger than ordinary in proportion to the iris, whilst those who have the contrary look younger and more childish than they really are.

In the progress of the face to maturity the features lose much of their roundness, and partake more of the oval, the nose rises, the cheeks retire, the mouth forms, and the disposition of the mind begins to shew itself in the air of the face, and more especially we now perceive a difference in the sexes, in the more speedy advance of the female towards that form which constitutes beauty.

By degrees
The human blossom blows, and every day
Soft as it rolls along shews some new charms,
'The father's lustre, or the mother's bloom.'

That distinguishing peculiarity, the growth of the beard, also takes place in the male; now indeed with us (the inhabitants of southern Europe,) under sentence of excision, but once universally esteemed the proudest distinction of man, and cultivated with all imaginary care by saints and heroes. See BEARD.

Arrived at maturity, the face possesses the whole character of the man, both physical and intellectual, and either shines distinguished by its character of sense or beauty, or appears odious in its grossness and deformity.

But the vicissitudes to which all the productions of this world are subject forbid a permanence of that maturity, and having now no farther progress to make in advance, the beauties of the face gradually change, wither, and die. Imperceptibly at first alteration takes place in the features, they lose their softness and fullness; lines steal upon the cheeks and forehead; the colour of the face declines, and the countenance becomes more and more marked with the repetitions of the actions and expressions of the passions. Advancing in life the change becomes more visible, and at length even rapid; and the continued action of the muscles of the face increasing the marking of its various parts, they become more angular, and broken into many forms; the projections of the bones become more apparent by the sinking in of the cheeks, from the loss of the teeth, which causes also the lips to disappear, by folding over the gums; and when the teeth are all gone, the mouth closing, brings the jaws nearer together, and shortens the space between the nose and chin; till at last time triumphant, overcomes all that designated the vigour and sense of man, or the beauty and amiability of woman, and renders those who bore so much resemblance to each other in infancy, again similar in intellect and in person; till the last earthly scene closes and mingles them in their common dust.

The varieties of the human countenance are not confined to these distinctive marks of the different periods of its existence. Every country, every climate, has its peculiarity; it would require a copious dissertation to describe all the peculiarities that are nationally characteristic; a few of the principal ones will answer our purpose. (See *Plate III. Painting, figs. 1, 2, 3, 4, and 5.*) Among them none are so obvious as the difference of the negro and the white man, in colour more particularly; for as to form, though the thick lips, broad flat nose, the want of beard, and the woolly texture of the hair of the former, are powerfully distinct from the appearance of the European; they are not more so than are the features of the Tartar or the Chinese, who have round faces pointed at the chin, small eyes, with the outer angle inclining upwards, giving strongly the character of cunning. In the North another race of men are found likewise distinct in their faces as well figure. The Laplander, and his opposite in North America, the Esquimaux Indian. hideous deformity to the eyes of an European characterizes their countenances, large, flat, and broad faces; broken and sunk noses; thick eye-brows drawn back towards the temples; high cheek bones; thick lips; and large mouths, conspire to disguise the "human face divine," as the poet has termed it, and conceal the expression of all that is amiable or inviting.

The successive approaches to union of these countries produce also the same succession of approach in countenance. From the East, the Chinese, the Hindoo, the Persian, the Turk, the Hungarian, the German, &c.: and from the North, the Laplander, the Russian, the Pole, the German, &c. have each their distinct classes of feature gradually receding from, and approaching to, each other: and on the Southern side of Africa, the union of the features of the

Negro and Chinese are found in the Hottentot (Barrow's Inland Tour from the Cape of Good Hope.) Add to these the different features of the various tribes of North and South America, and some idea may be formed of the almost infinite varieties of the human face. To such a wonderful extent is this carried, that it is probable that from the first formation of man to the present time, no two human beings have been exactly similar in feature and form of face.

This speculation, however, is carrying the matter much farther than is absolutely necessary for the purpose of the historical painter. Though it is not amiss to be thus informed on this head, yet as it has been said, and justly too, "that his principal business is to paint man, not men; the generic character, not the individual species," we will point out those proportions of the face which are allowed to be the most effective in exhibiting beauty or manly character. For this we must turn our eyes to the Greeks, who appear to have systematically arranged their ideas and practice in the production of their statues.

Audran, in a work published in Paris, has given the following comparative scale of proportions of the faces of the Apollo Belvidere, and of an antique Venus, from actual measurement. Taking the length of the nose, which he calls a part, and dividing that in twelve parts, which he calls minutes, he states the faces of the Apollo and of the Venus to have each three parts from the growth of the hair on the forehead to the bottom of the chin. Dividing the lower part into three, the uppermost gives the line of division of the lips; the other parts are proportioned as follow:

	Apollo.		Venus.	
	p.	m.	p.	m.
Width of the face from ear to ear	2	2	2	2
The eye, seen in front	-	6	-	5 $\frac{1}{2}$
Space between the eyes	-	6	-	6 $\frac{1}{2}$
Eye in profile, and the pupil in width	-	2	-	2
Width across the nostrils	-	7 $\frac{1}{2}$	-	6 $\frac{1}{2}$
Nose in profile	-	6 $\frac{1}{2}$	-	6 $\frac{1}{2}$
Width of mouth in front	-	9	-	7 $\frac{1}{2}$
----- in profile	-	4 $\frac{1}{2}$	-	3 $\frac{1}{2}$
From the nostril to the ear, in profile	-	8 $\frac{1}{2}$	1	6
Length of the ear	-	1	-	1

See *Plate I. Painting, figs. 1, 2, 3, 4.*

The greater part of the Greek statues of the higher class have nearly the same proportions, and in sculpture these rules are most usually adhered to, particularly where the subject is either a personification of divine or heroic character, which are indeed the only proper subjects for the display of this art. But painting having a wider range, both in subject and action, cannot always be bound by them, and in many views of the face it would be absolutely impossible to apply them. As the practice of the painter calls for more individuality than that of the sculptor, so is he more or less at liberty to dispense with these proportions in a degree; and it must never be forgot that men of different characters have differing countenances, their peculiar expressions requiring, or rather, perhaps, producing, different proportions. The painter who makes all his faces of the same standard can never excite an interest in his works, or ever enjoy the praise of selecting with judgment, or feeling the productions of nature for his imitation. This diversity in the form of the faces and features arising from internal character is the basis of physiognomy, to which, for farther illustration upon this subject, we refer the reader.

The general proportions mentioned above are, nevertheless, of essential service to the painter; for if they cannot

be said to have a binding influence over him to cause him to adhere to them alone, they serve him excellently as a rule to swerve from, constantly checking his caprice, and preventing his running into too common-place an imitation of nature, and producing caricature, instead of that character, consistent with the dignity of style, which should accompany all grand works aiming at superiority of effect.

In drawing the face there are some regulations which facilitate the progress of it. Having made the oval, or general shape of the head, it is usual to draw a perpendicular line down the centre when seen in front, and that is crossed by an horizontal one in the middle, for the station of the eyes. The perpendicular line being divided into four equal parts, the three lower ones give the space for the face, and according to the above-mentioned rules all the various parts may be set off upon these lines, it being remembered, that the eyes, nose, and mouth, are always parallel, and the bottom of the ears on a level with that of the nose; and in whatever view the face may be required to be drawn, these lines, though varying in their directions, will still be of use in determining the positions of the features. In a head looking downwards those which were horizontal in a direct front view will be found to become concave, or the inferior part of a circle, and the reverse takes place in one looking upwards; and the impossibility of the painter applying in every case the rules of proportion will be clearly seen, when it is known, that in most views of the face some of the features are seen fore-shortened, (see FORE-SHORTENING,) and of course others appear larger in line than their natural size.

When a face is directed to the ground, the forehead and the nose will appear far too large for the cheeks and chin; and by their projection hide somewhat of the other parts of the face. That of the forehead and eye-brows conceals part of the eyes; the nose hides the mouth partially, or totally, according to the degree of depression of the face, or elevation of the view: the mouth, if not itself rendered invisible, hides a part of the chin; and on the contrary, in the elevation of the face, the upper lip hides the space between it and the nose; the base of the nose conceals its length, and the eye-brows in part conceal the forehead as we see under them, consequently they project before it in the view.

In all these cases, as has been already observed, it is impossible to apply the rule, but the artist will do well always to keep it in view, as it will facilitate his labour, and generalize his characters, without confining him too strictly, or preventing his research after the more grand and just impressions of physiognomical character, or accidental effects of passion or expression; which give the highest value to works of art.

For the variations that take place in the face of a man whose mind is under the influence of the stronger passions, see EXPRESSION, in *Painting*, and PHYSIOGNOMY for the variations of the lines and features indicative of the peculiarities of natural character in mankind.

Of those peculiarities in the characters of countenance, found among the higher class of the Greek statues, we have spoken under the word BEAUTY, as relative to the arts of design; of their oval shape in front; of the straight, or nearly straight line in profile formed by the forehead and nose; of thin, full lips, and round chin. These are the forms which were selected by those elegantly minded and wise men, the Greek artists, as most impressive of grandeur and of beauty in the human face, and the propriety of this selection still remains unimpeached, though it is very rarely ap-

proached by Nature, and perhaps has never been completely produced by her in one countenance; yet as these various features were found separately in her works, and viewed with gratification, the artists judiciously united them; thus outfining in perfection the model they imitated, and producing another more pure for her imitation, which she has never yet been found to equal; so that to be as beautiful as the Venus in the language of the poets, is to possess that quality in a super-human degree.

In the productions of nature the human face varies in every direction from this definitely beautiful form. In our own nation (where countenances are not in general lacking either in sense or beauty, and often possessing both to a very considerable degree,) we find among them some faces tending to the round, others to the longer proportion, some are flat, others prominent, some square, others indefinitely shaped; the features in some are large in proportion to the face; in others, small and close together, occupying only the centre of the face; or else, far apart, and with large spaces between them. (See *Plate II. Painting, figs. 1, 2, 3, 4.*) These, with other variations of the like kind, are highly necessary to be observed by the portrait painter, or the sculptor, occupied in producing individual resemblance: and endeavouring to form in the mind a clear idea of the peculiar class of arrangement of feature in the face before them, is the readiest and surest way of producing its like on the canvas or marble. See *Portrait Painting.*

FACELLI, in *Geography*, a town of Naples, in *Lavora*; 18 miles N.E. of Capua.

FACET, or FACETTE, a little face or side of a body, cut into a great number of angles.

Multiplying glasses are cut in facets, or facet-wise. Diamonds are also cut in facets or tables.

In brilliants there are two sorts, skew, or skill-facets, and star-facets. Skill-facets are divided into upper and under. Upper skill-facets are wrought on the lower part of the bezel, and terminate in the girdle.

Under skill-facets are wrought on the pavillions, and terminate in the girdle.

Star-facets are wrought on the upper part of the bezel, and terminate in the table. See *Jeffries on Diamonds.* See *DIAMONDS.*

FACETS of a hill, in *Geology*, or face of a hill, are those parts which present a plane or flat surface. It has often been remarked, that hills and mountains have generally one flat side, and which, in most cases, faces towards the east; and a careful examination convinces us that the same is occasioned by this plane being the uppermost stratum of matter of which the hill is composed. In examining the geology of a district, it is of the utmost consequence to attend to the facets of the hills, because they invariably point out the position of the strata, and shew us where to look for the uniform top of the strata, and where to expect to see the edges and alternation of different strata, exposed to view, wherever the vegetable soil and alluvial deposits are removed. Some few hills and mountains are composed of volcanic matters, successively and pretty evenly distributed on their surfaces, but the number of such hills is exceedingly small; other hills owe their origin, in a few instances, to alluvial deposits of the ruins of strata, thrown together without order or any discoverable law; but it is far more common in alluvial countries to find stratified hills, with heaps of gravel and alluvial matter on them, generally raising them higher than they were before; but some parts of the facets of the strata are generally in such cases still to be discovered.

FACETANUS LAERTIUS, in *Zoology*, the name of a particular

peculiar species of lizard, called at Rome and Naples the tarantula.

FACIA, in *Architecture*. See FASCIA.

FACIAL ARTERY, in *Anatomy*, is synonymous with the external maxillary. See ARTERY.

FACIAL NERVE, is the portio dura of the seventh pair. See NERVE.

FACIAL VEINS. See VEIN.

FACIES HIPPOCRATICA, in *Medicine*, is when the nostrils are sharp, the eyes hollow, the temples low, the tips of the ears contracted and cold, the forehead dry and wrinkled, and the complexion pale or livid.

The facies Hippocratica is chiefly observed towards the period of phtisies and other consumptions, and is held a sure prognostic of death. If it appears within three days after the attack of an acute disease, it is deemed to indicate death.

FACILE HARBOUR, in *Geography*, a harbour of New Zealand, in Dusky Bay, on the west coast of Resolution island, recommended by Capt. Cook to those who are sailing southward. S. lat. 45° 40'. E. long. 166° 18'.

FACING, in *Engineering*, is the name for a small thickness of the common earth, soil, or stuff of a canal, laid in front of the side-lining or puddle, on the sloping sides C F and I G, *figs.* 14 and 15, *Plate I. of Canals*. Its use is to hold up the puddle, while the same is working and chopping in the act of puddling, and afterwards to guard the puddle from being penetrated by the hitches and poles used by the bagemen. See CANAL.

FACING, in *Military Language*, is that part of the uniform of a professional man, whether commissioned, non-commissioned, or private, which is contrasted with the colour of his coat, &c. and this relates as much to the collar and the cuffs, as to those parts usually called lapels, which fold back from the throat down to the waist. With the exception of one or two regiments, all our military corps are distinguished by facings of various colours; all bearing any royal deputation being of garter-blue, as are also the several corps of marines. For the most part, yellow, buff, white, grey, and light green are in use; a few may be seen of black, pompadore, or scarlet. Few regiments wear lapels, but confine themselves to the use of capes and cuffs of the appointed colour, to which their regimental standards, and the several ornamental parts of equipage invariably conform. It has been considered a rule, though not adhered to in modern times, that whenever a regiment loses its colours, its facings should be discontinued until the corps may have regained its credit by taking the colours of some opposing corps. This does not relate to that kind of privation resulting from a surrender, whether in the field, or in a fortified place, but merely to the act of abandoning the field in such disorder as subjects the ensigns to that most heart-breaking misfortune, which, to the honour of the British army, may be said not to be familiar to our service.

The mode now in use, of making lapels, or facings, to fold over to such extent as should afford comfort to the soldier, cannot be too much commended: we are surpris'd to see any deviation from a practice so evidently conducive not only to health, but to that compactness which facilitates the various movements of the r-lock. Considering the breast and stomach to be peculiarly subject to derangement, from exposure to inclement weather, it appears to us a desideratum, that in lieu of the many expensive, but frivolous parts of a soldier's equipment, some device should be adopted, whereby both excessive heat, and pinching cold, should be precluded at pleasure from parts so easily affected

thereby; if our information be correct the total absence of facings, such as might occasionally be either buttoned back, or be lapped over, a deficiency to be seen in many instances, has been the occasion of very serious illness, and of no brief obituary list, among several of our expeditions.

FACING, *Façade*, or *Revetement*, in *Fortification*, means that portion of masonry, or other binding, given to ramparts, with the view to prevent the soil of which they are composed from crumbling or giving way. When of masonry, the wall should be five feet thick at the top, with an increase or talus, equal to one-sixth of its height: buttresses, called counter-forts, should be built within, at about fifteen feet apart, to strengthen the facing. In order to prevent escalade, the facing is generally made full twenty-seven feet high, from the bottom of the ditch to the cordon. When the facing is carried up as high as the soles of the embrasures, it is called a whole revetement; but when confined to the ditch only, it is termed a half-revetement. These must depend on the nature of the soil, the facility of obtaining materials, the time that can be bestowed, the importance of the post, &c. Where difficulties occur, as also in temporary works, the facings are made with turf; in which case they are said to be gazoned. For field-works, and especially in the conducting of sieges, fascines, which are faggots made of various materials, are very generally employed, and are found to answer the intention. (See FASCINE.)

FACING, in *Ship Carpentry*, denotes letting one piece into another with a rabbet.

FACINI, PIETRO, in *Biography*, a painter of history, born at Bologna in 1560. He began to paint when already grown up to manhood, at the advice of An. Caracci, who, on seeing a whimsical design of his in charcoal, concluded he would be an acquisition to his school. Of this advice he had reason to repent, not only because Facini roused his jealousy by the rapidity of his progress, but because he saw him leave his school, become his rival in the instruction of youth, and even lay snares for his life. Facini had two characteristics of excellence, a vivacity in the attitudes and heads of his figures, that resembled the style of Tintoretto, and a truth of carnation which made Annibal himself declare that his colours seemed to be mixed with human flesh.

Beyond this he has little to surprise; his design is weak, his bodies vast and undefined, his heads and hands ill set on, nor had he time to correct these faults, as he died young, in 1602. At St. Francesco, in Bologna, is an altar-piece of his, the Marriage of St. Catherine, attended by the four tutelary saints of the city, and a number of infant angels, which shews the best of his powers. His children carolling, or at play, in the gallery Matvezzi, and elsewhere at Bologna, are equally admired; they are in the manner of Albani, but with grander proportions. Fuseli's Pilkington.

FACIO, UT FACIAS, and *ut des*, in *Law*. See CONSIDERATION.

FACK, in a *Ship*. See FAKE.

FACKER SEE, in *Geography*, a lake of Carinthia; 3 miles S.E. of Villach.

FACTEUR, Fr. in *Mechanics*, a maker; as in music, a flute or fiddle-maker, an organ-builder. How great a demand there was for flutes in Athens, may be conceived from a circumstance mentioned by Plutarch in his life of Isocrates. This orator, says he, was the son of Theodorus, a flute-maker, 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. Each tribe furnished their distinct chorus; which consisted of a band of vocal and instrumental performers, and dancers, who were to be hired, maintained, and dressed during the whole time of the festival: an expence considerable in itself, but much increased by emulation among the richer citizens, and the disgrace consequent to an inferior exhibition. The fluctuations of trade and public favour have rendered the business of boring flutes far less profitable at present than it was in the time of Theodorus. But then we have had a harpsichord-maker in our own country (old Kirkman) who died worth 100,000*l.* and who was as able to maintain a choir as Theodorus, or any dean and chapter of a cathedral.

FACTION, a cabal or party formed in a state to disturb the public repose.

The most celebrated factions were that of the Guelphs and Gibelins, who kept Italy in alarm for many ages; and with us that of the Whigs and Tories.

FACTION was originally an appellation given to the divers troops or companies of combatants in the games of the circus.

Of these there were four, *viz.* the green faction, the blue faction, the red faction, and the white faction. The emperor Domitian is said to have added two others, *viz.* the purple and the yellow.

These factions, with their liveries and badges, were at length abolished; the emulation which was at first between them growing to such a height, that in Justinian's time 40,000 men were killed in a contest between the green and blue factions.

FACTITIOUS, signifies any thing made by art, in opposition to what is the produce of nature.

FACTO, DE. See the article **DE FACTO.**

FACTOR, in *Agriculture*, is a term which in some places, especially in the northern parts of the kingdom, signifies an agent or person who has the overlooking and management of an estate for another. Persons of this description are something more than bailiffs, and have commonly a knowledge of the law, in so far as landed property is concerned.

FACTOR, in *Commerce*, an agent or person who acts and negotiates for a merchant by commission; called also commissioner, and on some occasion broker, and throughout the Levant, coagis.

Factors are either charged with the buying or the selling of goods, or with both.

Those of the first kind are usually fixed in places of considerable manufactories, or cities of great trade. Their office is to buy up commodities for merchants residing elsewhere; to see them packed, and send them to the persons for whom they were bought.

FACTORS of sale are usually established in places where there is a great vent. To these, merchants and manufacturers send their goods to be sold for them according to the price and other conditions expressed in the orders delivered them; and they are authorized by a letter of attorney, with a salary or allowance for their care.

The wages or allowances for selling are usually clear of all expences of carriage, exchange, remittances, &c. excepting postage of letters, which are never put to account.

Factors should strictly observe the orders of their principals, or else they are liable to the damage accruing from the neglect of them. When factors have unlimited commission to do for their constituents the best they can, they are excusable, though their transactions are attended with loss to their principals; but no factor, who has merely a commission to sell, &c. for another, is excusable for entrusting another person beyond the usual time allowed in the sale

of the commodities which he disposes of; in such a case he is answerable to the principal out of his own estate. (1 Bullst. 102.) In commissions at this time, it is common to give the factor power, in express words, to dispose of the merchandize, and deal therein as if it were his own; by which the factor's actions will be excused, though they occasion loss to his principal. Goods remitted to a factor ought to be carefully preserved, and he is accountable for all lawful goods that shall come to his hands; yet if the factor buy goods for his principal, and they receive damage after in his possession, not through his negligence, the principal shall bear the loss; and if a factor be robbed, he shall be discharged in account brought against him by his principal. (4 Rep. 83.)

If a factor sells on the usual trust to a person of good credit, who afterwards becomes insolvent, he is discharged; but not if the man's credit was bad at the time of sale. A factor should always be punctual in the advice of his transactions, sales, purchases, freights, and draughts by exchange: he should never deviate from the orders he receives in the execution of a commission for purchasing goods, either with respect to price or quality: if goods that are bought are sent to a different place from that to which they were ordered, they become the factor's, unless the merchant allows them. If a factor buy goods on account of his principal, where he is authorized so to do, the contract of the factor shall oblige the principal to the performance of the bargain; and the principal is the proper person to be prosecuted on non-performance: but if the factor enters into a charter-party of affreightment with a master of a ship, the contract obliges him only; unless he lades aboard generally his principal's goods, then both the principal and lading become liable for the freight, and not the factor. (Goldsb. 137.) It is a general rule, that where a factor, who is authorized to sell goods in his own name, makes the buyer debtor to himself, though he is not answerable to his principal for the debt, if the money be not paid; yet he has a right to receive it, if it be paid, and his receipt is a discharge to the buyer. The factor may compel such payment by action, and the buyer cannot defend himself by saying, that the principal was indebted to him more than the amount. (Cowp. 255, 6.) Where goods are sold by the factor at his own risk, for which he has an additional allowance, the vendor is not answerable to the owner. (Stra. 1182.) Though a factor has power to sell, and thereby bind his principal, yet he cannot bind or affect the property of the goods by pledging them as a security for his own debt, though there be the formality of a bill of parcels and a receipt. (Stra. 1178.) A factor that sells a commodity under the price ordered by his principal shall be obliged to make good the difference; and if he purchases goods for another at a limited price, and they rise in value, and he secures to himself the advantage, he is obliged to satisfy his principal for damages; or if he makes any advantage of the sale of goods which his principal directed him to purchase, the principal shall recover it from him, and he is liable to be amerced for the fraud. When factors have obtained a profit for their principal, they must be cautious how they dispose of it; for if they act without commission they are responsible; and if a merchant remits goods to his factor, and about a month after draws a bill on him, and the factor having effects in his hands, accepts the bill, but the principal breaks, and the goods are seized in the factor's hands, on behalf of the creditors, it has been judged that the factor must answer the bill, and come in as a creditor for so much as he was obliged by reason of his acceptance to pay.

If one employs a factor, and entrusts him with the disposal of merchandize, and the factor receives the money, and dies, indebted,

indebted in debts of a higher nature, and it appears by evidence that this money was vested in other goods, and remains unpaid, those goods shall be taken as part of the merchant's and not of the factor's estate; but if the factor has the money, it shall be considered as the factor's estate, and must first answer the debts of superior creditors, &c. (1 Salk. 165.) If a person employs a factor to sell goods, who sells them on credit, and before the money is paid dies indebted more than his estate will pay, this money shall be paid to the principal merchant, and not to the factor's administrator, deducting his commission; for a factor is only as trustee for his principal. (2 Vern. 638.) Bills remitted to a factor or banker, while unpaid, are in the nature of goods unsold; and if the factor become bankrupt must be returned to the principal, subject to such lien as the factor may have thereon. (2 Blac. Rep. 1:54.) A factor has a lien on goods consigned to him, not only for incident charges, but as an *item* of mutual account, for the general balance due to him, so long as he retains the possession; if he parts with the possession, he parts with his lien. (1 Burr. 489. 1 Blac. Rep. 1:4.) If he be surety in a bond for his principal, he has a lien on the price of the goods sold by him for his principal to the amount of the sum for which he is bound. (Cowp. 25.) A factor has no lien on goods for a general balance, unless they come into his actual possession; and if in consideration of goods being consigned to him he accept bills drawn by the consignor, and pay part of the freight, and become insolvent before the bills are due, and before the goods get into his actual possession, the consignor may stop them *in transitu*. (1 Term Rep. 119.) If a factor accept bills drawn by his principal upon the faith of consignments agreed to be made by the principal to the factor, and both of them become bankrupts before a cargo consigned came into possession of the factor; the factor's assignees have no property in such cargo, and cannot recover the produce of it against the assignees of the principal, if the latter have sold it, and received the purchase-money. (1 Term Rep. 783. 4 Bro. P. C. 47.) The consignor may stop goods *in transitu* before they get into the hands of the consignee, in case of the insolvency of the consignee; but if the consignee assign the bills of lading to a third person for a valuable consideration, the right of the consignor as against such assignee is divested. There is no distinction between a bill of lading indorsed in blank, and an indorsement to a particular person. (4 Bro. P. C. 57. 2 Term Rep. 63. 1 H. Blac. Rep. 357. 2 Term Rep. 674. 3 Term Rep. 465.) If a factor sell goods as his own, by indorsement of the bill of lading, though no delivery is made, the goods being at sea, the vendor shall keep possession, unless fraud appears between him and the factor. (4 Burr. 2:46. 1 Blac. Rep. 629.) A factor who has money in hand belonging to his principals, and who neglects to insure a ship and goods according to order, shall make good the damage if the ship miscarry; and if he make any composition with the insurers after insurance without orders, he is answerable for the whole insurance. As fidelity and diligence are required from the factor, so the law requires the like from the principal: if, therefore, a merchant remits counterfeit jewels to his factor, who sells them as true ones, and sustains loss or damage by imprisonment or other punishment, the principal shall not make satisfaction to the factor but to the party who purchased them. Business of this kind is called commission-business; and traders in this way have current as well as commission accounts constantly between them, and draw on, remit to, and send commissions to each other only by the intercourse of letters, which, among men of honour are as obligatory and authoritative as all the bonds and ties of law.

FACTORS, in *Arithmetic*, is a name given to the two numbers which are multiplied one into another; that is, the multiplicand and multiplier; so called because they are to *facere productum*, make or constitute the product.

FACTORAGE. The factorage or wages, called also commission, is different at different places, and for different voyages: at a medium it may be fixed at about three *per cent.* of the value of the goods bought, beside the charge of package, which is paid over and above. When factors make themselves answerable for the debts of those persons with whom they deal, the charges of commission or factorage are, of course, enhanced.

FACTORY, a place where a considerable number of factors reside, to negotiate and officiate for their masters or principals.

The term is chiefly used in speaking of the East Indies, and other parts of Asia, Turkey, Italy, Portugal, &c. whither the European nations send their ships every year, and where they keep factors to buy the commodities of the country, and sell those brought from Europe.

FACTORY is also a denomination applied in some of our manufacturing counties to the places where particular processes of the manufacture are carried on.

FACTUM, in *Arithmetic*, the product of two quantities multiplied by each other.

FACTUM, in *Law*. See **FAIT**.

FACULÆ, in *Astronomy*, a name given by Scheiner, and others after him, to certain spots on the sun's disk that appear brighter and more lucid than the rest of the body.

The word is Latin, being a diminutive of *fax*, *torch*, and supposed to be here applied from their appearing and disappearing by turns.

The faculæ or bright spots differ very considerably from the maculæ or dark spots, in light, colour, figure, magnitude, and duration.

Hevelius assures us, that July the 20th, 1634, he observed a facula that took up a third part of the sun's diameter; and from the observations of the same Hevelius we learn, that the maculæ frequently change into faculæ; but the faculæ into maculæ rarely, if ever. Some authors even contend that all the maculæ degenerate into faculæ before they quite disappear.

Huygens, however, declares he was never able to discover any faculæ, though the maculæ occurred to him very frequently. All the foundation he could see for the notion of faculæ, he says, was, that in the darkish clouds which frequently surround the maculæ, one sometimes discerns little points or sparks brighter than the rest.

Many authors after Kircher and Scheiner have generally represented the sun's body full of bright, fiery spots, which they conceive to be a sort of volcanoes in the body of the sun; but Huygens, and others of the latest and best observers, finding, that the best telescopes discover nothing of the matter, agree to explode the phenomena of faculæ. Their cause these authors attribute to the tremulous agitation of the vapours near our earth; the same as sometimes shews a little unevenness in the circumference of the sun's disk when viewed through a telescope. Strictly, then, the faculæ are not eruptions of fire and flame, but refractions of the sun's rays in the rarer exhalations, which, being condensed in the neighbourhood of that shade, seem to exhibit a light greater than that of the sun. See **SPOTS**.

FACULTY, a power or ability of performing an action. The term is much used by the ancient philosophers, and still retained in the schools for explaining the actions of natural bodies. Thus, to account for the act of digestion, they suppose a digestive faculty in the stomach; to account

for motion, they imagine a motive faculty in the nerves, &c. which is only a substituting of one name of an unknown phenomenon for another.

The FACULTIES or powers of the soul are commonly reputed two, *viz.* the understanding and will,

FACULTY is also applied in the *Schools*, to the divers parts or members of an university, divided according to the arts or sciences taught or professed there.

There are four faculties in most universities; that of arts, which includes the humanities and philosophy, and is much the most ancient and extensive; the second is that of theology; the third, medicine; and the fourth, jurisprudence, or laws. See each under its proper article.

The degrees in the several faculties in the universities are those of Bachelor, Master, and Doctor.

The FACULTY is frequently used absolutely, and by way of eminence, for that chiefly studied and taught in any particular place.

FACULTY, in *Law*, denotes a privilege or special power granted to a man by favour, indulgence, and dispensation, to do that which regularly by law he cannot; as to eat flesh upon days prohibited, or to marry without bans first asked, &c.

FACULTIES, *the Court of*. See COURT of Faculties.

FACULTY of *Advocates*, in Scotland. See ADVOCATE.

FACUSIM, in *Geography*, a town of Japan, in the island of Nippon; 55 miles N.E. of Meaco.

FADELA, a town of Fez; 28 miles S.W. of Salec.

FADEN-HOTUN, a town of Corea, on the river Oula. N. lat. 41 3'. E. long. 125° 44'.

FADLA, a town of Arabia, in the province of Nedsjed; 180 miles N.E. of Mecca.

FADOAL, a small island in the East Indian ocean. S. lat. 5° 51'. E. long. 132° 37'.

FÆCES, in *Physiology*, the residue of the food, which is expelled from the body, after the nutritious parts have been absorbed by the intestines. See DIGESTION.

FÆCES, in *Chemistry*. Excrement, feces, or fecal matter, is the indigestible residue of the food, both liquid and solid, mixed or combined with bile and other secretions, during its passage through the alimentary canal.

The eager and unwearied search after gold, which distinguished and disgraced the ancient alchemists, rendered them liable to be imposed upon by the slightest and most foolish coincidences and analogies: hence doubtless it was that the casual and slight resemblance in colour between gold and the most disgusting of all substances led them to submit human ordure to various chemical processes, with the expectation of obtaining from it an oil which should have the property of fixing mercury. The details of most of these experiments have suffered the oblivion which they merited, and the discovery of pyrophorus by Hönberg is the only known fact of any importance which has resulted from them. This preparation, which is now obtained by a perfectly inoffensive process, was first procured from the matter remaining in the retort after dry distillation of human excrement.

In the year 1806 a laborious investigation of this substance was undertaken by Berzelius with a view of illustrating the chemical history of the process of digestion, from which we have selected the following particulars. Recent excrement appears to contain neither acid nor alkali in an uncombined state. Its odour is peculiar and remarkably fetid, but by time it becomes sensibly sourish. When of a medium consistence it loses about three-fourths of its weight, by being dried in a water bath. It is diffusible in water by agitation and maceration, and if strained through a linen

cloth in this state, it may be divided into a somewhat turbid fluid and an insoluble residue. This latter is of a greyish brown colour, and a very permanently fetid odour. When dried it appears to consist principally of the undigested residue of vegetable, and perhaps also animal food. It amounts to about 7 per cent. of the entire matter. The strained liquid by standing deposits a slimy matter of a yellowish-green colour, which is separable from the more fluid portion by filtration. It appears to consist, first of a matter soluble in alcohol, and much resembling the resin of bile; secondly, of a matter insoluble in alcohol, but soluble in water, possessing many of the properties of mucus, and readily putrefying at the same time, exhaling the odour of urine; thirdly, of a greenish-grey residue insoluble in water and alcohol, and affording by incineration silex and phosphat of pot-ash.

The clear liquor, after separation of the slimy matter, is of a light yellow colour, which, by exposure to the air, becomes brown and turbid. By gentle evaporation it deposits crystals of ammoniaco-phosphat of magnesia.

The constituent parts of the remaining fluid are, 1, albumen; 2, resin of bile combined with soda; 3, a peculiar substance of a reddish brown colour, that appears to be resin of bile somewhat altered.

The proportions of the above substances, according to Berzelius, are the following:

Water	-	-	-	-	-	73.3
Vegetable and animal undigested residue	-	-	-	-	-	7.0
Bile	-	-	-	-	-	0.9
Albumen	-	-	-	-	-	0.9
Extractive matter	-	-	-	-	-	2.7
Carbonat of soda	-	-	-	-	-	0.9
Muriat of soda	-	-	-	-	-	0.1
Sulphat of soda	-	-	-	-	-	0.05
Ammon. phosphat of magnesia	-	-	-	-	-	0.05
Phosphat of lime	-	-	-	-	-	0.1
Slimy matter	-	-	-	-	-	14.0
						100.0

The excrements of stall-fed cattle have been examined by M. M. Thaer and Einhof. The colour of this substance is yellowish green; its odour is somewhat like that of musk. It contains no excess of acid or alkali; when submitted to the agency of sulphuric acid there is a disengagement and production of acetic acid.

100 parts of recent excrement are reduced, by drying on a water-bath, to 28.

When diffused through water and strained, there remains behind a yellowish fibrous matter, which appears to be vegetable fibre but little altered. The solution deposits, by standing, a slimy substance, to which the feces owe their peculiar odour and colour. It is insoluble in water or alcohol; when heated it gives out an odour like that of ox-bile. It is scarcely affected by the alkalies; but sulphuric acid develops from it acetic acid, and the oxymuriatic acid renders it yellow.

The fluid remaining, after separation of the above slimy substance, is at first colourless, but, by exposure to the air, becomes first of a wine yellow, and then of a brown colour. When evaporated to dryness, there remains a brown matter, of a bitterish taste, insoluble in alcohol, but soluble in water. It is not precipitated by infusion of galls; it soon becomes putrid, exhaling an ammoniacal odour, and during combustion exhibits the usual characteristics of animal matter.

ter. The fixed parts, after incineration of eight ounces of the entire excrement, were as follow :

Lime	-	-	-	-	-	12.
Phosphat of lime	-	-	-	-	-	12.5
Magnesia	-	-	-	-	-	2.
Iron	-	-	-	-	-	5.
Alumine with some manganese	-	-	-	-	-	14.
Silex	-	-	-	-	-	52.
Muriat and sulphat of potash	-	-	-	-	-	1.2

The excrements of carnivorous animals have not hitherto been examined. The dung of dogs (called album Græcum) merits notice on account of its remarkable efficacy in some of the processes of leather-dressing. The great consumption of dung of all kinds is in agriculture as a manure. It is also largely employed in the construction of artificial nitre-beds. The dung of the larger domestic graminivorous quadrupeds is dried and made use of as fuel in those countries that are destitute of coal and wood; the foot arising from this combustion is the substance from which the Egyptians procure sal ammoniac by simple sublimation; and it is probable that a similar advantage might be taken of it in other countries.

FÆCHDT, in *Geography*, a river of France, which runs into the Ill, near Guemar, in the department of the Upper Rhine.

FÆCULA. See **FECULA**.

FAENZA, in *Geography*, a city of Italy, and capital of the department of the Amone, the see of a bishop, suffragan of Ravenna; anciently called *Faventia*. It was ravaged by Totila, king of the Goths, in the 6th century, and in the 13th ruined by the emperor Frederick II. because it espoused the interest of the pope; but afterwards restored by Manfredi. It afterwards fell under the power of the Venetians, the Bolognese, and, at length, under that of the church. In 1708 it was taken by the Imperialists; in 1796 by the French, and afterwards by the troops of the pope, who garrisoned it. In 1797 the pope's troops were defeated and expelled. Although it has an old fortress, it has no other defence besides a plain covered curtain with its ditch. It had formerly 15 or 16 churches, or convents. The cathedral stands in the great square, and is adorned with a handsome steeple five stories high, with balustrades. Near the church is a fountain, the basin of which is surrounded by four fine lions of brass, and encompassed with a wrought iron rail. Faenza was famous for its pottery, which took its name from that of the town. It is 20 miles S.W. of Ravenna. N. lat. 44° 18'. E. long. 11° 51'.

FÆOE, an island of Denmark, in the Baltic, near the north coast of Laland, about 12 miles in circuit, with two or three villages. N. lat. 54° 52'. E. long. 11° 20'.

FAERNO, **GABRIEL**, in *Biography*, a Latin poet and philologist, was a native of Cremona. His great learning obtained for him the employment of corrector and revisor of the books in the Vatican library. He was afterwards patronized by the cardinal de Medicis, both while he was cardinal, and when he was elevated to the popedom by the name of Pius IV. Faerno employed all his influence in support of men of worth, integrity, and learning; but he did not long enjoy the opportunity of being thus useful; he died in the prime of life, in 1561, much respected for the amiableness and simplicity of his character. His chief work, as a literary man, is entitled "*Fabularum centum ex antiquis auctoribus selectarum*." Faerno was a skilful critic, and took pains in collating the best MSS. of ancient authors. He edited the *Philippics* of Cicero and the comedies of Terence. Moreri.

FAES, **VANDER**. See **LELY**.

FÆSTING MEN. See **FASTERMANS**.

FÆSULÆ, **FIESOLI**, in *Ancient Geography*, a town of Etruria, N.E. of Florentia; whence, it is said, the Augurs passed to Rome. Catiline made it a place of arms. The Goths, when they entered Italy under the consulate of Stilicon and Aurelian, A.D. 400, were defeated near this town.

FÆTOR. See **FOETOR**.

FAFAA, in *Geography*, one of the small Friendly islands, four miles N. of Observatory point, on the coast of Tongataboo.

FAG, is used for a knot or excrescency in cloth. Stat. 4 Edw. IV. cap. 1. The *fag-end* of a piece of cloth, or linen, is that in which the weaver ends his piece, and works up his worst materials.

FAG-end, in *Sea Language*, denotes the end of any rope or cord which is become untwisted and loosened by frequent use; to prevent which, the ends of ropes are generally well-fastened by winding a piece of small line or pack-thread around them, which operation is called whipping.

FAGAGNA, in *Geography*, a town of Italy, in Friuli, eight miles W. of Udina.

FAGAN, in *Conchology*. Adanson denominates the *Arca fenelis fagan* in his Hist. Senegal.

FAGARA, in *Botany*. The name seems to be of Arabian origin, and not, as the learned professor Martyn supposes, from *فأراو*, to eat. Linn. Gen. 16c. Schreb. 80. Willd. Sp. Pl. v. 1. 666. Mart. Mill. Dict. v. 2. Juss. 374. Gært. t. 68. Bauh. Pin. 412. Ger. em. 1548. (Pterota; Brown. Jam. 146. t. 5. f. 1. Euodia; Forst. Gen. t. 7.) Class and order, *Tetrandria Monogynia*. Nat. Ord. *Dumose*, Linn. *Terebinthaceis affine*, Juss.

Gen. Ch. Cal. Perianth inferior, very small, in four deep, concave, permanent segments. Cor. Petals four, oblong, concave, equal, spreading. Stam. Filaments four, longer than the corolla; anthers ovate. Pist. Germen superior, ovate; style thread-shaped, the length of the corolla; stigma of two bluntish lobes. Peric. Capsules one, two, four, or five, ovate, of one cell and two valves. Seeds solitary, roundish, polished.

Ess. Ch. Calyx four-cleft. Petals four. Capsules superior, of two valves and one cell. Seeds solitary.

A genus of aromatic, sometimes prickly, shrubs, with ternate or pinnate leaves. Willdenow has twelve species, found in various of the warmer parts of the globe, none of them in Europe.

Linnaeus confounded with his *F. Pterota*, which is Browne's Jamaica plant, the *F. Avicenna*, Clus. Exot. 185. Lob. Ic. v. 2. 133. Lamarck Encycl. v. 2. 445, which is the original officinal one, a native of China. Lamarck saw a specimen of this last, gathered by Father d'Incarville, in Jussieu's herbarium, and corrected the above error. The qualities of this fruit are somewhat aromatic and acid, whence it was formerly thought an useful stomachic, or stimulant, but it is now entirely laid aside in practice.

FAGARA, in the *Materia Medica*, the name of a fruit resembling the cubebs found in the Philippine islands. The part of this fruit which contains the principal virtue is the outer rind; this is tender and blackish, and of an aromatic and somewhat acid taste. When the berries are ripe they easily break, and disclose a black, shining, solid kernel, void of taste and smell. The berries, according to Avicenna, are heating and drying, and good for a cold weak stomach, to help digestion, and are astringent to the bowels. They were once much used, but of late are scarce known in the shops.

FAGER-

FAGERHULT, in *Geography*, a town of Sweden, in the province of Smaland; 35 miles N.W. of Calmar.

FAGGOT, in *Agriculture*, is a bundle of any sort of small wood tied up closely together by means of a with, or other kind of ligature. They are mostly made up from the cuttings or thinnings of under-woods, coppices, and hedges, being sold in many districts to the bakers, for the purpose of heating their ovens. They usually fetch a good price in many situations, especially near large towns. In making up these bundles the workmen trim off the superfluous spreading branches from the sides and ends, which gives them a neater appearance. These trimmings are put in the middles of the faggots which are to be made up, by which they appear to greater advantage.

These trimmings are of little or no use in the faggots, and ought to be left on the ground; for being small, they would soon rot there, and would manure the ground so as to be of more advantage to the next growth than is easily imagined. The leaves of the trees falling to the earth, manure it very much; but this is nothing to the advantage of these little pieces of wood; any rotten wood, but in a moderate quantity, will turn a common bad earth into good garden mould; and the growth of the young trees is more forwarded by this manure where it is left, than by any other means that can be used to it. We always see the land where wood-stacks have stood enriched to a surprising degree by them, and the same advantage will occur wherever wood of any kind is left to moulder and rot upon the ground. That sort of small wood which is bound up in faggots is called faggot-wood, and sometimes bush-wood. Faggots for fuel are required by 43 Eliz. cap. 14, to contain in compass, besides the knot of the bond, twenty-four inches of assize; and every faggot-stick within the bond shall contain full three feet of assize, except only one stick, which is to be but one foot long, to stop or harden the binding.

FAGGOT, or *Fagot*, in *Fortification*. See **FASCINE**.

FAGGOT of Steel, expresses the quantity of 120lb. weight.

FAGGOT, in the times of Popery in these kingdoms, was a badge wore on the sleeve of the upper garment by such as had recanted and abjured what was then deemed heresy; being put on after the person had carried a faggot, by way of penance, to some appointed place of solemnity. The leaving off this badge was sometimes interpreted a sign of apostacy.

FAGGOTS, among *Military Men*, are ineffective persons who receive no regular pay, nor do any regular duty, but are hired occasionally to appear at a muster, to fill up the companies, hide the real deficiencies thereof, and cheat the king of so much pay, which goes into the officer's pocket.

FAGIANO, in *Geography*, a town of Naples, in the province of Otranto; six miles E.S.E. of Tarento.

FAGIUS, PAUL, in *Biography*, a learned German divine, was born at Reinzabern, a town in the Palatinate, in the year 1504. In the course of his education he recommended himself to the notice and esteem of his preceptors by great diligence in his studies. At a very early period he was distinguished for his proficiency in the learned languages and in the Hebrew tongue. He became intimate with Bucer, and the other celebrated reformers. At the age of twenty-three he was obliged to engage in the business of school-master, in which he acquired great reputation, but he was bent on the work of the ministry, to which he looked as the consummation of his wishes, and in 1537 he was invited by the senate of Isne to undertake the pastoral office in that town, and for several years he discharged the duties connected with it with high reputation. Here the plague

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broke out with violence, during the ravages of which he displayed a noble and benevolent spirit, by reproving the rich, who, from their apprehensions, were led to desert the poor and the afflicted; by establishing a fund for the relief of the distressed, and by engaging the magistrates to make such wise and humane regulations as contributed to lessen the horrors of that dire calamity: and it is related, to his great honour, that Fagius never quitted the scene of infection, but devoted his whole time to the service of the afflicted, personally visiting them, and affording them every relief in his power. He was, however, spared by the hand of Providence, although he saw multitudes falling on his right hand and on his left. The plague reached to Strasburg, and numbered Wolfgang Capito among its victims, whom he afterwards succeeded in the ministerial functions: and at the same time he exerted all his powers in publishing such works as eminently conduced to the promotion of the interests of religion and literature. In 1546 Frederic II., elector palatine, sent for him to Heidelberg, to conduct the measures proper to bring about a reformation of religion in his dominions, a project which, from some unfavourable circumstances, was obliged to be suspended. He returned to Strasburg, resumed his ministerial and literary employments, and assisted Bucer and Martyr in the duties of the professorship of theology. In 1548 he was obliged, by the treatment which the Protestant divines experienced from the emperor, to quit Strasburg, and he fled for safety to England with Bucer, both of whom had received pressing invitations from Cranmer, archbishop of Canterbury. They resided for some time at Lambeth, and it was intended that they should proceed from thence to Cambridge, where they were to be employed as professors, and engaged in completing a new translation of the scriptures. Fagius died, before he had made any progress in the work, in 1550, at the age of 45. During the infamous reign of Mary, his remains, and those of Bucer, were dug up and burnt, a paltry kind of revenge, and worthy of those who inflicted it. His works are chiefly theological, and connected with biblical literature. Moreri.

FAGLOE, in *Geography*, one of the Faroer islands, in the North sea.

FAGNANO, a town of Italy, in the department of the Amona; 10 miles S. of Faenza.

FAGO, a town of Spain, in Aragon; 18 miles N.W. of Iaca.

FAGONA, in *Anatomy*, a conglomerate gland, called also thymus.

FAGONIA, in *Botany*, so called by Tournefort, in compliment to Monf. Fagon, principal physician to Louis XIV. and a great patron of botany. He was one of the chief promoters of Tournefort's journey to the Levant, which he strongly and repeatedly recommended to the consideration of his sovereign. Tourn. Inst. 265. t. 141. Linn. Gen. 212. Schreb. 289. Willd. Sp. Pl. v. 2. 565. Mart. Mill. Dict. v. 2. Juss. 296. Gært. t. 113. Class and order, *Decandria Monogynia*. Nat. Ord. *Rutaceæ*, Juss.

Gen. Ch. Cal. Perianth inferior, of five lanceolate, upright, small, deciduous leaves. Cor. Petals five, alternate with the calyx, rounded, equal, with claws about as long as its leaves, the limb spreading beyond their points. Stam. Filaments ten, simple, awl-shaped, smooth, erect, longer than the claws; anthers roundish. Pist. Germen superior, with five angles; style awl-shaped, as long as the stamens; stigma simple. Peric. Capsule ovate, with five deep furrows, and as many obtuse prominent angles, of five compressed cells, and ten valves. Seeds solitary, ovate, smooth.

Ess. Ch. Calyx of five leaves. Petals five, rounded.

K

with

with claws. Stamens simple. Capsule superior, of ten valves and five cells. Seeds solitary.

1. *F. cretica*. Linn. Sp. Pl. 553. Curt. Mag. t. 241. "Spinous. Leaflets lanceolate, flat." Annual, native of Crete, best preserved in the green-house, or even stove. *Stem* often procumbent, branched, divaricated. *Leaves* opposite, ternate, stalked, dark green; leaflets all sessile, nearly equal, acute, rough-edged. *Stipulas* spinous. *Flowers* solitary, from the forks of the stem, or terminal, of an elegant purple, with yellow stamens. Linnæus compares them to those of a *Malpighia*, which they somewhat resemble, but without any real affinity.

2. *F. hispanica*. "Not spinous." Native of Spain. Biennial.

3. *F. arabica*. "Spinous. Leaflets linear, convex." Found by Shaw in Arabia, who describes it with very long prickles.

4. *F. indica*. Linn. Mant. 238. Burm. Ind. t. 34. f. 1. "Spinous. Leaves simple, oval." Gathered in Persia by Garcin. Annual, with yellow flowers.

FAGOPYRUM. See POLYGONUM.

FAGOTTINO, *Ital.* in *Musica*, a little bassoon.

FAGOTTO, the Italian name for a bassoon, is derived from the manner in which it is tied up when taken to pieces, at which time it resembles a faggot, or bundle of sticks; and its French appellation is derived from its low pitch, *Bas-son*.

FAGRÆA, in *Botany*, so named by Thunberg in honour of his friend and countryman Jonas Theodore Fagræus, M.D. whose highly complimentary and florid effusions are prefixed to the *Flora Japonica*. Thunb. Nov. Gen. part 2. 34. Act. Holm. ann. 1782. 132. t. 4. Schreb. 112. Murr. Syst. Veg. ed. 14. 198. Willd. Sp. Pl. v. 1. 830. Juss. 150. Mart. Mill. Dict. v. 2. Class and order, *Pentandria Monogynia*. Nat. Ord. *Gentiana*, Juss. and not *Apocinea*, as he and Thunberg made it.

Gen. Ch. *Cal.* Perianth inferior, of one leaf, bell-shaped, in five obtuse, rounded, imbricated, equal segments, membranous at their margin. *Cor.* of one petal, funnel-shaped; tube round, gradually dilated upward, pervious, naked at the mouth, five times as long as the calyx; limb spreading, in five elliptic-oblong, obtuse, oblique, equal segments, about one-third as long as the tube. *Stam.* Filaments five, capillary, equal, inserted into the tube, rather shorter than the limb; anthers incumbent, ovate, two-lobed, furrowed, externally convex. *Pist.* Germen superior, roundish; style simple, thread-shaped, the length of the corolla; stigma peltate, orbicular, flat. *Peric.* Berry ovate, fleshy, coated, of two cells. *Seeds* orbicular, smooth.

Ess. Ch. Calyx five-cleft. Corolla funnel-shaped; limb oblique. Berry coated, of two cells. Seeds globose. Stigma peltate.

1. *F. zeylanica*, the only known species, was gathered by Thunberg in the island of Ceylon, between Columbo and Galle. The stem is shrubby, with thick, leafy, smooth, obtusely quadrangular branches. *Leaves* opposite, crossing each other in pairs, on very short dilated foot-stalks, ovate, obtuse, entire, smooth, somewhat fleshy, a span long, and three inches wide, tapering at the base. *Stipula* small, cloven, crowning the inside of each footstalk, just above its insertion. *Flowers* terminal, three together, in a sort of umbel, with small, acute, opposite bractæas, and thick, round, fleshy, smooth stalks. Of their colour we have no account, but they are large and handsome, about three inches long, with the aspect of a *Gardenia*, to which genus Jussieu, with great appearance of probability, guessed the genus might belong, and consequently to his natural or-

der of *Rubiaceæ*. A fine specimen, however, preserved unnamed in the herbarium of the younger Linnæus, has enabled us to correct, as we hope, what has been said before us upon this subject. By this specimen the affinity of the plant to *Lisianthus* is evident. Its stipulation is like the little intrafoliaceous rim or border, observable in the larger species of that genus, which perhaps deserves the same name; but in the *Fagræa* a positive cloven intrafoliaceous stipula is visible. We cannot, however, detect much of a bitter taste in this plant, nor is that flavour strong in *Lisianthus*. S.

FAGUS, from φαγω, to eat, because its fruit, or at least that of an oak which bore the same name, is supposed to have made a part of the food of mankind in the early ages of the world. Linn. Gen. 496. Schreb. 647. Willd. Sp. Pl. v. 4. 459. Mart. Mill. Dict. v. 2. Sm. Fl. Brit. 1027. Juss. 409. Gært. t. 37. (Castanea; Tourn. t. 352. Gært. t. 37. Willd. Sp. Pl. v. 4. 460.) Class and order, *Monocæcia Polyandria*. Nat. Ord. *Amentaceæ*, Linn. Juss.

Gen. Ch. Male *Cal.* Perianth bell-shaped, in five, six or seven deep, equal, acute segments. *Cor.* none. *Stam.* Filaments from five to twelve or more, capillary, longer than the calyx; anthers ovate-oblong, vertical, of two cells, bursting longitudinally.—Female *Cal.* Involucrum of one leaf, in four deep, acute, externally mucronated segments, containing two or three flowers, permanent; perianth (according to Gærtner) superior, of five or six small, linear, equal, withering leaves. *Cor.* none. *Pist.* Germen somewhat triangular, of three or six cells, with the rudiments of two seeds in each; style short, in three or six deep divisions; stigmas simple, oblong. *Peric.* none, except the enlarged, thick, prickly involucrum. *Seeds* two or three, ovate or triangular, pointed, coriaceous.

Ess. Ch. Male, Calyx bell-shaped, five-cleft. Corolla none. Stamens five to twenty. Female, Calyx four-cleft. Corolla none. Styles in three or six deep divisions. Nuts two or three, invested with the leathery prickly calyx.

Obs. Some authors separate *Castanea* from *Fagus*, chiefly because the male flowers in the former are disposed in a spurious sort of catkin, but it is by no means a "naked catkin," neither can the same part be termed corolla in this instance and calyx in the other. See the various writers quoted above.

The species are five.

1. *F. Castanea*. Chestnut. Linn. Sp. Pl. 1416. Engl. Bot. t. 886. (Castanea vesca; Gært. v. 1. 181. Willd. Sp. Pl. v. 4. 460.) "Leaves lanceolate, sharply serrated, smooth beneath. Prickles of the fruit compound and entangled."—Native of the warmer, rather mountainous parts of Europe, where it often composes large forests. It is one of the largest and most long-lived of European trees, sometimes enduring more than a thousand years. The name *Castanea*, whence come all its modern appellations, is said to be derived from Καστανί, a town in Thessaly, the neighbourhood of which abounded with these trees. The timber is extremely durable, at least under cover: the foliage umbrageous, rich and beautiful. In the landscapes of Salvator Rosa chestnut trees are very conspicuous, but most painters prefer the oak for beauty. The nuts produced in England are much smaller than in Spain or Italy. They are used in those countries as a substitute for flour, in bread or puddings, but chiefly by the poor.—The bark of the trunk abounds in deep reticulated fissures. *Leaves* alternate, stalked, six or eight inches long, veiny, smooth and shining, with numerous sharp shallow serratures. *Flowers* in long pendulous yellowish spikes; the males unpleasantly scented;

ed; produced in May. The fruit ripens rather late in autumn.

2. *F. pumila*. Chinquapin. Linn. Sp. Pl. 1416. Sm. Inf. of Georgia, t. 57. Leaves lanceolate, sharply serrated, downy beneath. Prickles of the fruit simple and straight.—Native of North America, from Maryland to Florida. A tree scarcely above fourteen feet high, known by the white backs of its leaves. The nuts are eatable.

3. *F. sylvatica*. Beech. Linn. Sp. Pl. 1416. Engl. Bot. t. 1846.—Leaves ovate, obsolete ferrated, smooth. Prickles of the fruit simple, wavy.—Common in Europe, especially on a rich calcareous soil, blossoming in April or May. Grasses do not thrive beneath its shade, but several of the *Orchideæ* are there in perfection. The wood is hard, but neither tough nor lasting in the open air. This tree makes excellent cut hedges for shelter, as the leaves remain, though faded, through the winter, and the twisted branches form a very firm fence. The nuts, called Beech Mast, are eaten by hogs. An oil has been extracted from them, which is sweet, and Hill the poet had a project for bringing it into general use for several purposes, but his scheme failed. The leaves are alternate, spreading, about two inches long, ovate, wavy rather than serrated, shining, finely fringed. Flowers in ovate, long-stalked, hairy heads, the males lateral, the females terminal. Nuts with sharp dilated angles, the prickles of their coats simple and pliant.—The purple-leaved beech is a variety.

4. *F. ferruginea*. American Beech. Ait. Hort. Kew. v. 3. 362. Sm. Inf. of Georgia, t. 75. "Leaves ovate, pointed, downy beneath, widely serrated."—Native of North America. Messrs. Lee and Kennedy are recorded as having introduced it into our gardens in 1766. Leaves broader, and much more distinctly serrated than in the last. Fruit smaller, tawny.

5. *F. antarctica*. Antarctic Beech. G. Forst. Magell. 32. Willd. Sp. Pl. v. 4. 460.—Leaves ovate, smooth, doubly and obtusely serrated, reticulated with veins.—Native of Terra del Fuego. A shrub, with spreading irregular branches. Leaves scarcely an inch long, ovate, mostly obtuse, thick and rigid, smooth, doubly and bluntly serrated, reticulated with innumerable veins; their base running down into the footstalk. Flower-stalks scattered, above an inch long, single-flowered. Calyx reddish. Anthers long and narrow. Fruit unknown. The young branches are downy, and young leaves glutinous.—We suspect that the *Betula antarctica* of Solander, enumerated by G. Forster, among others from the Banksian herbarium, at the end of his paper on Magellanic plants, is no other than this *Fagus*. His *Celastrus venustus* we know to be our *Escallonia ferrata*. See ESCALLONIA.

FAGUS, in Gardening, contains plants of the tree kind, of which the species cultivated are; the common beech-tree (*F. sylvatica*); the common chestnut-tree (*F. castanea*); and the dwarf chestnut-tree, or Chinquapin (*F. pumila*.)

It is remarked by Martyn, that some suppose there are two species of the common beech tree, the mountain beech, and the wild beech; "the first of which has a whiter wood than the second; but that this difference arises only from the soil."

The nurseries have two varieties, one with yellow, and the other with white-striped leaves. And in Germany there is another variety common with dark red leaves, which is called the purple beech. In woods there is likewise a sort with a rougher bark, which is termed hay beech by woodmen in general.

And of the second sort there is a variety cultivated with gold-striped leaves, which is very ornamental.

Method of Culture.—These trees are capable of being increased without much difficulty in the methods described below.

Modes of Culture in the Beech kind.—These are easily raised by sowing the well-ripened seed, or mast, on beds of fine mould prepared for the purpose, either in the early autumnal or spring season, in slight drills, or broadcast, covering them well in by raking. When the plants come up they should be kept perfectly clear from weeds, and, after two years' growth, be planted out in nursery rows, two feet, or two feet and a half apart, and from a foot to eighteen or twenty inches distant in the rows; in which situation they should be kept properly cleared from weeds, and have the intervals of the ground well dug over annually, in the autumn or very early spring. Some advise cutting the roots under with a sharp spade at the depth of four or five inches once or twice while in the seed-bed. When they have attained the growth of four or five feet in height, they are proper for being planted out in plantations, shrubberies, and other places, where they are to grow for ornament or timber.

The varieties with striped leaves are to be continued by budding or grafting on common beech stocks, taking care not to plant them where the soil is of the very rich kind.

Modes of Culture in the Chestnut kind.—These trees are capable of being increased by sowing or planting the nuts, which have been well ripened here, or such as have been brought from abroad, without being dried in kilns, in the early spring, on beds of fresh earth, in drills two or three inches deep, and about a foot asunder, placing them three or four inches distant, and covering them well in. When the plants appear, they should be kept clear from weeds, and, after they have had two years' growth in these beds, they should be removed into nursery rows in the beginning of autumn, being planted two feet and a half from row to row, and from one to two feet distant in the rows, great care being taken not to injure their roots in taking them up, unless they happen to have tap roots, which must be cut off in a careful manner.

After they have remained in this nursery four or five years, and have been kept perfectly free from weeds, by hoeing or slightly digging over the intervals between the rows, they will be in a proper state for being finally planted out as ornamental fruit, or forest trees. When they are intended to be planted for the fruit, they should be more frequently transplanted before they are finally set out where they are to grow, but they are not of much importance in this view, as the fruit does not always ripen well in this part of the country.

The varieties with variegated or blotched leaves must be continued by budding or inarching them on stocks of the common kind, which answer perfectly well.

And the third sort may be raised in the same manner from nuts brought in sand from America, and have the same method of culture afterwards as the others.

The first sort is frequently made use of as timber-trees, and in forming hedges, and the others as ornamental trees in lawns, elumps, borders, and other parts of pleasure-grounds, where they have a fine effect. They succeed on almost any soil, but the best on those of the loamy kind. They form good fences on the borders of the sea in many situations, as well as for protection or shelter in gardens and other places.

FAGUTAL, in *Mythology*, a temple of Jupiter, so called from *figus*, the beech, a tree sacred to Jupiter; because, as some say, the temple was erected in the neighbourhood of a forest of beech; and on this account they say that

part of mount Esquiline, which was formerly called Mons Appius, was afterwards called fagutalis; and that Jupiter Fagutalis was the same with Jupiter of Dodona.

FAHACA, in *Ichthyology*; the Arabians call the Tetrodon lineatus by this name, according to Hasselquist.

FAHALFAHARA, in *Geography*, a town of Persia, in the province of Mecran; 100 miles N. W. of Kidge.

FAHAU, one of the Carolina, or New Phillipine islands, in the Pacific ocean.

FAHLERZ, in *Mineralogy*, is an ore of copper, which see.

FAHLUN, in *Geography*, a town of Sweden, in the province of Dalecarlia, situated in the midst of rocks and hills, between the two large lakes of Run and Warpen, and containing 1200 houses, and, including the miners, 7000 inhabitants. Excepting two churches of brick, roofed with copper, and a few other houses of the same materials, the buildings are principally of wood and of stone. This town owes its celebrity to the copper mine on its eastern side. The great antiquity of this mine is proved by the earliest records of Sweden, and particularly in the charter of Magnus Smek, which renews its privileges, and considers it as existing from time immemorial; hence we may fairly conclude that it must have been worked eight or nine hundred years. The mine is private property, and consists of 1200 shares, each worth 150 rix-dollars (37*l.* 10*s.*) The ore is divided four times a week into 11 equal heaps, eight of which are distributed among eight of the proprietors, and the remaining three are sold by auction; one of which is appropriated to the repairs of the works, another to pay the salaries of the miners and other workmen, and the third, which formerly belonged to the king, is now employed in defraying the expence of new excavations. In this manner the ore is equally divided, until all the proprietors have had their respective shares; and then the rotation begins again. The copper of this mine is not found in veins, but in masses, and the bed does not extend an English mile in circumference. The matrix of the ore, or rock, is the Saxum of Linnæus and pyrites of iron. The richest part of the ore may perhaps yield 20 per cent. of copper; but as the poor and rich parts are blended, they give only two per cent. when first brought from the mine, and 12 per cent. when once smelted. Twelve hundred workmen are employed, 600 miners, and the same number in roasting and smelting the ore, making charcoal, and other works above ground. The mouth, or opening of the mine, is perhaps the largest in the world, being 1200 feet in diameter, or near $\frac{1}{2}$ of an English mile in circumference. The descent is by steps cut in the rock, and sloping so gently that horses may be employed in bringing up the ore. The galleries are from six to 10 feet high, and sufficiently spacious. The perpendicular depth of the mine from the top of the chasm is 1020 feet. *Coxe's Travels*, vol. v.

FAHNELEN, **FANELEN**, or *Fanklen*, among the Germans, a kind of greater fiefs which the emperor alone could confer.

This was done by the delivery of a standard, whence they had the name of fahnelen; *i. e.* *feuda vexilli*. We find them mentioned in the golden bull of the emperor Charles IV. ann 1356: "Feudis principum exceptis, & illis quæ vanhelen vulgariter appellatur, quorum investituram & collationem soli imperatori, vel regi Romano specialiter reservamus." *Du-Cange Gloss. Lat. in voc.*

The word is more usually written *fahnlehn*.

FAHR, in *Geography*, a town of Germany, in the principality of Wurzburg, five miles S. S. W. of Gemunden.

FAHRAG, a town of Persia, in the province of Faristan; 180 miles N. E. of Schiras.

FAHRENHEIT, **GABRIEL DANIEL**, in *Biography*, a native of Hamburg, known for the thermometer which is graduated according to a standard invented by himself. The time of his birth and that of his death are not accurately known. About the year 1720 the improvement in thermometers, of using mercury instead of spirit of wine, was brought into use, and in 1724 Fahrenheit published "A dissertation on Thermometers." The scale he employed is chiefly used in this country, and in this, the freezing point is marked 32°, and the boiling point 212°, and the interval between these points is divided into 180 equal parts, the remainder of the tube, below 32° and above 212°, is divided into similar parts as far as it extends. From 0 or zero, below the freezing point, the degrees are marked — or minus. Thus mercury freezes and becomes solid and malleable at —40° or at 72° below the freezing, a degree of cold never experienced naturally but in the very northernmost parts of the world. See THERMOMETER, FREEZING-MIXTURE. *Nouv. Hist. Dict.*

FAHRLAND, a town of Germany, in the New Mark of Brandenburg; four miles N. of Potsdam.

FAID, or **FEID**, a town of Arabia, in the province of Nedsjed, 120 miles N. E. of Hagar. N. lat. 26° 54'. E. long. 40° 30'.

FAIDA, in our *Old Writers*, is used for malice or deadly feud. *Leg. Hen. I. cap. 88.*

FAIDIT, **ANSELM**, or **GAUSELM**, in *Biography*, a Troubadour, who had been much esteemed by our Richard when he was count of Poitou, and resided at the court of Provence during the life of his father Henry II. and who accompanied him to Palestine, in the holy war, and has left a poem on the death of his benefactor, which we found in the Vatican, among the MSS. bequeathed to that library by the queen of Sweden, No. 1659, with the original music, by the bard himself, who was as much admired by his contemporaries for setting his poems to music, as writing them: having been said, in the old language of Provence, to have composed de bons mots, & de bons sons, good words, and good tunes. He seduced from a convent at Aix, and married, a beautiful nun, with whom he travelled on foot from one court to another, many years. This lady, besides her personal charms and accomplishments, had a remarkable fine voice, and was much admired for singing her husband's songs. The melody to the verses on the death of Richard is the most ancient which we have been able to find to Provençal words.

FAIDO, in *Geography*, a town of Switzerland, in the canton of Uri, situated on the Tesino; it is the residence of a bailiff, who remains in office four years with almost unlimited power; 12 miles N. of Bellinzona.

FAIFO, or **FAIFO**, a sea-port town of Cochinchina, situated in a bay of the Chinese sea. It is a place of great trade, and has an annual fair, which continues about four months. N. lat. 15° 50'. E. long. 108° 10'.

FAILDA, a town of Portugal, in the province of Trasilos Montes; seven miles S. of Braganza.

FAILIS, in *Lexicology*, a French term, denoting some failure or flaw in an ordinary, as if it were broken, and a splinter taken from it.

FAILS, in *Mining*, are short flat pieces of wood, laid on the cross pieces or stemples, across a vein, for forming a floor, on which to lay the refuse of the mine, or for making a gate or gang-way, &c.

FAILURE, or **FAILING**, a species of bankruptcy, particularly called breaking or stopping payment.

FAILURE of Record, in Law, is used when an action is brought against a man who alleges in his plea matter of record in bar of the action, and endeavours to prove it by the record. The plaintiff replies, *nul tiel record*; that is, he denies there is any such record. Upon which the defendant has a day given him by the court to bring it in; and if he fails to do it, he is said to fail of his record, and the plaintiff shall have judgment to recover. *Terms de Ley.*

FAILURE of the Strata, in Geology, is a term which Mr. Kirwan uses (*Geol. Ess.* p. 162) seemingly to denote the sinking down or depression of masses of strata; in which sense it answers to the effect produced by a *fault*; see that article.

FAINT, or FAINT-ACTION, in Law, is as much as *feigned action*; that is, such an action as, though the words of the writ be true, yet, for certain causes, the party has no title to recover thereby. By which it differs from falsification, which is that where the words of the writ are false. Yet sometimes the two are confounded.

FAINT Pleading, a fraudulent, false, or evasive manner of pleading, to the deceit of a third person; against which, among other things, was made the statute 3 Edw. I. cap. 29.

FAINTS, in the Distillery, the weak spirituous liquor that runs from the still in rectifying the low wines after the proof spirit is run off.

FAINTS denote also the last runnings of all spirits distilled by the alembic. The clearing the worm of these is so essential a point in order to the obtaining a pure spirit by the succeeding distillation, that all others are fruitless without it.

FAINTING. See *SYNCOPE*.

FAIOM. See *FAYOUM*.

FAIR, a public place, where merchants, traders, and other persons, from divers parts, meet on some fixed day in the year, to buy and sell commodities, and to partake of the diversions usually accompanying such assemblies: or it denotes the concourse of persons assembled on such occasions. See *MARKET*.

The word fair is formed of the French *foire*, which signifies the same thing; and *foire foire* derive from the Latin *forum, market*; others from the Latin *feria*, because fairs were anciently always held in the places where the wakes, or feasts, of the dedications of churches, called *feria*, were also held; and because it is incident to a fair, that persons shall be privileged from being molested or arrested in it, for any other debt or contract than what was engaged for in the same. (See stat. 17 Ed. IV. c. 2. made perpetual by 1 R. III. c. 6. See also stat. 2 Ed. III. c. 15. 5 Ed. III. c. 5. 27 Hen. VI. c. 5. 1 & 2 P. & M. c. 7. 13 Eliz. c. 21.) The Romans called them *nundinae*. Eric Puteanus has a pretty little treatise on the fairs of the Romans, "De Nundinis Romanorum," which he calls *nova fustorum facula*.

Fairs can only be established by virtue of the king's grant, or by long and immemorial usage and prescription, which supposes such a grant (2 Inst. 220. 3 Mod. 123); he is also the sole judge where fairs and markets ought to be kept; and if any person set up a fair without the king's authority, a *quo warranto* lies against him; and the persons who frequent such fairs, &c. may be punished by fine to the king. Fairs are generally kept once or twice in the year; and it has been observed, that, as they were first occasioned by the resort of people to the feast of dedication, they are kept, in most places, on the same day with the wake or festival of that saint to whom the church was dedicated; and for the same reason they were held in the churchyard, till restrained by stat. 13 Ed. II. ft. 2. c. 6. (2 Inst.

221. Blount.) The reason of their being held near some cathedral, church, or monastery, on the anniversary dedication of the church, or on the festival of the saint to whom it was dedicated, seems to have been as follows. When bishops and abbots observed that crowds of people assembled from all places to celebrate the festivals of their patron saints, they took advantage of this circumstance, and applied to the crown for charters to hold fairs at those times, for the accommodation of strangers, and with a view to increase their own revenues by the tolls which their charters authorized them to levy at these fairs. Hence the multitude of attendants increased, some of whom were actuated by religious, and others by commercial views. Many precautions were taken to preserve good order, and to prevent theft and cheating in these ecclesiastico-commercial fairs, some of which are not a little singular. When a fair was held within the precincts of a cathedral or monastery, it was not uncommon to oblige every man to take an oath at the gate, before he was admitted, that he would neither lie, nor steal, nor cheat, while he continued at the fair. (Murator. t. 2. Dissert. 30.) Many of these ecclesiastical fairs are still kept in all Popish countries; and many of our own fairs are still held on the same saint's days to whose honour they were originally instituted. Every fair is subject to the regulation of the court of piepowder. The duration of fairs is determined by proclamation, by stat. 2 Ed. III. c. 15; and if a person shall sell any goods after the time of the fair expires, he shall incur a forfeiture of double the value of the goods sold, one-fourth to the prosecutor, and the rest to the king. (5 Ed. III. c. 5.) Any citizen of London may carry his goods to any fair or market in England at his pleasure. (See stat. 3 Hen. VII. c. 9.) If any person is intitled to hold a fair or market, and another is set up within the distance of a third part of twenty miles, either on the same day, or a different day, it is a nuisance, and an action on the case lies; and also against persons disturbing such as are coming to buy or sell in the fair or market, so that the person holding the fair, &c. loses his toll, (see *TOLL*;) or receives prejudice in the profits arising from it. (2 Rol. Abr. 140. 2 Saund. 172. 1 Mod. 69. 1 Rol. Abr. 106. 2 Vent. 26. 28.)

Owners and governors of fairs are to take care that every thing be sold according to just weight and measure; for which purpose they may appoint a clerk of the fair or market, who is to mark and allow all such weights, and to take his reasonable and just fees. (4 Inst. 274. Moor. 523. 1 Salk. 327.) Fairs and markets are forfeitable franchises; and if the owners of them hold them contrary to their charter, as by continuing them longer than the charter admits, by disuse, and by extorting fees and duties where none are due, or more than are justly due. (2 Inst. 220. Finch 164. 3 Mod. 103.) As to their interest, it arises chiefly from tolls. See *TOLL*.

Fairs abroad are either free, or charged with tolls and impositions. The privileges of free fairs consist chiefly, 1. In that all traders, &c. whether natives or foreigners, are allowed to enter the place, and are under the royal safeguard and protection in coming and returning, they and their agents, with their goods, &c. 2. In that the said persons, and their effects, are exempt from all duties, impositions, tolls, and servitudes. 3. That merchants in going to, or returning from, the fair, &c. cannot be arrested, or their goods stopped, &c. It is the sovereign alone that has a right, by his letters patent, to establish fairs, whether free, or subject to duties, and the other ordinary laws and penalties.

Several fairs are held in the open fields, or on heaths and commons,

commons, under tents, booths, and barracks, erected for the purpose; as Stourbridge-fair, &c. others in places walled in for the purpose, and formed into regular streets, lanes, &c. for the occasion; as the fair of St. Laurence at Paris. Lastly, others are held in the open places and streets of cities; as Bristol-fair, the fair of St. Germain, &c.

Fairs, particularly free fairs, make a very considerable article in the commerce of Europe, especially that of the Mediterranean or inland parts; as Germany, &c. where the continual passage and re-passage of vessels are impracticable.

The most celebrated fairs in Europe are those: 1. Of Francfort, held twice a year, in spring and autumn; the first commencing the Sunday before Palm-Sunday, and the other in September. Each is declared by sound of bell, and lasts three weeks; the first of which is called the week of acceptance, and the second the week of payment; though many bills of exchange are now payable in the third week, but this must be mentioned, because every bill payable in the fair is, without such a clause, deemed payable in the second week. They are famous for the sale of all kinds of commodities, but particularly an immense quantity of curious books, no where else to be found; and from whence the bookfellers throughout all Europe used to furnish themselves. Before each fair there is a catalogue of all the books to be sold at it, printed and dispersed, to call together purchasers, though the learned have generally complained of divers unfair practices therein, as fictitious titles, names of books purely imaginary, &c. beside great faults in the names of the authors, and the titles of the real books. 2. The fairs of Leipzig, which are held thrice a year; one beginning on the first of January, another three weeks after Easter, and a third after Michaelmas; they last twelve days each, and are, at least, as considerable as those of Francfort. 3. The fairs of Novi, a little city in the Milanese, under the dominion of the republic of Genoa. There are four of these in the year; commencing on the first of February, the second of May, the first of August, and second of November. Though the commodities bought and sold here be very considerable, yet, what chiefly contributes to render them so famous is the vast concourse of the most considerable merchants and negociants of the neighbouring kingdoms, for transacting affairs, and settling accounts in matters of bank and exchange. Each of these usually lasts eight days. 4. The fairs of Riga, whereof there are two in the year; one in May, and the other in September. They are much frequented by the English, Dutch, and French ships; as also by others from all parts of the Baltic. The best time for the sale of goods at Riga is during the fairs. Since the building of the famous city of Petersburg, these fairs have suffered some diminution. 5. The fair of Archangel; during which, all the trade foreigners have with that city is managed. It continues a month, or six weeks at most; commencing from the middle of August. The Muscovite merchants attend here, from all parts of that vast empire; and the English, Dutch, French, Swedish, Danish, and other ships in the port of that city, on this occasion, ordinarily amount to three hundred. But this is no free fair, as the rest are: the duties of exportation and importation are very strictly paid, and on a very high footing. 6. The fair of St. Germain, one of the suburbs of Paris, commencing on the third of February, and holding till Easter; though it is only free for the first fifteen days. It is frequented by traders with various sorts of cloths and stuffs; and the goldsmiths, jewellers, and toy-men of Paris, have well furnished and hand-

some shops in it. 7. The fairs of Lyons, which Mons. Du Chesne, in his "Antiquity of Cities," would insinuate, from a passage in Strabo, were established by the Romans; though it is certain, the fairs, as they now stand, are of a much later date. There are four in the year, each lasting twenty days, and free for ever. They begin on the first Monday after Low Sunday, the fourth of August, the third of November, and the first Monday after Easter. 8. Fair of Guibray, a suburb of the city of Falaise, in the Lower Normandy. It is said to have been established by our William the Conqueror, in consideration of his being born at Falaise. It commences on the sixteenth of August, and lasts fifteen days; free by charter, and longer by custom. 9. Fair of Beaucaire, held partly in a city of that name, in Languedoc, and partly in the open country, under tents, &c. It commences on the twenty-second of July, and only continues for three days; yet it is the greatest, and most celebrated, of all the fairs in that part of Europe, both for the concourse of strangers from all parts of the world, and for the traffic of all kinds of goods: the money returned, in these three days, amounting sometimes to above six millions of livres. Besides these, there are, or there were, before the late revolution, in France, several other fairs of considerable note; as the four fairs of Rheims, the two of Rouen, two of Bourdeaux, two of Troyes, two of St. Dennis, that of Caen, of Dieppe, and of Toulon, &c.

The fairs of Porto-Bello, Vera-Cruz, and the Havannah, are the most considerable of all those in the Spanish West Indies. The two first last as long as the flota and galleons continue in those parts; and the last is opened as soon as the flota, or galleons, arrive there, upon their return for Spain; this being the place where the two fleets join.

The principal fairs in Great Britain are, Stourbridge-fair, near Cambridge; the two fairs of Bristol; that of Exeter, West Chester, Edinburgh, Weyhill, and Burford fairs, for sheep; Paucrafts fair, in Staffordshire, for saddle-horses; Barnet fair, near London, for lean and Welsh black cattle; St. Faith's, in Norfolk, for Scots runts; Yarmouth fishing fair for herrings; Ipswich butter fair; that of Woodborough Hill, near Blandford in Dorsetshire, famous for west-country manufactures, Devonshire kerseys, Wiltshire druggets, &c. two cheese-fairs at Atherston and Chipping Norton; besides many more fairs and weekly markets in different parts of the kingdom. See MARKET.

FAIR, in *Sea Language*, is used for the disposition of the wind, when it is favourable to a ship's course, in opposition to that which is contrary or foul. The term fair is more comprehensive than large, and includes about sixteen or eighteen points of the compass; whereas large is confined to the beam or quarter, that is, to a wind which crosses the keel at right angles, or obliquely from the stern, but never to one right a-stern. Falconer's Marine Dict.

FAIR-Way, the path or channel of a narrow bay, river, or haven, in which ships usually advance in their passage up and down; so that if any vessels are anchored therein, they are said to lie in the fair-way. Falconer.

FAIR-Curve, in *Ship Building*, is a winding line, used in delineating ships, whose shape is varied, according to the part of the ship which it is intended to describe.

FAIR Maids of Kent, in *Gardening*, a common name given to a species of ranunculus. See RANUNCULUS.

FAIR-Foreland, or *Vogel-Hook*, in *Geography*, the N.W. point of Prince Charles's island, in the Northern ocean; N. lat. 78° 52'.

FAIR Island, or *Fara*, an island in the North sea, lying

lying between Shetland and Orkney, 24 miles from the former, and 30 from the latter. It is more than three miles from north-east to south-west, and nearly two miles in breadth, consisting of high and barren rocks, which are interspersed with some sheep pastures. It has two harbours for small boats, and contains about 160 inhabitants, who chiefly subsist by fishing. On the coast of this island the duke of Medina Sidonia, commander of the Spanish Armada, was shipwrecked, A. D. 1588.

FAIR River, a river of Canada, which runs from Wapafaga to lake St. John.

FAIR Pleading, in Law. See *BEAU-pleader*.

FAIR Ape, in Zoology. See *SIMIA Argentata*.

FAIRFAX, ROBERT, doctor in music, in *Biography*, an eminent English composer during the reigns of Henry VII. and Henry VIII. He had his doctor's degree at Cambridge, and was incorporated at Oxford in the year 1511. He was of the Yorkshire family of Fairfax, and a very valuable musical MS. is preserved which once appertained to the subject of this article, and was afterwards in the possession of general Fairfax, upon whose demise it made a part of the Thoresby collection, at the sale of which it was purchased by John White, the Quaker, of Newgate street, who exclusively dealt in straw hats for ladies. He was a great collector of scarce and curious things of all kinds, among which the music book of Dr. Fairfax was a rarity, with the loan of which we were obligingly indulged. It consists of a collection of the most ancient English songs, to which the music has been preserved. The writing is very clear and intelligible for the period when it was transcribed, though the time of the musical characters, from the want of bars, and the use of ligatures and prolation, with a mixture of red notes for diminution, is sometimes difficult to ascertain. We scored the whole of this curious MS. by which we were enabled to judge of the progress which had been made in secular music by our countrymen, at the beginning of the 16th century; which, to say the truth, was not very great; the leading and fundamental laws of harmony were not violated; 5ths and 8ths in succession were sedulously avoided; but there appear no design, no grace, invention, or melody. The composers of these songs are William of Newark, — Sheryngham, Edmund Turges, Tutor, or Tudor, Gilbert Banister, — Browne, Richard Davy, William Cornyshe, junior, sir Thomas Phelyppes, and Robert Fairfax. But little is known now concerning these musicians, except that Turges is a name which occurs among the musicians of Henry VI. Tudor was author of several compositions in the music book of prince Henry, afterwards Henry VIII. Cornyshe was of Henry VII.'s chapel; and Fairfax was admitted to a doctor's degree in music, at Cambridge; but as he is not styled doctor in this MS. we may reasonably suppose his compositions in it to have been anterior to his receiving that honour in the university.

Most of these musicians seem to have been merely secular composers, as we have met with none of their names, except that of Fairfax, among those for the church. The music of these ditties is somewhat uncouth; yet it is still better than the poetry: but this may be accounted for, by the frequent changes of our national language, which was never seriously cultivated till the reign of queen Elizabeth. The Saxons, who possessed the Britons of the greatest part of the island, we find, from Bede's account of Cædmon, had poetry, though not rhyme, in the seventh century; for he repeatedly calls the compositions of Cædmon carmina, poemata, and in one place versus. No traces, however, of rhyme, or metre, can be found in our language, till some

years after the conquest, at which time French was forced upon us, and till the reign of Edward III. it was the practice in all schools to contrive Latin into Norman French; a language which was fashionable at our court, even before the time of William the Conqueror; as Edward the Confessor, who had been brought up in the court of Normandy, encouraged many Normans to follow him into England.

In the thirty-sixth year of Edward III., however, a law was made, "That all pleas in the court of the king, or of any other lord, shall be pleaded and adjudged in the English tongue; and the reason recited in the preamble was, that the French tongue was too much unknown." And yet for near sixty years afterwards the proceedings in parliament appear to have been in French.

The English of Robert of Gloucester, who flourished about 1265, during the reigns of Henry III. and Edward I., is more Saxon than Norman; however, it would not be very difficult to read, if the characters in which it is printed had been those in present use, instead of Saxon, with which it abounds. The language of Trevisa, 1385, is not very unintelligible, if the \bar{x} be regarded as a g , for which we believe it was originally meant. About the first year of Henry VI., 1422, French and English seem pretty equally balanced, and to have been used indifferently; however, very little improvement was made in our language and verification from the time of Edward IV. to that of Henry VIII. Indeed, few English songs are to be found which were set to original music during that period; it having been the fashion for the great to sing none but French words, as appears by the music book of Prince Henry, son of Henry VII., in which all the songs are in French, Italian, or Latin.

It was so much the custom for our old poets to write new words to old tunes, that there was little business for a composer. These tunes, like those of the Improvatori of Italy at present, being very simple, and little more airy than the chants of the church, required no teaching, and were an easy and ready vehicle for the bard who wished to get at the heart of his audience, or at least to engage its attention by the blandishments of his own art, not those of another. For metrical romances, and historical ballads of great length, this kind of plain and familiar melody was best adapted; as it had scarce any other effect than just to render the tone of the narrator's voice a little longer and louder, and consequently more articulate and distinct than in common speech.

FAIRFAX, EDWARD, an English poet, was son of sir Thomas Fairfax, of Denton, in Yorkshire; by some writers he has been represented as illegitimate, but later biographers, upon apparently good authority, have refuted the assertion. His education was liberal, and his literary acquirements very considerable. He entered into no profession, but is supposed to have rendered himself useful to his brother lord Fairfax, by the education of his children, and in the management of his estate. He published a work on "Demology," in which he treats on witchcraft, and shews that he was not free from the credulity and superstition of the age in which he lived. He is known as a poet by a translation of "Tasso's Godfrey of Bouillon," which was dedicated to queen Elizabeth, in the year 1600. The translation is given in stanzas of eight lines, and he rendered the original line by line. Mr. Fairfax wrote a history of Edward the Black Prince, and some eclogues; of the first, nothing is known, and of the others, only the fourth, which was printed in the "Muse's Library," 1737. He died about the year 1632, leaving behind him a son named William, who translated Diogenes Laertius. *Biog. Brit.*

FAIRFAX, THOMAS, lord, general of the Parliament's army in the civil wars of Charles I. was eldest son of Ferdinando lord Fairfax, and born in 1611. He was educated at St. John's college, Cambridge; from thence he went to Holland, and served as a volunteer with the English troops under Horatio lord Vere, with whom he was at the taking of Bois-le-Duc. On his return he retired to the country, and married the daughter of lord Vere, by whom he was afterwards instigated to take a decided part against the royalists. When actual hostilities broke out, he was made general of the horse under his father. At first they sustained several signal defeats. Their valour, enterprise, and zeal were, however, very conspicuous, and when the army was new-modelled, Fairfax was unanimously appointed to succeed the earl of Essex as general; and in the year 1645, when the two parties met at Naseby, he gained a complete and most decisive victory over the royal army. It was his character to be animated, during action, with a spirit which did not seem to belong to his ordinary temper, and which rose to enthusiasm. He pursued his success with vigour, and was every where triumphant, and, to his honour it is spoken, he uniformly conducted himself with humanity, and exhibited a studious concern for the interests of literature, so that on the surrender of Oxford he diligently preserved the Bodleian library and other places from pillage. It is recorded, that the university suffered vastly less from the rebels, as they were then called, than from the royalists.

After this Fairfax joined the army agitators, advanced to London, and joined in the restoration of the seceding members, which destroyed all parliamentary independence. He behaved with respect towards the king, and seemed desirous of restoring him to the throne; nevertheless he concurred in the declaration of the army to support the vote of the commons for no farther addresses or application to him. He succeeded his father, in March 1648, in his titles, and thus united the hereditary dignity of the peerage with the honours which he had acquired by his bravery. He now refused his arms, and acted with his usual vigour. He was engaged in the siege of Colechester, which had been occupied by the insurgents; this place held out eleven weeks, when it surrendered without conditions. On this occasion lord Fairfax, contrary to his general character, ordered two brave men, sir Charles Lucas and sir George Lisle, whom he considered as soldiers of fortune, to be shot. Returning to London, he took up his quarters at Whitehall, and prepared the way, by over-awing and purging the parliament, for the king's trial. He was among the first of those nominated for the king's judges, but he refused to act, and it was expected he would have interfered to prevent the execution, but it was said that he was kept back in prayer and conference at major Harrison's apartments till the fatal blow was struck. To soothe his resentment he was appointed general in chief of the forces in England and Ireland; and under this commission he suppressed the levellers, who were become formidable in Oxfordshire. In 1650 the Scottish nation declared for Charles II. when it was determined to make war upon that country, and Fairfax was looked to for this purpose, but chose rather to lay down his arms, and retired into the country with a pension of 500*l.* per annum. At the eve of the restoration he determined to make his peace with the exiled king, and was at the head of the committee appointed to wait upon him at the Hague, to invite him to return and resume his office. He was well received, and having performed the commission entrusted to him, he retired into the country, where he died, in 1671, in the sixtieth year of his age. Lord Fairfax was of a manly aspect,

gloomy but gentle in his disposition, sincere, open, disinterested, liberal in his sentiments, a lover and patron of learning, but possessing moderate talents, and unfit for taking a lead in any affairs but those of the army. *Biog. Brit.*

FAIRFAX, in *Geography*, a county of Virginia, in America, about 25 miles long, and 18 broad, on the W. bank of Potowmack river. It contains 7239 free inhabitants, and 6078 slaves; the chief town is Alexandria. The court-house, which has a post-office, is 14 miles from Washington.—Also, a post-town in Franklin county, Vermont, E. of Georgia, and on the bank of the river La Moille, containing 786 inhabitants; about nine miles from lake Champlain.

FAIRFIELD, the south-westernmost county of Connecticut, bounded W. by the state of New York, E. by New Haven county, N. by Litchfield, and S. by Long Island sound. It is divided into 13 townships, of which Fairfield and Danbury are the chief; and contains 38,208 inhabitants, including 276 slaves. It is separated from New Haven county and part of Litchfield county by Stratford river. The other parts of the county are watered by several small streams. Several harbours and small isles lie along the sound, in the towns of Greenwich, Stamford, Norwalk, Fairfield, and Stratford. The face of the county is rough, and the soil is good.—Also, a post-town and port of entry of Connecticut, and capital of the above county, the "Unquowa" of the Indians, pleasantly situated on Mill run, a little above its entrance into Long Island sound, 22 miles S.W. by W. of New Haven, and 64 from New York. It contains about 200 houses, and 3730 inhabitants, a neat congregational church, and a court-house. About 4 miles N.W. of the centre of the town is the beautiful parish of Greenwich, in which is a flourishing academy. This town was settled from Weathersfield in 1639. It carries on a considerable trade to the West Indies.—Also, a county in the state of Ohio.—Also, a township in Kennebeck county, Maine, on the S.E. bank of Kennebeck river, S. of Canaan and opposite to Hancock, 7 miles from fort Halifax, and 225 miles N.E. of Boston. It contains 552 inhabitants.—Also, a new township in Herkemer county, New York; containing 2065 inhabitants.—Also, a post-town in Franklin county, Vermont, E. of St. Albans; containing 911 inhabitants. It is 13 miles S. of the Canada line, and as far from the nearest part of lake Champlain.—Also, a township in Washington county, New York, containing 591 inhabitants.—Also, a township in Cumberland county, New Jersey, on Cohanzey creek, and at the head of Black creek; 25 miles E. by S. of Salem, in Salem county.—Also, a township in Westmoreland county, Pennsylvania, containing 1363 inhabitants.—Also, a district of South Carolina, between Wateree river, which separates it from Lancaster county, and Broad river, which divides it from Newbury and Union districts. Its chief town is Winnsborough.

FAIRFORD, a market town in the hundred of Brightwells Barrow, Gloucestershire, England, is situated on the banks of the river Colne; and derives its name from an old ford over that river near its confluence with the Thames. The celebrity of this town has arisen more from the beauty of its church, and the very fine painted glass of which that is the repository, than from any other circumstance. The church, dedicated to the Virgin Mary, is a fine specimen of the style of architecture that prevailed about the close of the fifteenth century. It consists of a lofty nave, a chancel, and side aisles, with a tower rising from the centre. The internal architecture is extremely fine and highly embellished: the aisles are divided from the nave by light fluted pillars, sustaining four arches on each side, with a range of windows

windows above them in the upper part of the nave. The aisles are continued parallel with the chancel, with which is a communication by two arches of equal height. A beautiful oak screen surrounds the chancel, ornamented with finely carved tabernacle-work, and having stalls in the same style. On the north side of the altar are three niches, or subcellia, used in the Catholic times by the officiating priests. This elegant church, 120 feet in length, and 55 in breadth, owes its erection to John Tame, an opulent merchant of London; who, about the year 1492, is recorded to have captured a vessel bound from a Flemish port to Italy and laden with painted glass, which, agreeably to the expensive piety of the times, he determined to put up in a large edifice expressly built for its reception. The glass was disposed in twenty-eight windows, with four or more compartments in each: but in several of them the figures are now mutilated or displaced. The principal subjects are scriptural, and display the most important events in the life of our Saviour, with a few of the more remarkable transactions recorded in the Old Testament. The church contains a variety of monuments and sepulchral inscriptions. In the north aisle is a table tomb of Italian marble to the memory of John Tame, the beneficent founder of this edifice, and Alice his wife.

The town consists of two streets; the buildings in general are neat and regular: here are three bridges over the river Colne. Among many charitable institutions is a free-school, established by the produce of money expended in the purchase of lands, and bringing in about sixty pounds annually, pursuant to the bequests of the Hon. Elizabeth Fernor, and Mary Barker, spinster. Two fairs are held annually, and a weekly market on Thursdays; originally granted by Henry III. in 1263, and renewed and confirmed by a charter procured in 1688, through the interest of Andrew Barker, esq. Fairford is 79 miles distant from London: the population of the parish in 1801 was returned at 1326; and the number of houses at 273.

Near the church was anciently a manorial residence, erected by the earls of Warwick, and called Beauchamp and Warwick court. This appears to have been rebuilt by the Tames, as Leland mentions "a fayr mansion-place of the Tames, hard by the churche-yarde, builded thoroughly by John Tame and Edmund Tame: the back thereof goithe to the very bridge of Fairford." This edifice was pulled down by Andrew Barker, esq. who, with the materials, erected at a few furlongs distance, the present manor house, which is a spacious and convenient building, situated in a pleasant park, and now inhabited by John Raymond Barker, esq. who has considerably improved it.

Two miles north from Fairford is Queenington, or Queenington, a small village, remarkable for the architecture of its church, which is a small low building, displaying vestiges of great antiquity; though it has apparently undergone considerable alterations during the two last centuries.

About three miles from Fairford is the grand canal which unites the rivers Severn and Thames. Rudge's History of Gloucestershire, 2 vols. 8vo. Bigland's ditto fol.

FAIRHAVEN, a town of America, in Bristol county, Massachusetts, lying on the N.W. side of Buzzard's bay, and on the eastern side of Accusinct river, opposite to Bedford. N. lat. $41^{\circ} 34'$. W. long. $70^{\circ} 50'$.—Also, a considerable port-town in Rutland county, Vermont, N.W. of Poultney, containing 4:1 inhabitant; and 51 miles N. of Bennington.—Also, a bay on the N.W. coast of Spitzbergen. N. lat. $79^{\circ} 50'$. E. long. 65° .

FAIRHEAD, a cape of Ireland, on the northern coast

of the county of Antrim, opposite to the island of Rathery. It forms part of that interesting basaltic region, so frequently referred to in geological controversies. It is supposed to be the Robogdium Promontorium of Ptolemy, and its Irish name is Ben-more, or the great promontory, a name to which it seems well entitled. It and the promontory of Bengore stand at the distance of eight miles from each other: both formed on a great and extensive scale, both abrupt to the sea, and abundantly exposed to observation; and each in its kind exhibiting noble arrangements of the different species of columnar basaltes. Fairhead raises its lofty summit more than five hundred feet above the sea, forming the eastern termination of Ballycastle bay. It presents to view a vast mass of rude columnar stones, the forms of which are extremely gross, many of them exceeding two hundred feet in length, and the texture so coarse as to resemble an imperfect compact granite, rather than the uniform fine grain of the Giant's causeway basaltes. At the base of these gigantic columns lies a wild waste of natural ruins, of an enormous size, which, in the course of successive ages, have been tumbled down from their foundation by storms, or some more powerful operations of nature. These massive bodies have sometimes withstood the shock of their fall, and often lie in groups and clumps of pillars, resembling many of the varieties of artificial ruins, and forming a very novel and striking landscape. A savage wildness characterizes this great promontory, at the foot of which the ocean rages with uncommon fury. Scarce a single mark of vegetation has yet crept over the hard rock to diversify its colouring, but one uniform greyness clothes the scene all around. Upon the whole it makes a fine contrast with the beautiful capes of Bengore, where the varied brown shades of the pillars, enlivened by the red and green tints of ochre and grass, cast a degree of life and cheerfulness over the different objects. Dr. Hamilton says that, from attentive observation, there is reason to imagine that this enormous pile rests on the fossils usually attendant on beds of sea-coal; and that the strata of the Ballycastle coal pits extend entirely under the promontory of Fairhead. This cape is in long. $6^{\circ} 2'$. W. from Greenwich, lat. $55^{\circ} 44'$. N. Hamilton's Antrim.

FAIRLEE, a township of America, in Orange county, Vermont, on the W. bank of Connecticut river, 16 miles N. of Dartmouth college. This township, which is hilly but having a good soil, is divided into E. Fairlee, containing 435 inhabitants, and W. Fairlee, including 371.

FAIRLEY, a town of Scotland, in the county of Ayr; 11 miles N.W. of Irvine.

FAIRLEY ROAD, a narrow strait of Scotland, in the frith of Clyde, between the islands of Cumora and the county of Ayr.

FAIRNESS SOUND, a harbour on the W. coast of Eday, one of the Orkney islands.

FAIRUYOSAND, a town of Persia, in Segestan, on the Heermund; 20 miles S.W. of Bost.

FAIRWEATHER CAPE, a cape on the N.W. coast of America, in N. lat. $58^{\circ} 36'$. W. long. 138° .—Also, a cape on the E. coast of Patagonia. S. lat. $51^{\circ} 34'$. W. long. $68^{\circ} 25'$.—Also, a mountain on the W. coast of North America; 100 miles S.E. of Admiralty bay. N. lat. 59° . W. long. 137° .

FAIRY, a term frequently occurring in ancient traditions and romances, denoting a kind of genii, or imaginary deities, conversant on earth, and distinguished by abundance of fantastical actions and offices, either good or evil.

The fairies, according to these traditions, are peculiar species of divinities, that have but little relation to any of

those of the ancient Greeks and Romans, unless, perhaps, to the larvæ; though others will not have them ranked among deities, but suppose them an intermediate kind of beings, neither gods, nor angels, nor men, nor devils.

They are of oriental extraction, and seem to have been invented by the Persians and Arabs, whose history and religion abound with tales of fairies and dragons. The Persians call them Peri, and the Arabs Ginn; having a peculiar country which they suppose them to inhabit, called Ginniklan, and, by us, Fairy Land. Our famous countryman Spenser's master-work, the Fairy Queen, is an epic poem under the persons and characters of fairies.

Fairy Circles, or Rings, an expression by which certain spots, frequently to be observed upon the grafs in the fields, are commonly denoted. The spots consist of grafs more green and more luxuriant than the rest of the field. The figure of the spot is sometimes circular; viz. an area either circular, or nearly circular, is peculiarly luxuriant throughout its whole surface; but it more commonly consists of a circular or nearly circular zone of luxuriant grafs, including a space of the same kind of coloured grafs as that which surrounds the zone. In this latter, and by far more frequent case, the circular zone is seldom complete, generally consisting of an arch or segment, part of which often bends its direction in an irregular manner.

The size of these spots varies considerably. When the spot is luxuriant throughout, its diameter generally is very small; but the circular zones, which are from two inches to a foot or more in breadth, are the arches of very different circles, the radius of their curvature varying from a few inches to ten feet and upwards.

These singular appearances have been long noticed, not only by shepherds and labourers in the field, but likewise by philosophers and naturalists, who have endeavoured to examine all their peculiarities, for the purpose of investigating their nature and origin.

With respect to the old vulgar opinion relative to the origin of these spots, we need not say any thing, the absurdity of it being pretty well manifested by their denomination; but of the scientific opinions it is incumbent upon us to give a distinct and satisfactory account.

Two different opinions have been principally advanced by philosophers with respect to the origin of these spots, and both opinions are grounded upon experiments and observations. The fairy circles were for a long time supposed to be the effects of lightning; but they were afterwards attributed to the growth of fungi: and this latter opinion seems upon the whole to be the most probable, especially in the manner in which it has been lately illustrated by Dr. Wollaston.

One of the early volumes of the Philosophical Transactions contains the following observations of Mr. Jeffop.

"I have," he says, "often been puzzled to give an account of those phenomena which are commonly called fairy circles. I have seen many of them, and those of two sorts: one sort bare, of seven or eight yards in diameter, making a round path, something more than a foot broad, with green grafs in the middle; the others like them, but of several bignesses, and encompassed with a circumference of grafs, about the same breadth, much fresher and greener than that in the middle. But my worthy friend Mr. Walker gave me full satisfaction from his own experience: it was his chance one day to walk out among some mowing grafs (in which he had been but a little while before) after a great storm of thunder and lightning, which seemed by the noise and flashes to have been very near him; he presently observed a round circle, of about four or five yards diameter,

the rim whereof was about a foot broad, newly burnt bare, as the colour and brittleness of the grafs roots did plainly testify. He knew not what to ascribe it unto but to the lightning, which, besides the odd capricious remarkable in that fire in particular, might, without any wonder, like all other fires, move round and burn more in the extremities than the middle. After the grafs was mowed, the next year it came up more fresh and green in the place burnt than in the middle, and at mowing-time was much taller and ranker."

Dr. Priestley, at the end of his History of Electricity, where he relates his original electrical experiments, describes, amongst others, the effects which were produced by the discharges of a battery upon several substances, especially upon metallic surfaces, which he sometimes covered with water. The experiment which principally relates to our present subject is as follows.

"I then laid," the doctor says, "more water upon the copper, but so as only to moisten it; for the surface, being convex, would not allow it to be in any great quantity; and upon taking the explosion, I found no circles, but several beautiful circular spots melted very deep, one of which was much larger than the rest. These experiments seem to shew that the electric matter meets with a considerable resistance, in passing through water, which confines its excursion more than the air; and that, by such a condensation, its force is greatly increased, so as to leave deeper impressions upon the metal than when it had passed only through the air. In like manner, if two pieces of metal be placed nearly in contact, or if they be light, and one of them lie upon the other, the impression made upon both of them by the discharge of the battery passing through them will be considerably deeper than it would have been if the electric matter had not been confined to so small a compass as the points in contact.

"To account for the formation of these concentric circles nothing seems to be necessary but the supposition of the elasticity of the electric fluid, whereby its particles repel one another. For then, supposing a quantity of electric matter to issue from one piece of metal to another through the air, it will endeavour to spread, but will be confined in its passage by the surrounding electric medium and the strong attraction of the opposite metal. If this piece of metal have a flat surface, or one that is nearly so, the fluid will be attracted by it pretty equally, within a certain space, so that the mutual repulsion of its particles will have room to exert itself, and produce a division of the whole quantity: and as this repulsion is the same in all directions, the effect must be its throwing itself into a circle, or several concentric circles, on its entering the opposite piece of metal, and consequently melting it in that form. For the same reason, the circles themselves will consist of separate dots, each of which might have been caused by the fluid in another hollow circle, but being so small the fusion of the metal could not shew that circumstance."

And a little farther on the doctor says, "communicating this experiment to Dr. Price, he suggested to me, that the circles, called *fairy rings*, which consist of grafs of deeper green in pasture fields, and which have by some been imagined to be occasioned by lightning, might be analogous to the circles above-mentioned, but that they want a central spot. I have since examined one of these rings. It was about a yard in diameter, the ring itself about a quarter of a yard broad, and equally so in the whole circumference; but there was no appearance of any thing to correspond to the central spot."

Notwithstanding these experiments and these conjectures,

it was not long after the publication of Dr. Priestley's History of Electricity, that the fairy circles began to be attributed to the growth of fungi; for Mr. Cavallo, in the first edition of his Treatise on Electricity, which was published in the year 1777, describes the method of forming, by means of the electrical apparatus, such rings as were discovered by Dr. Priestley, and which have been already described; after which he says,

"I have given these spots the appellation of *fairy circles*, on account that they bear some resemblance to the spots so called, which are often observed upon the grafs in the fields. These, which we may call natural fairy circles in the fields, it has been thought to be effected by lightning, on account of their bearing some resemblance to the above-mentioned circles produced by electricity; the supposition, however, seems not very probable; for the spots in the fields, called *fairy circles*, have no central spot, no concentric circles, neither are they always of a circular figure; and, as I am informed, they seem to be rather beds of mushrooms, than the effects of lightning."

In the year 1807 Dr. Wollaston presented a paper to the Royal Society, containing various valuable observations relative to the fairy circles, and from this paper, which is contained in the volume of the Philosophical Transactions for the above-mentioned year, we shall now transcribe such passages as seem absolutely necessary to illustrate the subject of this article.

"That," he says, "which first attracted my notice, was the position of certain fungi, which are always to be found growing upon these circles, if examined in a proper season. In the case of mushrooms, I found them to be solely at the exterior margin of the dark ring of grafs. The breadth of the ring in that instance, measured from them towards the centre, was about twelve or fourteen inches, while the mushrooms themselves covered an exterior ring about four or five inches broad.

"The position of these mushrooms led me to conjecture that progressive increase, from a central point, was the probable mode of formation of the ring. I was the more inclined to this hypothesis, when I found that a second species of fungus presented a similar arrangement, with respect to the relative position of the ring and fungi; for I observed, that in all instances the present appearance of fungi was upon the exterior border of a dark ring of grafs. I thought it not improbable that the soil, which had once contributed to the support of fungi, might be so exhausted of some peculiar *subulum* necessary for their production, as to be rendered incapable of producing a second crop of that singular class of vegetables. The second year's crop would consequently appear in a small ring surrounding the original centre of vegetation, and at every succeeding year the defect of nutriment on one side would necessarily cause the new roots to extend themselves solely in the opposite direction, and would occasion the circle of fungi continually to proceed by annual enlargement from the centre outwards. An appearance of luxuriance of the grafs would follow as a natural consequence, as the soil of an interior circle would always be enriched by the decayed roots of fungi of the preceding year's growth."

In the sequel Dr. Wollaston relates some observations of Dr. Withering, who had already attributed these spots to the growth of fungi, but he confined his conjecture to one species only of agaric; (*viz.* the *Ag. orcales* of his arrangement.) "I am satisfied," Dr. Withering says, "that the bare and brown, or highly clothed and verdant circles in pasture fields called fairy-rings, are caused by the growth of this agaric."—"Where the ring is brown and almost bare, by

digging up the soil to the depth of about two inches, the spawn of the fungus will be found of a greyish white colour; but where the grafs has again grown green and rank, I have never found any of the spawn existing." Dr. Wollaston then continues in the following manner. "Had," he says, "Dr. Withering frequently repeated this examination of the soil, he would have corrected the last remark, which is not universally true, as the grafs may at some period be found luxuriant even over the undecayed spawn. During the growth of the fungi, they so entirely absorb all nutriment from the soil beneath, that the herbage is for a while destroyed, and a ring appears bare of grafs, surrounding the dark ring. If a transverse section be made of the soil beneath the ring at this time, the part beneath the fungi appears paler than the soil on either side of it, but that which is beneath the interior circle of dark grafs is found, on the contrary, to be considerably darker than the general surrounding soil. But in the course of a few weeks after the fungi have ceased to appear, the soil where they stood grows darker, and the grafs soon vegetates again with peculiar vigour; so that I have seen the surface covered with dark grafs, although the darkened soil has not exceeded half an inch in thickness, while that beneath has continued white with spawn for about two inches in depth.

"For the purpose of observing the progress of various circles, I marked them three or four years in succession, by incisions of different kinds, by which I could distinguish clearly the successive annual increase, and I found it to vary in different circles from eight inches to as much as two feet. The broadest rings that I have seen were those of the common mushroom (*Ag. campestris*); the narrowest are the most frequent, and are those of the champignon (*Ag. orcales* of Dr. Withering.) The mushroom accordingly makes circles of largest diameter, but those of the champignon are most regular. There are, however, as many as three other fungi that exhibit the same mode of extension, and produce the same effect upon the herbage. These are the *Ag. terreus*, *Ag. procerus*, and the *Lycoperdon bovista*, the last of which is far more common than the two last mentioned agarics.

"There is one circumstance that may frequently be observed respecting these circles, which can satisfactorily be accounted for, according to the preceding hypothesis of the cause of their increase, and may be considered as a confirmation of its truth. Whenever two adjacent circles are found to interfere, they not only do not cross each other, but both circles are invariably obliterated between the points of contact; at least in more than twenty cases; I have seen no one instance to the contrary. The exhaustion occasioned by each obstructs the progress of the other, and both are starved."

Fairy-Stones, or *Fairy Night-caps*, in *Natural History*, are the vulgar names, in some parts of England, for the impressions of *Echini* which are found plentifully imbedded in the chalk strata, and are often ploughed up on the surface of such strata. See Dr. Woodward's "Method of Fossils," p. 11, or Parkinson's "Organic Remains," vol. i. p. 4. See also W. Martin's "Outlines of the Knowledge of Extraneous Fossils," p. 93.

FAISAN of *Spain*, in *Ornithology*. See *PHASIANUS*, *FAISANS*. ISL. DE, *Il. of Phœnicians*, or *Il. of Corsica*, in *Geography*, a small island in the river Bidassoa, celebrated for being the place where the peace of the Pyrenees was concluded in 1660, between France and Spain, and for the interview between the kings of France and Spain, on the marriage of Louis XIV., the first name it received from the number of pheasants found there, and the last

from the circumstance of the interview. It is two miles distant from Fontarabia.

FAISTENBERGER, ANTHONY and JOSEPH, in *Biography*, two brothers, landscape painters; they both imitated Gasper Poussin with considerable success, and their works are so much alike, that with difficulty the difference is discernible. They wrought together at the court of Vienna in several large works, and were likewise employed by many of the princes of the empire. Anthony died in 1722, aged 44.

FAIT, FACTUM, in *Law*, is used for a writing lawfully executed to bind the parties thereto. See DEED.

FAITH, FIDES, in *Antiquity*, as denoting honesty or fidelity, was deified by the Romans, and represented with an erect open air, and dressed in a thin robe, so fine, that one might see through it. This deity is also represented as very old and grey-headed; and she appears on medals as giving her hand, and sometimes only by two hands joined together. The oath made in the name of this deity, or "Jupiter Fidius," who was the same, was of all oaths the most inviolable. The temple of Faith erected by Calatius was in the capitol, near that of Jupiter; and if we admit the testimony of Dionysius Halicarnassensis, and that of Plutarch, the first who erected a temple to this deity was Numa Pompilius. He likewise ordered the priests, whom he set over the worship of this deity, to wear white vestments when they offered sacrifices. Dionysius Halicarnassensis, (l. ii. c. 5.) has stated the reasons why Numa Pompilius gave Faith a place among the venerable Roman divinities. This was done in order to engage the people to observe mutual fidelity and truth in their contracts with one another. With this view he deified Faith, and consecrated a temple to this divinity. Hence Faith came to be so revered, and held in such awe, as to have greater influence with the Romans than witnesses and oaths. Hercules was represented as presiding over Faith pledged in contracts: and the oath taken on such occasions was thus conceived, "Medius Fidius," i. e. "Ita me Deus Fidius adjuvet." So help me Medius Fidius, or Hercules. "Swear to me," says Plautus in one of his comedies, by Medius Fidius.

FAITH, in *Philosophy and Theology*, that assent which we give to a proposition advanced by another, the truth of which we do not immediately perceive from our own reason or experience; or, it is a judgment, or assent of the mind, the motive whereof is not any intrinsic evidence, but the authority, or testimony, of some other, who reveals or relates it.

Hence, as there are two kinds of authorities and testimonies, the one of God, and the other of man, faith becomes distinguished into *divine* and *human*.

FAITH, *Divine*, is that founded on the authority of God; or, it is that assent we give to what is revealed by God.

The objects of this faith, therefore, are matters of *revelation*, which see.

FAITH, *Human*, is that whereby we believe what is told us by men. The object of this faith is matter of human testimony and evidence. See EVIDENCE and TESTIMONY.

Faith, again, may be distinguished into *implicit*, and *scientific*.

FAITH, *Implicit*, or *Blind*, is that whereby we give our assent to a proposition advanced by another, of whose knowledge and veracity we have no certain and evident reason, or proof. This is only opinion, under another name.

We may observe here, that the terms *implicit faith* are used in two different senses. With us Protestants, at least in this country, no more is commonly meant by them than the belief of a doctrine, into the truth of which we have made no inquiry, on the bare authority of some person or society declaring it to be true. But this pre-supposes some knowledge, or some conception of the doctrine itself. In this acceptation of the term *implicit*, it merely denotes that, in lieu of evidence, one rests on the judgment of him or them by whom the tenet is affirmed: and no other ignorance is implied but that of the proofs. But the *implicit faith*, recommended by the schoolmen, is a very different thing, and is constituted thus: if you believe that all the religious principles, whatever they be, which are believed by such particular persons, are true, those persons who hold the principles are explicit believers, but you are an *implicit believer* of all their principles. Nor is your belief the less efficacious, because you are ignorant of the principles themselves. The transcendent excellency of *implicit faith* consists in this: that you have it then in the highest perfection, when, in regard to its object, you know nothing, and have heard nothing at all. This is as if we should call one an *implicit mathematician*, who knows not a tittle of mathematics, nor even the definitions and axioms; but is convinced of the knowledge of some other person, who is really, or whom he supposes to be an adept in that science. "To believe implicitly," says Bona, "is to believe in general universally all that holy mother church believes; so as to dissent from her in nothing, nor disbelieve any of her articles." It is of no consequence, according to the scholastic doctors, what a man's explicit faith may be; he may be an Arian, a Socinian, an Anthropomorphite, a Polytheist, in short, any thing; he cannot err, whilst he has an *implicit faith* in the church. *Implicit faith* has been sometimes ludicrously styled "*fides carbonaria*," from the noted story of one who, examining an ignorant collier on his religious principles, asked him what it was that he believed. He answered; "I believe what the church believes." "What then," rejoins the other, "does the church believe?" He readily replied, "the church believes what I believe." The other desirous, if possible, of bringing him to particulars, resumes his inquiry: "Tell me then, I pray you, what it is which you and the church both believe?" The only answer the collier could give was, "Why truly, sir, the church and I both believe the same thing:" this is *implicit faith* in perfection, and, in the estimation of some celebrated doctors, the sum of necessary and saving knowledge in a Christian. Campbell's Lectures on E. H. Lect. xxiii.

FAITH, *Scientific*, or *seeing*, is that by which we give our assent to a proposition advanced by one who can neither deceive, nor be deceived; which may be properly referred to science and knowledge.

Divine faith, *ceteris paribus*, is stronger than human. When we are fully convinced, that any proposition comes from God, faith becomes assurance, or science; it being an ingredient in our idea of God, that he can neither deceive, nor be deceived; but when there is any doubt, whether the proposition is declared by God, the faith can be no stronger, or weaker, than the reasons on which it is founded; divine faith, therefore, may either be strong, weak, or none at all. Again, the reasons or motives of believing men may be of such weight and force, that being perfectly understood, they may equal a mathematical evidence; and then the human faith is scarce inferior to the divine; there being, as it were, an equal necessity of giving our assent on each side.

Hence,

Hence, it is easily observed, that all our faith or belief has its foundation on reason, which cannot deceive us, if we make a due use of our liberty, and do not acquiesce, till that necessarily compels us.

All our present religious faith is really human, as depending on the secondary testimony of men; of whose veracity, however, we have the strongest proofs. The prophets, or those to whom God immediately revealed his will, believed him, because they knew he could not deceive. We at this day believe them, or rather their writings, for other reasons; *viz.* the same which oblige us to believe all well-attested histories. (See EVIDENCE.) Besides the two species of faith, human and divine, the Romanists make a third, or intermediate kind, called

FAITH, *Ecclesiastical*, which is the assent orthodox persons give to certain events decided by the church, and enjoined to be believed by all. As, when the church declares that such a book contains heretical doctrine, &c.

This term, ecclesiastical faith, was first introduced by Mr. Perseux, to distinguish the faith whereby we believe matters of divine revelation, from that whereby we believe matters of ecclesiastical determination.

FAITH, in *Practical Theology*, makes the first of the theological virtues, or graces.

Faith in God, in this sense, denotes such a conviction of his being, perfections, character, and government, as produces love, trust, worship, obedience, and resignation. Faith in Christ, as it has been defined by some, is a mere assent to the Gospel as true; according to others, it signifies such a persuasion that he is the Messiah, and such a desire and expectation of the blessings which he has promised in his Gospel to his sincere disciples, as engage the mind to fix its dependence upon him, and subject itself to him in all the ways of holy obedience; and thus defined it is a very extensive principle, and includes in its nature and inseparable effects the whole of moral virtue. In this sense it has been said, that under the Gospel a man is justified by faith. Faith, likewise, in respect to futurity, is a moral principle, implying such a conviction of the reality and importance of a future state, as is sufficient to regulate the temper and conduct.

A theological writer of considerable reputation, who is of opinion that the New Testament teaches, with the clearest evidence, a double justification, (which see,) or salvation, maintains a distinction of faith, corresponding to his ideas of justification. Accordingly he says, that the faith which gave a right to the first justification, or an admittance into the kingdom of God in this world, was consistent with a man's perishing eternally: because he might be admitted into the church upon a profession of *that* faith, and yet remain a wicked person, and be lost for ever. This was evidently the case with Simon the forcerer, (Acts, viii. 21.) of whom it is said, though "his heart was not right in the sight of God," and he was in the "gall of bitterness, and bond of iniquity," (v. 23.) that "he believed and was baptized," (v. 13.) Consequently, *that* faith must be the *general faith*, which is common to all *Christians*, good and bad; or faith considered simply and separately from the fruits and effects of it. It was that general profession of faith in Christ Jesus, as the Messiah and Saviour of the world, (which included a profession of repentance, and which indeed ought to have been sincere,) upon which the apostles baptized the first converts. In this sense, "we are all the children of God by faith in Jesus Christ," (Gal. iii. 26.) This faith may be called the *first* faith. (See 1 Tim. v. 12.) And it is the continued profession of this faith in Christ, which gives us a continued right to a place in the church. For, if

we cast off this *first* faith, we renounce our profession, we cease to be Christians; or, we no longer belong to the peculiar family of God. Of this *first* faith St. James speaks, (chap. ii. 14—26.) and he very justly pronounces it insufficient, being *alone*, for our final salvation or justification. In order to *that*, this general and professed faith must grow into a principle in the heart, working by love, overcoming the world, and bringing forth all the fruits of righteousness in this life; or otherwise the *first* faith, and *first* justification, will come to nothing. This is the *working* faith, (Gal. v. 6); faith perfected by works, (Jam. ii. 23.); the *continued* faith (Col. i. 23.); the *growing* faith (2 Thess. i. 3. 2 Pet. i. 5. 2 Cor. x. 15.); the *steadfast*, or established faith (Col. ii. 5.); *unfeigned* faith (1 Tim. i. 5.) The *first* faith is the common faith of all *Christians*; this *latter* faith is peculiar to *real* Christians. The *first* may be a dead, inactive faith, (Jam. ii. 17. 20. 26.) The *other* is living and active. The *first* is a profession; the *other*, an operative principle. A man may have the *first* faith, and perish; by the *other*, we "believe to the saving of the soul." (Heb. x. 39.) The *first* faith may be a foundation without a super-structure; the *other* is faith *built upon* and improved. (2 Pet. i. 5—8. Jude, 20.) This distinction of faith seems to be agreeable to the following texts. Rom. i. 17. 1 John, v. 13; in the latter of which the *first* and *second* faith appears to be distinguished. Taylor's Introduction to his Paraphrase, &c. on the Romans.

The distinction above stated will serve to reconcile the declarations of St. Paul and St. James concerning faith and works, which some have pretended are contradictory; or, they may be otherwise reconciled by considering that St. Paul puts faith for the whole of Christianity, in contradiction to the law of Moses, and the works which he declares to be unnecessary for justification, are the rites and ceremonies of that law. On the other hand, by faith, St. James means a bare assent to the truth of the gospel; and the works which he declares to be necessary for justification are the moral duties enjoined by the gospel, and which are produced by faith. St. Paul, therefore, says, the religion of Christ, if believed and obeyed, is sufficient to justify. St. James says, the bare belief of the religion of Christ, without conformity to its precepts, is not sufficient to justify. These two propositions are perfectly consistent with each other; and the seeming contradiction in the passages themselves arises from the circumstance just mentioned, namely, that the two apostles, in reasoning against different errors, use the same words in different senses. See Bishop Tomlin's Elements of Christian Theology, vol. ii. p. 262.

FAITH, *Articles of*. See ARTICLES.

FAITH, *Confession of*. See CONFESSION.

FAITH and Homage, in the *Feudal Law*. See FEALTY.

FAITHFUL, an application which the Mahometans assume to themselves. See MUSSULMAN.

FAITHFULNESS, in *Ethics*, is an agreement between a man's promises and his actions.

FAITIERE, in *Natural History*, the name of a species of shell-fish, called by many authors, by a much less determinate name, concha imbricata. The French have thus called it, from the word *faitage*, which, in the same language, signifies the roof of a house. The shell is of the bucardium, or ox heart-kind, and has seven longitudinal ribs, and a great many laminae running transversely across them, so that it greatly resembles the roof of a house, where the rafters and cross-beams are seen while it is not covered with tiles.

FAITOURS is used in stat. 7 Ric. II. cap. 5. for evil-doers; and may be interpreted idle livers, from (says the author

author of the *Terms de Ley*) *faitardise*, which signifies a kind of sleepy disease, proceeding from too much sluggishness. In the fore-mentioned statute it seems synonymous with vagabond.

FAKAUL, in *Geography*, a town of Asiatic Turkey, in Caramania; 4 miles N. of Cogni.

FAKE, or FACK, in the *Sea Language*, one round or circle of a cable; or otherwise called a coil.

FAKENHAM, in *Geography*, a small market town in the hundred of Gallow, Norfolk, England, is situated on the slope of a hill near the river Yar. The buildings are neat and compact. The church, dedicated to St. Peter, is a large, commodious structure, consisting of a nave, two aisles, chancel, porch, and lofty stone tower: the latter has a fine western door-way with a large window divided into six lights, and subdivided by a horizontal mullion and tracery mouldings. In the church is an octangular font, richly ornamented on every side with religious emblems. The quarter-sessions for this part of the county were formerly held alternately here and at Walsingham; but since the town has been removed hence to Holt, the sessions-house has been used as a school. The sheriffs' open court for the whole county is still kept on an adjoining hill. Fakenham is 108 miles distant from London; contains 237 houses, and 1236 inhabitants; has two annual fairs, and a weekly market on Thursdays, which is esteemed the best for corn in the county, and is regularly attended by the merchants from Wells and other contiguous ports. Blometfield's *Topographical History of Norfolk*.

FAKIR, or FAQUIR, a kind of dervise, or Mahometan religious, who travels the country, and lives on alms.

The word *fakar* is Arabic, and signifies a *poor or needy person*. It is formed of the word פקר, *fakara*, to be in need.

D'Herbelot makes fakir and dervise the same thing. The Turks and Persians use the name dervise for any poor person, whether he be so out of necessity or choice; and the Arabs apply fakir in the same sense. Whence, in some Mahometan countries, the religious are called dervises; and in others, particularly throughout the states of the Great Mogul, fakirs.

The fakirs sometimes travel single, and sometimes in companies of two or three hundred. When they go in companies, they have a superior, who is distinguished by his habit. Each fakir bears a horn, which he blows at his arrival in any place, as also at his departure; and a kind of scraper or trowel, to scrape the earth in the place where he sits, or lies down. When they go together, they divide their alms equally amongst them; give what is left every night to the poor: and never reserve any thing for the morrow.

There is also a kind of idolatrous fakirs, who follow much the same practice. D'Herbelot reckons in the Indies eight hundred thousand Mahometan fakirs, and twelve hundred thousand idolatrous ones; to say nothing of divers extraordinary species of fakirs, particularly penitents, whose mortification and penance consist in very odd observances. Some, *e. gr.* remain night and day, for many years, in certain uneasy postures. Others never sit or lie down to sleep, but sustain themselves by a rope, hung down for that purpose. Others bury themselves in a ditch, or pit, for nine or ten days, without eating or drinking. Others keep their arms lifted up to heaven so long till they cannot let them down again if they would. Others lay fire on their heads, and burn the scalp to the very bone. Others roll themselves naked on thorns. Tavernier, &c.

In Bengal, where they are very numerous, they are the

refuse of society, and live altogether on the alms bestowed upon them by the superstition of the people. They go, says Stavorinus, entirely naked, and are wholly devoid of shame. On their shoulders they carry a thick club, the end of which is wound round with rags of cloth, of different colours. It is dangerous to meet them in solitary places, or in the woods; for they make no scruple of knocking down, and murdering any one that has any thing of value about him. They strew their hair, which hangs down their backs, with ashes, and sometimes wallow in ashes. They generally take up their abode in shady places, either in the open air, or in old and ruinous buildings, without any thing to repose upon, or to cover themselves. The genuine fakirs make vows of penance; and Stavorinus says, that he saw one of them, who had imposed upon himself a silence of 12 years.

Another class of fakirs retire into mosques, live on alms, and devote themselves to the study of the law, the reading of the Alcoran, &c. to fit themselves for monks, or doctors. People of quality sometimes assume the character of fakirs. The famous Aurengzebe himself, before he ascended the throne, gave out, that he intended to commence fakir.

FAKIRA, in *Geography*, a town of Japan, in the island of Ximo; 15 miles S. of Nagasaki.

FAKOENI, a town of Walachia, on the Danube; 21 miles N.N.E. of Raslovat.

FALACA, a kind of bastinado inflicted on the Christian captives in Algiers. The falaca is properly a piece of wood, about five feet long, bored with two holes, through which the feet of the patient are put, who is laid on his back on the ground, with his arms tied. Two men are employed to give him fifty or an hundred strokes with a cudgel, or bull's pizzle, on the soles of his feet. A very trifling fault often incurs this severe punishment.

FALACER, in *Mythology*, the name of a Roman deity recorded by Varro.

FALAISE, in *Geography*, a town of France, and principal place of a district, in the department of Calvados, situated on the Ante. The town is divided into two parts, one containing 8000 inhabitants in 10 communes, and the other 6000 in 30 communes; on a territorial extent of 237½ kilometres. It has manufactures of serges, linens, and lace. This was the native place of William the Conqueror. It lies 18 miles S. of Caen. N. lat. 48° 55'. W. long. 0° 7'. —Also, a small town in the department of the Dyle; 16 miles S.E. of Tirlemont.

FALARI, a town of Italy, in the Patrimonio; 10 miles N.E. of Sutri.

FALARICA, in *Antiquity*, a kind of dart or missile weapon, of singular service to the Saguntines in their contest with the Carthaginians. This dart was discharged by the parties poised in wooden towers, upon the enemy. These wooden towers were called "falæ," from which was derived the name of the weapon. Towards the end it had a square piece of iron, bound about with tow, besmeared with pitch. The iron head, resembling that of the Roman pilum or javelin, was three feet long, that it might be capable of penetrating the strongest armour, and, through it, of doing execution. As the combustible part of it was set on fire before it was discharged upon the enemy, and this fire must have been greatly increased by the air fanning it in its motion, it could not fail to do mischief, and to excite terror. This dart was sometimes discharged out of the balista with an inconceivable force, and did not only destroy men, but likewise frequently consumed the wooden towers of the enemy, at which it was levelled. Liv. lib. xxi. *Ann. apud Fest. in voc. Falarica.*

FALARII, FALARI, in *Ancient Geography*, a town of Italy,

Italy, in Etruria, E. of Tarquinii, and very near the Tiber. The ancients represent it as a well fortified city. The inhabitants often took up arms against the Romans, but when it was subdued by them, they established a colony in it.

FALASJAM, a country of Africa, W. of Abyssinia.

FALCADE, in the *Manege*. A horse makes falcades, when he throws himself upon his haunches two or three times, as in very quick curvets, which is done in forming a stop, and half-stop. A falcade, therefore, is the action of the haunches, and of the legs, which bend very low, as in curvettes, when you make a stop or half-stop.

They say, this horse stops well, for he makes two or three falcades, and finishes his stop with a pefate. This horse has no haunches, he will make no falcades. The falcades are so much the prettier, as in making them his haunches are low. Stop your horse upon the haunches, in making him ply them well, so that after forming his falcades, he may resume his gallop without making a pefate, that is, without stopping or making one time. And thus he will make an half stop. See HAUNCHES and TIME.

FALCANDUS, HUGH, in *Biography*, a Sicilian historian of the 12th century, was supposed to have been a Norman by birth. He published his history about 1190, of which the subject is the exploits of the Normans in Sicily, and the calamities which it underwent from 1154 to 1169, under the two kings William I. and II. This work has been several times printed. Moreri.

FALCATA, in our *Old Writers*, was used for the grass fresh mowed, and laid in swathes.

FALCATED, one of the phases of the planets, popularly called horned.

The astronomers say, the moon or any planet is falcated, when the enlightened part appears in form of a sickle, or reaping-hook, by the Latins called *fals*.

The moon is falcated whilst she moves from the third quarter to the conjunction, and from the conjunction, or from new moon, to the first quarter; from hence to opposition or full, and from full to the third quarter the enlightened part appears gibbous, and the dark falcated. See MOON.

FALCATOR, in our *Old Writers*, the servile tenant who performed service of falcature.

FALCATURE, FALCATURA, signifies one day's mowing of grass; a customary service to the lord by his inferior tenants. Kennet's Gloss. in voc.

FALCKENBERG, in *Geography*, a town of the duchy of Holstein; seven miles W.S.W. of Nordtorp.

FALCKENBURG, a town of France, in the department of Mont Tonnerre; 20 miles E.S.E. of Deux Ponts.

FALCO, in *Ornithology*, a genus of *Accipitres*, the bill of which is hooked, and furnished at the base with a cere; head closely covered with feathers; tongue bifid at the end.

The falcons are distinguished from the vultures in several essential respects, notwithstanding the similarity in their general appearance and manners of life. The bill in the vulture is of a more lengthened form, or straight, being only hooked at the apex; in the falcon the curvature of the bill commences nearly at the base; the head of the vulture is also bare of feathers, and the neck retractile; they differ besides in other particulars, but the two tribes may be clearly ascertained by the above characters. The falcons are very generally dispersed throughout the globe, being inhabitants of almost every climate, while the vulture is confined to the warmer regions. Both prey on smaller birds, quadrupeds, reptiles, and some species on fish: these the vulture seems to prefer in a putrid state, as it is rarely known to attack living animals unless urgently pressed by hunger; but the falcon, on

the contrary, rejects its food in this state, delighting to seize its prey alive, and devour it recent. The falcon, like the vulture, is capable of enduring abstinence for a considerable period without experiencing any material inconvenience. It has been observed of the falcon tribe that they associate only in the breeding season, and then only in pairs for the purpose of perpetuating their offspring; their nest is sometimes formed of a few sticks and herbage on the bare ground; most commonly, however, they seek some convenient spot on the summits of rocks or hills, and the larger kinds the loftier pinnacles of mountains.

A considerable variation prevails with regard to the colours as well as markings of the plumage in the falcon tribe at different periods of their growth, and hence writers who have treated on this family have been occasionally misled, and induced to describe as distinct species what are in reality no other than the same bird in different transitions of plumage. Some material errors of this kind have already been detected, and others of a similar nature will, no doubt, be discovered likewise, as we become better acquainted with the history of this tribe than we are at present. The falco genus, in point of species, is very numerous.

Species.

HARPYJA. Head crested with long feathers; body variegated beneath. Gmel. *Vultur harpyia*, Linn. *Aquila brasiliensis cristata*, Briss. *Aquila cristata* genus, Raf. *Tzquaubtli*, Hernand. *Crested eagle*, Will. *Oronoko eagle*, Brown. *Crested vulture*, Lath.

Size rather exceeding that of the turkey; the plumage above mixed with black; the head is covered with feathers, and adorned with a crest of four feathers, two placed on each side; the middle ones are two inches long; those at the sides rather shorter, and the whole are moveable at the will of the bird. The hind part of the neck is fulvous; body beneath white; tail fasciated with brown and black; vent and thighs with black and white; the legs are covered with white feathers, and spotted with black. Linnæus describes the legs in his species harpyja as being naked. This creature inhabits South America, and is said to possess such amazing strength that it is able to cleave a man's skull at one stroke of the bill.

JACQUIN. Feathers of the head long and numerous; feet naked; body snowy white. Gmel. *Vultur coronatus*, Jacquin Beytr. *Crowned vulture*, Lath.

Native of the mountains of New Granada; in size nearly resembling the former. The back, wings, greater part of the neck, and bill, black; head reddish ash, with a crested tuft of long feathers, which stand erect when the bird is irritated; tail long, whitish, with transverse black bands; feet and toes yellow; claws black.

ALBICILLA. Cere and legs yellow; quill-feathers white, the middle ones tipped with black. Linn. *Aquila albicilla*, Briss. *Grand pyrgue*, Buff. *Cinereous eagle*.

Found in Europe and the southern parts of Russia; the size is equal to that of the turkey, and its food consists chiefly of fish and small birds.

CORONATUS. Cere ferruginous; feet white, spotted with black, downy; breast rufous; sides banded with black. Gmel. *Aquila africana cristata*, Briss. *Crowned eagle*, Edwards.

Inhabits Guinea. The body is brown above, with the edge of each feather pale brown; beneath white, with round black spots; breast rufous; the sides fasciated with black; tail deep grey, transversely banded with black; toes bright orange. The feathers on the top of the head, and forming a crest.

FALCO.

CHRYSAETOS. Cere yellow; legs downy, yellowish rusty; body variegated brown, and rusty; tail black, waved at the base with cinereous. Linn. *Le grand aigle*, Buff. *Gold adler swirling*, *Golden eagle*, Lath.

The length of this bird is three feet; breadth, when the wings are expanded, seven feet; the bill is blue; the cere and legs yellow; the head and neck bright rust colour; body and tail dark brown. It delights in mountainous situations, and occurs throughout Europe and Siberia. The golden eagle is a bird of prodigious strength and courage, and preys on all the smaller tribes of animals and birds, and is sometimes known to carry off the lambs from the flocks of sheep in the mountain pastures; it flies to an amazing height in serene weather.

OSSIFRAGUS. Cere and legs yellow; legs somewhat downy; body ferruginous; tail-feathers white on the inner side. Linn. *Aquila ossifraga*, Briss. *Sea eagle*, Will.

Size of a large turkey, and inhabits Europe and North America; this bird lives chiefly on fish.

LEUCOGASTER. White; back, wings, and tail dull brown; tip of the tail white; bill and legs yellow. Gmel. *White bellied eagle*, Lath.

Inhabits North America. The length is two feet nine inches; the bill brownish yellow, large, and much hooked; the head, neck, breast, belly, thighs, and vent white; back, wings, and tail dark brown; legs yellow, and very stout; claws black. Described from a specimen formerly in the Leverian museum. Native place supposed to be the islands in the South seas.

JAPONENSIS. Cere dusky; legs yellow; body brown. Gmel. *Japonefe hawk*, Lath.

Described from a specimen in the Bankian collection, measuring one foot eleven inches; the bill is narrow, at the base blue, tip black, and beneath yellowish; the forehead buff colour; the rest of the head and body brown, with the tips rusty; throat white, streaked with black, and surrounded with a black ring; feathers of the breast and belly yellowish-white at the edges; quills dark, and on the inner web of each several ferruginous spots placed transversely; tail deep brown, and all the feathers spotted each side of the webs with ferruginous, except the two outermost, which are plain on the outer web; claws rather large, hooked, and black.

FEROX. Cere green; body above brown; back, belly, and tail-coverts snowy, variegated with chestnut spots; tail-feathers equal, brown, with four paler bands. Gmel. Nov. Comm. Petr. *Fierce eagle*, Lath.

Was found abundant, according to Gmelin, near the city of Altrachan, in the winter of 1769. The length is about two feet, and its disposition highly fierce and rapacious, as it would not feed on the carcases of dead animals. The bill is lead colour; eye-lids blue; the head and neck ferruginous mixed with whitish; quill-feathers twenty-six in number, black, beneath white; tail-feathers twelve, equal, and beneath white; legs white, thick, and rough, and claws crooked.

SINENSIS. Cere and legs yellow; body above red-brown, beneath yellowish. Gmel. *Chinese eagle*, Lath.

Native of China, and other parts of Asia. In size corresponding nearly with the common eagle; across the wing a dusky band; two bands and tip of the tail dusky.

AMERICANUS. Cere, and woolly legs pale yellow; head, neck, and breast dusky-cinereous; transverse band on the cheeks, back, belly, wings, and tail black. Gmel. *Black cheeked eagle*, Arct. Zool.

Size of the common eagle; inhabits North America.

CHEELA. Somewhat crested, and fuscous; body brown;

wing-coverts spotted with white; rump white; tail with a broad white band. Lath. *Cheela falcon*.

Length exceeding two feet; the species inhabits India, where it is not uncommon, and is known by the name of Cheela.

ASIATICUS. Legs yellow, half downy; body brown above, white beneath; breast streaked; tail-feathers silver grey; external ones with five pale bands. Lath. *Asiatic falcon*.

Native of China; size that of the honey-buzzard. The bill is black; quill-feathers grey with black bands; upper tail-coverts white; legs downy on the fore part.

NOVA HOLLANDIÆ. White; cere, orbits, and legs pale yellow; hind claw twice as long as either of the rest. *Falco Nova Hollandia*, Gmel. *New Holland white eagle*, Lath.

Described on the authority of Dr. G. R. Forster. The species inhabits New Holland, is twenty inches in length, and has the bill and claws black.

AUSTRALIS. Deep brown; cere yellow; tail black with the tip yellowish. Gmel. *Staatenland eagle*, Lath.

Length twenty-five inches; the species inhabits Staten Land, and has a peculiar note, resembling the cry of the common hen.

GLAUCOPIS. Cere and legs citron yellow; legs somewhat downy; back and breast brown; head and crown yellowish-white with brown stripes; quill-feathers black. Gmel.

Found among the mountains of Germany; its length one foot nine inches. The bill is glaucous; nostrils large, oval, and beset with bristles; front with brown lunate marks; legs short, and covered with soft feathers.

MELANONOTUS. Cere, and woolly legs pale yellow; head, hind part of the neck, belly, and wing-coverts ferruginous; throat, breast, back, and quill-feathers black. Lath. Ind. Orn. *Falco niger*, Gmel. *Black backed eagle*, Brown.

Size of the golden eagle; bill and claws black; base of the tail to the middle white; the extreme part black; claws black. Native place unknown.

LEUCORYPHOS. Cere livid cinereous; legs pale whitish, slightly downy; body clouded brown; crown with a triangular white spot; throat white. Gmel. *Aquila leucorypha*, Pallas. *White crowned eagle*, Lath.

Frequents the southern parts of Siberia. This bird is larger than the osprey, and in several respects resembles it; the wings are dusky black, within white; tail long, stiff, equal; claws very large and black.

THARUS. Cere and legs pale yellow; body of the male whitish with black spots; female grey; crown crested. *Falco tharus*, Gmel. *Ubilese eagle*.

Described by Molina as an extremely common species in Chili, where it builds in the highest trees, forming its nest of twigs, wool, hair, and feathers; and lays five eggs. This bird feeds on carrion, poultry, &c. The female is rather smaller than the male.

MOGILNIK. Cere pale yellow; legs woolly, and with the rest of the body dusky ferruginous; back mixed with white. *Aquila mogilnik*, Gmel. Nov. Comm. Petrop. *Russian eagle*.

Inhabits the deserts near Tanais; the bill, pupil, claws, and quill-feathers black; tail equal; tail-feathers black, with dusky grey bands; tawny at the tips.

CRISTATUS. Head crested; back, throat, and wings black; belly white; tail with four parallel cinereous bands. Gmel. *Crested falcon*, Dillon. *Caracca falcon*, Lath.

Size

FALCO.

Size of a turkey; upper mandible much hooked, lower straight.

HALIÆTUS. Cere and legs blue; body above fuscous, beneath white; head whitish. Gmel.

LEVERIANUS. Legs yellow; head fuscous and white in alternate stripes; body above fuscous, beneath white; wings dull brown. Gmel. *Leverian falcon*, Arct. Zool.

Native of Carolina; size of the buzzard.

LAGOPUS. Cere and downy legs yellow; body black, spotted with white; tail-feathers white, towards the tip black. Gmel. *Graa-falk*, Act. Nidros. *Rongb-legged falcon*.

This rare species inhabits Europe, and has been observed in Britain; a specimen shot near London occurs in the collection of Mr. Donovan.

GROENLANDICA. Cere and legs lead-colour; body above brownish, beneath whitish with longitudinal brown streaks. Gmel. *Greenland falcon*, Arct. Zool. *Falco fuscus* β, Faun. Græn. *Falco lagopus* β, Lath.

By some writers this bird is considered as a variety of the former; the crown is brown with irregular oblong spots of white; front whitish; cheeks blackish; tail above dusky, crossed with paler bars, beneath whitish.

ANTILLARUM. Body entirely brown. Briss. *Mansfany*, Hist. Antilles.

Native of the West Indies. The species feeds on smaller birds, snakes, and other reptiles; and is about eighteen inches in length.

PENNATUS. Cere and legs yellow; body above variegated with blackish brown and dirty grey, beneath brown yellow, with longitudinal blackish lines; feet feathered to the toes. Gmel. *Falco pedibus pennatis*, Briss. *Booted falcon*.

Length about twenty inches; the bill blackish; head and neck yellow-grey with blackish lines; tail brown, towards the tip blackish, with the apex grey; claws black. Described by Brisson from a specimen in the museum of Madame de Bandeville; its native place unknown.

MARITIMUS. Cere and legs yellow; body and tip of the tail white; flanks reddish mixed with white. Gmel. *Javan eagle*.

A large species, measuring in length near four feet; it lives on the sea coast of Java, and feeds on fish and carrion.

ÆGYPTIUS. Cere yellow; legs half downy and yellow; body above cinereous, beneath ferruginous; wings above brown; tail forked, as long as the body, and barred with brown. Gmel. *Falco cinereo-ferrugineus*, Forkal. *Arabian kite*, Lath.

Frequent in Egypt. Length eighteen inches; bill yellow; tail-feathers black towards the tip; wings beneath grey-brown; tail cinereous; claws black.

NILOTICUS. Cere and legs yellow; body above reddish brown with transverse black rays; tail forked, as long as the body; wings variegated with brown, grey, white and reddish. Sonnini. *Nilotic falcon*.

Length twelve inches; the bill black, at the base grey; feathers of the head black in the middle, of the sides of the head varied with black, grey, and red; throat grey; upper part of the breast reddish with black longitudinal spots; rest of the body beneath grey, tinged with red; legs spotted with black.

MILVUS. Cere yellow; tail forked; body ferruginous; head whitish. Linn. *Milvus regalis*, Briss. *Milan royal*, Buff. *Hüner-geyer*, Licht. *Weisser Milan*, Cunnth. *Kite*, Will. *Donov. Brit. Birds*, &c.

The kite is common in most of the hilly parts of Britain,

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and is found in Sweden, Germany, and other parts of Europe, and also in Asia and Africa, but upon the best authorities appears to be unknown as an inhabitant of the American continent. In England it remains throughout the year; as it approaches the more northern climates it becomes migratory, passing the winter in milder climates. The kite is a bird of large dimensions, in length exceeding two feet. The smaller kinds of birds, and other animals of inferior size, are its usual prey; and poultry especially, in quest of which it is often seen hovering on the wing over farm-yards in the country ready to dart down upon the straggling young and carry them away. The egg of the kite is blueish white, inclining to red at one end.

In the last edition of the *Système Nature* three supposed varieties of this species are enumerated, as 2 *milvus vertice et gula castaneis*, Gmel. having the head and throat chestnut; 3 *accipiter korschun*, S. G. Gmel. found in the deserts at Tanain in the Russian dominions; the bill of which is blueish black; cere greenish; area of the eyes white; sides of the head pale brown; head and throat chestnut; 2 *milvus jai-censis*, Lepechin, with the coverts of the back violet; feathers marked at the top with a white spot.

ATER. Cere and legs yellow; above fuscous black; head and beneath whitish; tail forked. Gmel. *Milvus niger*, Briss. *Milan noir*, Buff. *Black geld*, Sibbald. *Braunermald geyer*, Kram.

Smaller than the common kite, and inhabits Europe.

AUSTRIACUS. Cere and legs yellow; legs somewhat downy; body above chestnut, beneath brickdust colour spotted with brown; tail forked. Gmel. *Brauner-geyer*, Kram. *Austrian kite*.

Inhabits the woods of Austria, and feeds on small birds and dormice; in point of size resembles the common kite.

BRASILIENSIS. Legs yellow; body rufous with white and yellow dots; tail variegated with white and brown. Gmel. *Circus brasiliensis*, Briss. *Milvus brasiliensis*, *Caracara*, Ray. *Brazilian kite*, Will.

Native of Brasil; its size is that of the common kite, and it is exceedingly destructive to poultry. Length nine inches.

FURCATUS. Cere obscure; legs yellowish; body above fuscous, beneath white, tail forked and very long. Gmel. *Milvus carolinensis*, Briss. *Falco peruvianus, cauda furcata*, Klein. *Milan de la Caroline*, Buff. *Swallow-tailed hawk*, Catesby. *Swallow-tailed falcon*, Arct. Zool.

An elegant species, and of larger size than the common European kite; it inhabits Carolina in the summer months, where it is called the snake hawk. The principal food of this bird consists of insects.

URUBITINGA. Cere and legs yellow; body fuscous and ferruginous varied; wings black mixed with cinereous; tail white, the tip black speckled with white. Gmel. *Urubitinga*, Ray. *Brazilian eagle*.

Brisson describes this as being about the size of a half grown duck, and as a native of Brasil.

ÆQUINOCTIALIS. Legs pale yellow; head, neck, and back black-brown; breast reddish; wing coverts and shoulders chocolate; tail black; the feathers, except the two middle ones, marked with the letter V in white. Gmel. *Equinoctial eagle*.

Native of Cayenne; length twenty-one inches; bill pale; claws pale, with the tip black.

ORIENTALIS. Legs lead-colour; body fuscous; eyebrows ferruginous; wings and tail spotted with white. Gmel. *Oriental hawk*, Lath.

Length seventeen inches; the bill is black, beneath yellow;

FALCO.

low; body beneath sub-ferruginous; the species inhabits Japan.

INDICUS. Cere and legs yellow; body reddish fuscous; front and rump white; belly streaked with whitish; tail brown, with five black bands. *Falco indicus*, Gmel. *Javan hawk*.

Size of the last; bill black, base yellow; hind head whitish.

PONTICERIANUS. Cere blueish; body chestnut; head, neck, and breast white, with a longitudinal brown line in the middle of all the feathers. *Aquila ponticeriana*, Briss. *Aigle de Pondichery*, Buff. *Pondicherry eagle*.

About the size of the jer-falcon, the length one foot seven inches. The species is held sacred among the natives on the coast of Malabar, where it inhabits.

BUREO. Cere and legs yellow; body fuscous; abdomen pale with fuscous spots; tail fulvous and banded. Linn. *La buse*, Buff. *Maasse geyer*, Gunth. *Pojana scunda*, Zinnan. *Buzzard*, Will.

The buzzard is a native of Europe and preys on small birds, reptiles, the inferior tribes of quadrupeds, and insects; its length is twenty inches. Not uncommon in Britain.

APIVORUS. Cere black; legs half naked and yellow; head cinereous; tail with a cinereous band, and white tip. Linn. *La bondrée*, Buff. *Pojana*, Zinnan. *Honey buzzard*, Lath. *Donov. Brit. Birds*.

Inhabits Europe, and preys on mice, lizards, frogs, small birds, and insects, especially bees, whence its name; the male birds are very uncommon, the female extremely rare. The length of this species is one foot eleven inches.

VARIEGATUS. Legs yellow, body fuscous, beneath white with fuscous spots; head and neck whitish with ferruginous-brown striz; tail pale brown, with paler bands crossing each other. *Falco variegatus*, Gmel. *Buzzardet*, Arct. *Zool. Speckled buzzard*, Lath.

Length twelve inches; the bill dusky with black claws. This species inhabits North America.

JAMAICENSIS. Cere and legs pale yellow; body above brownish yellow varied with fuscous. Gmel. *Jamaica buzzard*, Lath.

Inhabits Jamaica; the size of the common buzzard, and rare.

BOREALIS. Cere and legs pale yellow; body above brown, beneath white; tail pale rusty, with a transverse rusty band near the tip. Gmel. *Red tailed falcon*, Arct. *Zool*.

Size of the last, and inhabits North America.

RUFUS. Legs yellow; body rufous, above inclining to brown; tail cinereous. Gmel. *Circus rufus*, Briss. *Fischgeyer*, Frisch. *La harpaye*, Buffon. *Harpy falcon*.

Native of France and Germany.

ÆRUGINOSUS. Cere greenish; body grey; crown, chin, arm-pits, and legs yellow. Linn. *Falco baticus*, Gern. *Circus palustris*, Briss. *Bufard*, Buff. *Fausperdrieux*, Belou. *Il nibbio*, Zinnan. *Moor-buzzard*, Will.

Length twenty-one inches; the species inhabits Europe, where it frequents marshy places, and subsists principally on fish, aquatic birds, and rabbits. Some variation is observable in the plumage of different individuals of this species.

SLAVONICUS. Cere yellow; legs downy; body brick-dust colour, spotted with black; head and neck whitish. Kram. *Slavonian buzzard*.

Native of Slavonia; its size that of the common cock.

MARGINATUS. Cere blueish; body above variegated brown and rusty, beneath rusty, with irregular oval brown spots; tail-feathers barred with blackish, edged with white. *Falco marginatus*, It. *Pofegan*. *Croatian buzzard*.

Rather less than the former, and also inhabits Slavonia and Croatia.

RUBIGINOSUS. Fuscous; beneath whitish-yellow; breast with a yellow spot; tail-feathers with four dull red bars. It. *Pofegan*.

Bill black; head whitish yellow; wing-coverts white at the tip; legs pale yellow. The species inhabits Slavonia.

JAVANICUS. Cere black, in the middle yellow; legs yellow; head, neck, and breast chestnut; back brown. *Wurmb*.

Inhabits the maritime parts of Java, and feeds on fish.

SPADICEUS. Cere yellow; body chocolate mixed with rusty; beneath white at the sides; legs feathered to the toes. *Falco spadiceus*, Phil. *Tranf. Bay falcon*, Lath.

This and the Placentia falcon (Lath.) are supposed to be varieties of the same species. The first is from Hudson's bay, the other from Newfoundland. The Bay falcon preys on ducks, which they seize as they rise out of the water; its length is twenty-two inches.

OBSOLETUS. Legs yellow, body brown; beneath slightly spotted with white; tail-feathers in the middle pale brown. Gmel. *Plain falcon*.

Length two feet; bill black, nape spotted with white; native of Hudson's bay.

NOVÆ ZELANDIÆ. Cere and legs yellow; body ferruginous brown; beneath striated with rufous; tail fasciated with pale yellow; thighs ferruginous. Lath. *New Zealand falcon*.

The female measures twenty three inches in length, the male eighteen. Its bill is blue, as are also the naked orbits of the eye; in the female the orbits are blue.

LINEATUS. Cere and legs yellow; body ferruginous brown, varied with white and pale-rusty lines; tail-feathers dusky brown, with two transverse dirty white bands and tips. Gmel. *Red shouldered falcon*, Arct. *Zool. Barred-breasted buzzard*, Lath.

Native of North America; size that of the common buzzard.

RUSTICOLUS. Cere, eye-lids, and legs yellow; body waved with cinereous and white; collar white. Linn. *Collared falcon*.

Inhabits Sweden, and, according to Linnæus, is the size of the common hen.

MACRORUS. Cere and legs pale yellow; bill blackish; body above cinereous, beneath white; inner parts of the wings cinereous, tips white. *Lepechin, &c. Long-tailed falcon*.

The length of this bird is nineteen inches; tail nearly nine inches; it inhabits Russia, and is known by the name of Lun.

CAYENNENSIS. Legs blue; head and neck blueish-white; back and wings dusky ash, throat, breast, and belly whitish. Gmel. *Petit autour de Cayenne*, Buff. *Cayenne falcon*.

Native of Cayenne; the bill is blue; irids yellow.

PALUMBARIUS. Cere black, edged with yellow; legs yellow; body brown; tail-feathers with pale bands; eye-brows white. Linn. &c. *Astur*, Briss. *Grosser gepfeiler*, Falck, Frisch. *L'astore*, Cetti. *Goskaruk*.

Formerly used in falconry, and highly esteemed for that purpose; the species is twenty-two inches in length; the bill blue with the tip black; irids yellow; head brown; body beneath white, waved with black; tail long, cinereous, white at the tip, and claws blueish. The gofhawk is scarce in England, in Scotland not uncommon, and is there considered very destructive to game. The species inhabits various parts of Europe, and extends to Asia and America.

GENTILIS.

FALCO.

GENILIS. Cere and legs yellow; body cinereous with brown spots; tail with four blackish bands. Linn. *Falco montanus*, Ray. *Falcon gentil*, Will. &c.

Inhabits the mountains of Europe and North America, and occurs rarely in England; the size excels that of the goshawk, and the species preys on partridges. The bill is lead-colour; irids yellow; head reddish with oblong black spots; tail dotted with white; claws black.

COMMUNIS. Body brown; the feathers edged with rusty; tail with darker transverse bands; bill blueish ash; cere, irids, and legs yellow. Linn. *Accipiter fuscus*, Frisch. *Falcon*, Buff. *Il falcone cetti*. *Common falcon*.

The common falcon is about the size of a moderate fowl, and nearly eighteen inches in length. Whether this be the primitive stock from whence the following supposed varieties, enumerated by falconers, have originated, we cannot pretend to determine; and shall only observe that it is admitted as such by writers of repute.

Varieties.

Hornotinus β. Inclining to cinereous. Gmel. *Falcon fors*, Buff. *Yearling falcon*, Lath. *The young of the common falcon*.

Gibbosus γ. Back gibbous. Ray. *Falcon haggard ou bossu*, Buff. *Haggard falcon*, Will.

So named when grown old, from drawing its head close between the shoulders, as though it were hump-backed.

Leucocephalus δ. Head white, with small brown spots. Briff. *Raub-fufs-geyer*; *gelbbrauner geyer*, Frisch. *White beaded falcon*.

In this variety the bill is ash-coloured; cere pale yellow; back and wing-coverts spotted with brown, rufous, grey, and whitish indiscriminately; beneath grey with brown spots, each spot encircled with rufous; feet feathered to the toes; legs yellow; claws black. There is another variety in which the head, neck, and breast are white, with minute fuscous spots only.

Albus ε. Entirely white. Ray. *Weisser falk*, *Weisser geyer*, Frisch. *White falcon*, Will.

Several varieties of this kind are described; in some the back and wings are marked with a few black spots, and the tail barred; others have the white plumage marked with scarcely visible yellow spots.

Ater ζ. Uniformly blackish brown. Briff. *Falco columbarius nebbi dielus*, Ray. *Black hawk*, Edw.

Buffon admits this to be a distinct species, and names it le *Falcon Passager*.

Navius η. Wings spotted. Briff.

Fuscus θ. Dark brown. *Braunfabler geyer*, Frisch. *Brown falcon*.

Ruber ι. Spotted with black and red. *Falco rubens*, Ray. *Red falcon*, Will.

Indicus κ. Beneath reddish fulvous. *Falco ruber indicus*, Briff. *Falcones rubri indici Aldrovandi*, Ray. *Red Indian falcon*.

Italicus λ. Breast pale yellow with ferruginous spots; wings near the tip spotted with white. Briff. *Italian falcon*.

Found in the Alps.

The varieties above-mentioned are widely dispersed throughout Europe, and North America, China, and other parts of Asia.

GYRFALCO. Cere blue, legs yellow; body fuscous; beneath fasciated with cinereous; tail at the sides white. Linn. *Jer-falcon*.

Inhabits Europe.

ISLANDICUS. White, with fuscous spots; tail-feathers white; outer edges spotted with brown. Lath.

Native of Iceland.

PEREGRINUS. Cere and legs pale yellow; body above blue, cinereous, striped with brown; beneath reddish-white, with blackish stripes; tail dotted with white. Gmel. *Peregrine falcon*. Donov. Brit. Birds, &c.

Breeds in the mountainous parts of Britain, and was formerly employed in the sports of falconry. The species is found in various parts of Europe, Asia, and America.

VERSICOLOR. Cere yellow; head and body above white, with pale reddish spots, beneath white; breast a little spotted with ferruginous. Gmel. *Spotted falcon*.

Three distinct species of the falco tribe have been described by different English writers, under the name of the spotted falcon. The first bird to which this name was assigned is smaller than the other two, and differs considerably in plumage; the second is the spotted falcon of Pennant; and the third the spotted falcon of Lewin and Walcot. The errors of the latter-mentioned writers have originated from misconceiving the specimen first designated by the title of the spotted falcon, and which for this reason ought with propriety to be considered as the original. Each of the individual specimens described by those respective writers were preserved in the late Leverian museum, and are at present in the possession of Mr. Donovan.

BARBARUS. Cere and legs pale yellow; body blueish, with fuscous spots; breast immaculate; tail fasciated. Linn. *Falco tunetanus*, Ray. *Barbary falcon*, Will.

Length one foot five inches; the species inhabits Barbary.

S. JOHANNIS. Cere and feathered legs yellow; body brown; above with black and dirty white oblique lines; beneath with white and yellowish spots; tail barred, and white at the tip. Gmel. *St. John's falcon*, Arct. Zool.

Native of Newfoundland.

SACER. Cere and legs blue; back, breast, and primary wing-coverts spotted with brown; tail with kidney-shaped spots. Briff. *Sacre*, Buff.

A large species, measuring in length two feet; it inhabits Europe, and extends to Tartary. The speckled partridge-hawk of the Arctic Zoology is supposed to be a variety of this bird.

NOVÆ TERRÆ. Cere and legs yellow; body above brown, beneath and hind head ferruginous; tail variegated with paler and darker lines. Gmel. *Newfoundland falcon*.

Length twenty inches; legs half-feathered; the species inhabits Newfoundland.

STELLARIS. Legs blue; body blackish, with radiate spots; beneath intermixed with black and white. Briff. *Falco cyanopus*, Klein. *Blue footed*, Will. *Starry falcon*, Lath.

Native of Europe. Size of the peregrine falcon; wings shorter; tail longer; irids golden.

HYEMALIS. Cere yellow; head and back black brown; neck streaked with white; breast and belly white, with cordated spots. Gmel. *Winter falcon*, Arct. Zool. *Northern falcon*, Lath.

Inhabits New York during the winter season. Length eighteen inches; in the male the wing-coverts are dusky, edged with dull white, the exterior one orange; tail with brown and black bars, and white at the tip; bill black; feet long and slender.

RHOMBUS. Legs yellowish; body above grey, beneath brown, with rhombic spots; tail-feathers with eleven oblique black bands. Lath. *Rhomboidal falcon*.

The length of this bird is nineteen inches; the bill is lead colour;

FALCO.

colour; head and neck black; back and wings grey, with black bands; tail grey, and fasciated with black; native of India, about the river Ganges.

NIGRICOLLIS. Legs yellow; body rufous, with black bars; crown and neck streaked with black; tail-feathers blackish at the tips. Lath. *Black-necked falcon*, Lath.

Native of Cayenne; its length one foot eleven inches; bill black, and a black streak behind the eyes.

ALBICOLLIS. Legs yellow; head, neck, fore part of the back, breast, and belly white; wings black, with white spots; feathers between the shoulders marked with square black spots. Lath. *White-necked falcon*.

Length twenty-two inches; quill-feathers spotted with white from the base to the middle. Inhabits Cayenne.

MELANOLEUCOS. Legs pale yellow; body white; head, neck, back, shoulders, and quill-feathers black; wing-coverts and tail white. Gmel. *Black and white Indian falcon*, Ind. Zool.

Described by Sonnerat as a native of Ceylon, under the title of *falcon á collier des Indes*. The length is sixteen inches; its irids are yellow; orbits spotted with white; bill, claws, and middle wing-coverts blackish.

CIRRATUS. Cere and feathered legs pale yellow; bill crell on the hind head pendulous; body above black; beneath striated black and white. Lath. *Falco indicus cristatus*, Buff. *Cirrhatus*, Ray. *Falcon bapé des Indes*, Buff. *Crested Indian falcon*, Will.

Size of the goshawk; the bill dark blue; irids yellow; neck tawny; tail with cinereous and black bands placed transversely; claws black. A supposed variety, has a black band across the breast, and another on the wing.

MERIDIONALIS. Cere and chin yellow; head and neck rufous, with dark streaks; belly whitish, with narrow black bars; four middle tail-feathers with one, the outer with six pale bars. Lath. *Rufous-headed falcon*.

Length nineteen inches; the species inhabits Cayenne.

MELANOPS. Cere and legs pale yellow; body black, with white spots; beneath white; head and neck white, with black stripe; orbits black; quill-feathers black, with a white band in the middle. Lath. *Streaked falcon*.

Size of a rook, and inhabits Cayenne.

CACHINNANS. Cere and legs pale yellow; eye-brows white; body varied with brown and whitish; crown white, with a black ring. Linn. *Laughing falcon*, Lath.

Inhabits South America, and emits a laughing sound when observed. The back, wings, and rump are brown; neck, chin, breast, and belly, with the under parts of the wings white; tail with yellow and black bands.

SUFFLATOR. Cere and legs pale yellow; body whitish-brown; eye-lids bony. Linn. *Surinam falcon*, Lath.

Native of Surinam.

BIDENTATUS. Bill bidentated and fuscous; body lead colour; breast and abdomen rufous; vent white; quill-feathers with many, tail with three bars of white. Lath. *Notched falcon*.

Native of Cayenne; length fourteen inches.

FORMOSUS. Cere and legs pale yellow; throat and neck purple; body above blue, tinged with red; abdomen flesh-colour. *Falco formosus*, Lath. *Falco aquilinus*, Gmel. *Petit aigle d'Amérique*, Buff. *Red-throated falcon*.

The length of this beautiful species is eighteen inches. The bill is blue and straight at the base; irids orange; legs yellow; claws black. Inhabits Cayenne and South America. The female is five inches longer than the male, the body blacker, purple on the neck more obscure, and the posterior part of the thighs with the vent white.

ALBICANS. Cere and legs pale yellow; body brownish,

beneath whitish; quill and tail-feathers blackish. Gmel. *White lanner*.

Inhabits Europe, and is by some believed to be the same with the common lanner.

LANNERUS. Cere pale yellow; legs and bill blue; body beneath marked with black longitudinal spots. Linn. *Le lanner*, Buff. *Lanneret*, Alb. *Lanner*, Arct. Zool. *Bronze lanner*.

Rather less than the buzzard, and inhabits Europe; very rare in Britain.

CYANEUS. Cere white; legs fulvous; body blue-grey; a white arch over the eyes, and surrounding the chin (male). *Falco cyaneus*, Linn. *Falco torquatus* (mal.), Buff. *Falco accipiter* (mal.), Ray. *Falco othmanella*, Germ. *Falco cinereus*, Fisch. *Oiseau St. Martin*, Buff. *Hen Harrier*, Lath. Donovan. Br. Birds, &c.

Cere and legs yellow; body cinereous; abdomen pale, with oblong rufous spots; orbits of the eyes white (female). *Falco pygargus*, Linn. *Falco torquatus* (fem.). *La foubuste*, Buff. *Ring-tail*, Lath. Donovan. Br. Birds, &c.

The above are the two sexes of the same species; the male is fifteen inches in length, the female nineteen inches and a half; the species is found in Europe and Siberia.

HUNSONIUS. Cere and legs yellow; back brown; eye-brows white; speculum on the wing bluish. Linn. *Ring-tailed hawk*, Edwards. *White-rumped bay falcon*, Lath.

Length one foot nine inches and a half; the bill black; body beneath white, with rufous-brown spots. The Hudson's bay ring-tail of Latham is supposed by that writer, in Ind. Orn. to be the same with the above, and both, together with the following, are imagined to be varieties of cyaneus.

BURROSI. Cere blue; legs yellow; body blackish chestnut; beneath reddish buff; eye-brows yellow; tail with pale and dusky brown spots. Gmel. *Cayenne ringtail*, Lath.

Inhabits Cayenne.

ULIGINOSUS. Cere and legs orange, body above brown, beneath shining rusty; tail with four black bands. Gmel. *Blayß hawk*.

Brisson considers this as a variety of *falco cyaneus*, and in this opinion he is countenanced by some other writers; it differs principally in being larger, and in having a black streak through the eye, independently of the above-mentioned characters. The Marsh hawk is represented as a fierce bird, and inhabits Jamaica.

CALIDUS. Legs yellow; body brown-black, beneath white, with black lamellae; tail with obsolete bars. Lath. *Lebrée falcon*.

This species inhabits India, and is called *Behree*; its length is nineteen inches.

NIVIDUS. Lead colour; beneath white, with cinereous bands; tail-feathers blackish, with two narrow transverse white lines. Gmel. *Plumbeus falcon*.

Native of Cayenne; length thirteen inches and a half; legs yellow.

TINNUNCULUS. Cere and legs yellow; back rufous with black dots; breast striated with fuscous; tail rounded. Linn. *Cenebris*, Klein. *La Créffrelle*, Buff. *Kesril*, *stannel*, or *windbower*, Will. Lath. Donovan. Brit. Birds, &c.

The male is fourteen inches in length, the female much larger; the former has the head and tail grey, and the back and wings purplish red, with black spots; in the female the head is reddish with black streaks; back, tail, and wing-coverts rusty with black lines. The species was formerly employed in the sports of falconry for young partridges, and small birds. The hawk, called *l'épervier des alouettes*

FALCO.

alouettes by Brisson is supposed to be a variety of the female kestrel.

SPARVERIUS. Cere and legs pale yellow; head fuscous; crown and abdomen red; wings blueish. Linn. *Falco carolinensis*, Briss. *Emerillon de Cayenne*, Buff. *Little falcon*, Catesby.

Native of Carolina, Virginia, and St. Domingo; the length eleven inches, bill and irids yellowish; head blueish ash; crown, body above, and wing-coverts brown-orange, with black transverse lines; tail red-brown, with dots of black; legs yellow; head of the supposed female surrounded with seven blackish spots.

DOMINICENSIS. Cere and legs pale yellow; head cinereous; body above red-brown, beneath dirty white, and both spotted with black; eight middle tail-feathers chequered, towards the tips black, and at the extremity white. Gmel. *Falco dominicensis*, Briss. *Emerillon de St. Domingue*, Buff. *New York merlin*, Lath. and *St. Domingo falcon*, Lath.

Inhabits St. Domingo. The bill is yellow, with the tip black; irids yellow; outer tail-feathers of the male white on the outside and tips; inside chequered, with a transverse black spot towards the tips; of the female the outside white, with five black spots; claws black. The male also differs in having the upper part less numerously spotted than in the female, and the throat and fore part of the neck more inclining to red-brown. In the Ind. Orn. of Latham sparverius and dominicensis are admitted to be of the same species, the first as male, the other female.

NIUS. Cere green; legs yellow; abdomen undulated with grey; tail with blackish bands. Linn. *Accipiter*, Briss. *Nisus striatus sagittatus*, Frisch. *Le sparviere*, Cetti. *Epervier*, Buff. *Sparrow hawk*, Will. Donov.

The two sexes of this hawk are exceedingly dissimilar; the male is twelve inches in length, and the female fifteen. In the male the plumage verges to dove colour, like the female it is marked on the breast with transverse lines, but which are less abrupt, and numerous than in the other sex; and the under parts are also darker. Both sexes are pale above the eyes, and the bill and legs blue. The sparrow hawk commits vast havoc among the young of poultry and game, as well as pigeons, and all the smaller tribes of bird. The spotted sparrow hawk of Latham, *Pepervier tacheté* of Brisson, is a variety of this species. The sparrow hawk with the plumage perfectly white, or milky white, occurs occasionally. Gmelin describes one of this kind as a distinct variety "accipiter corpore toto lacteo unicolore." The same circumstance is however observable in birds of every description.

BOHEMICUS. Legs yellowish; body above cinereous; beneath white; orbits white; five exterior quill-feathers black. Gmel. *Mausf-habicht*, *missilauce*, Mayer. *Bohemian falcon*.

Inhabits the mountains of Bohemia, and preys in the evening on mice. Length about one foot.

FUSCUS. Cere cinereous; legs yellow; body black, waved; above cinereous-brown, beneath whitish. Gmel. *American brown hawk*.

Size of the sparrow hawk; bill lead colour; tail cinereous with three transverse pale brown bands; tip paler; claws black.

PISCATOR. Somewhat crested; head ferruginous; body cinereous; margin of the feathers fuscous; beneath yellowish, with longitudinal fuscous spots. Lath. *Falcon peckeur*, Damp. *Fishing falcon*.

Native of Senegal, and subsists on fish; the bill and irids are yellow; legs fuscous.

BADIUS. Legs pale, head and body above brown, beneath white, with yellow lunar spots; tail pale brown, with four dusky lines. *Falco badius*, Gmel. *Brown hawk*, Brown Illustr.

Inhabits Ceylon; length thirteen inches; bill blue, irids yellow.

DUBIUS. Cere, irids, and legs yellow; body fuscous, beneath white, striated with fuscous; tail-feathers cinereous, with four black bands. Gmel. *Dubius falcon*, Lath.

Length ten inches, and inhabits Carolina.

OBSCURUS. Cere and legs yellow; hind head and neck spotted with white; body above fuscous; beneath whitish lined with black; tail with fuscous bands. *Falco obscurus*, Gmel. *Dusky falcon*, Arct. Zool.

Smaller than the last, and inhabits New York. The bill is blueish; head dull fuscous; tail short; legs with the tip white.

COLUMBARIUS. Cere, irids, and legs pale yellow; body fuscous; beneath whitish, striated with fuscous; tail with four narrow black bands. Linn. &c. *Accipiter carolinensis*, Briss. *Epervier des pigeons*, Buff. *Pigeon hawk*, Catesby.

Length ten inches, the bill whitish, with black tip; legs yellow, and claws black; the species is a native of Carolina, and other parts of North America, and is called the small bird hawk by the inhabitants of Hudson's bay. It feeds on small birds, and shrieks hideously.

VOCIFERUS. Legs yellow; body cinereous grey, beneath white; larger and lesser wing-coverts black. Gmel. *Pette buse criarde*, Son. *Criard falcon*.

Frequent among the rice plantations on the coast of Comandel, where it is supposed to prey on the frogs which abound in those places; when disturbed, it utters a loud cry, and has hence obtained the name of criard. Its size is that of a pigeon; the irids are yellow, and the orbits red and naked.

SUPERCILIOSUS. Cere and eye-lids pale yellow; body fuscous, with whitish waves; quill-feathers rusty, with black bands. Linn. *Guiana falcon*, Lath.

Size of the magpie, and inhabits Surinam and Guiana. The secondary tail-feathers are whitish at the outer edge; the tail black, with two broad bands, and cinereous tip; vent white, with a few black streaks; bill and claws black.

VESPERTINUS. Cere, legs, and eye lids pale yellow; vent and thighs ferruginous. Linn. *Kober*, Decouv. *Ingrian falcon*.

Native of Ingrida, Russia, and Siberia; on the banks of the Baikal very common, and known by the names of kober and derbuitcheok; it flies chiefly in the evening or night time, and feeds on quails, small birds, reptiles, &c. The size is that of the pigeon; the body blueish, fuscous; belly blueish white; head fuscous; bill yellow; legs naked. The nest is built on the tops of high trees, and not unfrequently it takes possession of the magpie's nest instead of constructing one for itself.

VESPERTINOIDES. Cere, legs, and eye-brows pale yellow; thighs black; neck, breast, and belly brownish, with white spots, *Falk*, &c. *Permian falcon*.

Inhabits Permian and Baschkuria, in Siberia; size half that of vespertinus.

MAGNIROSTRIS. Cere and legs yellow; body fuscous; abdomen white, with ferruginous stripe; quill-feathers black and white banded. Gmel. *Epervier à gros bec de Cayenne*, Buff. *Great-billed falcon*.

Larger than the sparrow hawk, and inhabits Cayenne.

JOHANNENSIS. Legs pale yellow; body ferruginous, with

with linear black dots; throat pale yellow; quill-feathers blackish fuscous; tail cuneiform and white. Lath. *Johanna falcon*.

Inhabits the island of Johanna, in India; its size uncertain, the species being described from a manuscript in the possession of the late Dr. Fothergill.

SUBBUTEO. Cere and legs yellow; back fuscous; nape white; abdomen pale, with oblong fuscous spots; vent and thighs rufous. Linn. *Falco barletta*, Ger. *Hobreau*, Priss. *Baum falck*, Gunth. *Hobby*, Will. Lath. *Donov.* Br. Birds, &c.

Native of Europe, and extending as far as Siberia. Length twelve inches; the bill blue; orbits yellow; lateral tail-feathers with blackish bars; claws black. Preys on larks, and other small birds. A variety of this bird has the body above blueish black; cheeks white with a black line reaching through them from the crown.

LITHOFALCO. Cere yellow; body cinereous fuscous; beneath reddish with longitudinal fuscous streaks; tail-feathers blackish toward the tips, and at the extremity white. *Falco lithofalco*, Ray. *Le rochier*, Buff. *Stone falcon*, Will.

Size of the kestrel, and inhabits Europe; bill lead-colour, irids yellow.

MONTANUS. Legs pale yellow; body cinereous brown, beneath whitish; head black; throat spotted; tail at the base cinereous, in the middle blackish, at the tip white. Gmel. *Falco montanus*, Ray. *Mountain falcon*, Will.

Briffon describes this bird as being less than the peregrine falcon, and as a probable variety of the stone falcon; the "faucou de montagne cendrée" of the same writer is conceived to be another variety; the latter is twenty-one inches in length; the bill is black; iris yellow; general colour cinereous; palest on the wing-coverts; beneath white; legs luteous.

AURANTIUS. Bill and legs lead colour; body blackish; back, base, and tail with white interrupted bands; breast fulvous; thighs ferruginous. Lath. *Orange-breasted hobby*.

Native of Surinam, and in length fifteen inches. The bill is whitish at the base; throat with round white spots; lower tail-coverts rusty; legs long and slender; claws black. There is a variety in which the body is more dusky; the chin white, and throat orange; this is two-thirds the size of the former. Another of the same magnitude as the latter small variety has the legs tawny; body above blueish-black with blueish streaks, and streaked beneath with white.

PLUMBEUS. Cere dusky; legs yellow; body cinereous; upper part of the back black-lead colour; tail feathers underneath with three white spots. Lath. *Spotted-tail hobby*.

Size of the sparrow hawk; bill and claws black; head and neck cinereous; legs short. Native of Cayenne.

ÆSALON. Cere and legs yellow; head ferruginous; body above blueish-ash with rusty spots and stripes; beneath yellowish white with oblong spots. Gmel. &c. *Cenobris*, Frisch. *Accipiter fmerillus*, Ger. *Merlin*, Will. *Donov.* Br. Birds, &c.

The merlin inhabits various countries in Europe, and the southern part of Asia, but appears to be every where rather uncommon. The species is of a small size, being scarcely larger than a blackbird: it was nevertheless formerly employed in the sports of falconry, and was not considered inferior in point of spirit to any of the hawk tribe. Merlins have been known to breed, though very rarely, in North Britain; in less temperate regions they migrate southerly

at the approach of winter. The bill is blueish; tail marked with alternate dusky and reddish streaks; claws black.

There are several varieties of this species: one kind has the front cinereous; crown, back, and wing-coverts chestnut; temples with a triangular spot of white, edged with black; tail chestnut with black stripes, beneath varied with black and white. The Caribbee variety is rather larger than a thrush; it is rufous above with black spots, beneath white with longitudinal spots of black. Briffon considers this as a variety of the merlin, and names it *Pemerillon des Antilles*. The natives of the Antilles call it *gry gry*. The true falconer's merlin, according to Buffon, resembles the hobby in figure, except that the wings are shorter, and in colour and other respects accords with the stone falcon. This, however, seems very doubtful, as Salerne observes, for sportsmen have commonly confounded all birds of the hawk tribe inferior in size to the buzzard, under the name of merlin, and there are, for this reason, several birds which have an equal claim to the same title, as well as the ambiguous variety mentioned by Buffon.

MINUTUS. Cere brown; legs yellow; body beneath white; tail-feathers brown, banded with black. Linn. *Accipiter minor*, Briss. *Minute falcon*.

Inhabits the island of Malta; length eleven inches; the bill and claws are black; body above brown, varied with rufous; beneath with transverse brownish red streaks; belly with lanceolate spots.

CÆRULESCENS. Cere, eye-lids, legs, and body beneath pale yellow; back blueish black; temples furrounded by a white line. Linn. *Falco bengalensis*, Briss. *Little black and orange Indian hawk*, Edw. *Bengal falcon*. Length six inches and a half; inhabits Bengal.

REGULUS. Cere greenish; legs obscure yellow; ruff ferruginous; body above lead colour, beneath whitish with rusty spots. Pallas. *Siberian falcon*.

A rare species discovered by Pallas in Siberia; the irids are brown; crown brown with black lines; wings white at the edges, varying beneath; tail feathers lead-colour towards the tip, beneath with pale bands, edges black, tips white. Less than six inches in length; and preys on larks.

TINUS. Legs yellow; body cinereous fuscous; beneath whitish with blackish bands; crown whitish. Lath. *Tiny falcon*.

This minute species, formerly in the Leverian museum, is six inches in length, or rather less; the bill dusky; legs yellow. The tail in this specimen wanting.

The jer-falcon, the gentil falcon, the common falcon, the peregrine, and the goshawk, were the principal species used in the diversion of *Falconry*, which see.

FALCON, in *Gunnery*. See **FAUCON**.

FALCON ISLANDS, in *Geography*, two or three small islands near the coast of Connecticut, in Long Island found. N. lat. $41^{\circ} 10'$. W. long. $72^{\circ} 40'$.

FALCON, in *Ornithology*. See **FALCO**.

FALCONARA, in *Geography*, a town of Naples, in Calabria Citra; nine miles W. of Cosenza.

FALCONE, DA BENEVENTO, in *Biography*, an ancient chronicler, filled an high office under pope Innocent II. about the middle of the 12th century. He was afterwards chief magistrate of Benevento. He wrote a chronicle of the affairs of the kingdom of Naples from 1102 to 1140, which is esteemed a faithful and very useful record. It is found in Muratori's and other historical collections. Moreri.

FALCONER, a person who brings up, tames, and makes, that is, tutors and manages birds of prey; as falcons, hawks, &c. The grand seignior usually keeps six thousand

falconers in his service. The French king had a grand falconer, which was an office dismembered from that of great hunt, grand veneur. The duke of St. Alban's is hereditary grand falconer of England.

Historians take notice of this post as early as the year 1250. One great business of the falconer is to consider the quality and mettle of the birds, to know which to fly early, and which late. He must also be busy and cleanly in freeing them of lice, nits, and vermin. Every night after flying he should give his bird casting; nor must he forget to water her unless she have been bathed. After this, she must be put in a warm room, having a perch, with a candle burning by her; where she is to sit unhooded, that she may prune and pick herself. Next morning she should be weathered, &c.

FALCONER, WILLIAM, in *Biography*, was born in a village in Fifeshire, Scotland, and left, at an early age, an orphan. He was brought up a sailor, and in that capacity he spent the greater part of his life, in a very low station. We do not know how he acquired a taste for literature, but while serving on board a man of war he attracted the notice of Campbell, author of *Lexiphanes*, who took him for his servant, and became his literary instructor. He published, in 1751, a poem on the death of Frederic, prince of Wales, which was but little noticed, and he was left to struggle with the hardships of his profession. Like many other poets, he seems to have been the sport of ill fortune, for he calls himself "a hapless youth, whose vital page was one sad lengthened tale of woe." He suffered shipwreck in a voyage from Alexandria to Venice, a circumstance that produced a poem to which he is indebted for celebrity: it is entitled "The Shipwreck." He dedicated this little work to Edward, duke of York, by whose interest he obtained the lucrative employment of purser to the Royal George. This poem consists of three cantos: the scene of the first is near the city of Candia, and the time about four days and a half; the scene of the second lies in the sea between Cape Frefchia in Candia, and the island of Falconera; the time from nine in the morning till one the following morning; the scene of the third stretches from that part of the Archipelago which lies ten miles to the northward of Falconera to Cape Colonna, in Attica; the time from one till eight in the morning. The versification of this poem is varied and melodious; its description, being drawn from reality, is strong, glowing, and often original. It is, nevertheless, so technical, as sometimes to be too obscure for common readers; but it has the advantage of communicating new ideas, which is no common quality in cultivated verse. After Mr. Falconer's promotion in the sea-service, he enlisted in the field of satirical controversy, as one of the king's friends, and wrote a satirical poem, entitled, "The Demagogue," in which Mr. Pitt, Wilkes, Churchill, and the opposition in general, were treated with virulence. In 1769 he published "The Marine Dictionary," a work of considerable merit, and to which many modern Cyclopædias have been indebted. This was his last performance, for in the same year he embarked on board the *Aurora*, bound to the East Indies, where Falconer proposed to settle. The vessel was never heard of after she left the Cape of Good Hope, and it is supposed she perished with all her crew. *Lives of the Poets*.

FALCONERA, in *Geography*, a town of Italy, in the duchy of Mirandola; four miles N.E. of Mirandola. N. lat. 36° 57'. E. long. 24° 1'.—Also, a town of Italy, in the department of the Panaro; four miles N. of Mirandola.

FALCONET, in *Gunnery*. See FAUCONET.

FALCONIERI, in *Geography*, a small island in the Mediterranean, near the coast of Sicily.

FALCONRY, or FAUCONRY, the art of taming, managing, and tutoring, birds of prey, particularly falcons and hawks; and employing them with advantage in the pursuit of game; called also hawking. This art is now in a great degree superseded through most parts of Europe by the more certain and ready services of the gun.

The word is formed of *falco*, *falcon*, or *faucon*, the bird of most use and esteem in this kind of sport.

Falconry, though the principal amusement of our ancestors, was either wholly unknown, or very little practised, among the Greeks and Romans. All their writings do not furnish so much as a proper name to call it by; so far are they from teaching us the terms. Aristotle (*Hist. Anim.* l. ix. c. 6.) merely mentions some rude practice of this art in Thrace; and Ælian (*Hist. Anim.* l. iv. c. 26.) speaks of hawks and crows among the Indians (see also Pliny *H. N.* l. ii. c. 8.); but little or no mention of true falconry occurs before Julius Firmicus, in the days of Constantius, son to Constantine the Great. If the Romans, says the learned Rigaltius, had well understood their airy chase, they would have abandoned or less regarded their Circensian recreations. In the European world the Germans and the French seem to have been the first who devoted themselves to the science of falconry.

It is the French language alone that has particular words for all the parts of falconry and hunting; and from them most of our terms, as well as what we know of the art itself, are borrowed.

The art of falconry, says Beckmann, who maintains that it was known to both the Greeks and Romans, seems to have been in the greatest perfection, and to have been much in vogue with the principal courts of Europe, in the 12th century. Hence some have, therefore, ascribed the invention of it to the emperor Frederic I., and others to Frederic II. But when the invention of gun-powder was introduced, hawks were discarded, and the diversion of fowling was very much restricted to shooting.

"In our own country," says Mr. Pennant, "I cannot trace the certainty of falconry till the reign of king Ethelbert, the Saxon monarch, in the year 760, when he wrote to Germany for a brace of falcons, which would fly at cranes and bring them to the ground, as there were very few such in Kent. It seems highly probable, that falconry had its rise in Scythia, and passed from thence to the northern parts of Europe. Tartary is even at present celebrated for its fine breed of falcons; and the sport is in such general esteem, that, according to Olearius, (tom. i. p. 217, 218.) there was no hut but what had its eagle or falcon. The boundless plains of that country are as finely adapted to the diversion, as the wooded or mountainous nature of most part of Europe is ill calculated for that rapid amusement."

In England falconry seems to have continued in high repute till about the time of the Usurpation, after which it appears to have gradually declined. This diversion was pursued with such ardour so late as the reign of James I. that sir James Monson is said to have given a thousand pounds for a cast of hawks; and the laws were very rigorous that tended to preserve this pleasure. In the 34th of Edw. III. it was made felony to steal a hawk; and to take its eggs, even in a person's own ground, was punishable with imprisonment for a year and a day, besides a fine at the king's pleasure; and in the reign of queen Elizabeth the imprisonment was reduced to three months; but the offender was to find security for his good behaviour for seven years, or to remain in prison till he did. We may here observe, that

almost

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almost every kind of falcon, from the largest to the smallest, may be trained to falconry; even eagles themselves have here been used for the chase of the roebuck, the antelope, the wolf, fox, &c. Falcons of the larger kind, as the jer-falcon, the peregrine, and the goshawk, were used for the flight after the heron, the wild goose, the crane, the hare, &c.; and the common falcon for game in general; while those of the smaller kind were often instructed to fly at the partridge and the quail. The Iceland falcon is, according to Mr. Pennant, in the highest esteem, and will last ten or twelve years (some falcons are said to continue in full vigour for twenty years); whereas those of Norway, and other countries, are seldom fit for the sports of the field after two or three years' use. The feats performed by the jer-falcon may be numbered among the noblest in the practice of falconry. Seeliger asserts, that he saw some which belonged to Henry, king of Navarre, strike down a buzzard, two wild geese, divers kites, a crane, and a swan. Among the best of hawks for falconry is also the goshawk; these were used by the emperor of China in his sporting progresses attended by his grand falconer, and a thousand subordinate persons in his train. The emperor often carried a hawk on his hand, to let fly at any game which might present itself, and which were usually pheasants, partridges, cranes, or quails. This diversion was witnessed by Marco Polo in the year 1269. The flight of a strong falcon is wonderfully swift. To this purpose it is recorded that a falcon, belonging to a duke of Cleve, flew out of Westphalia into Prussia in one day; and in the county of Norfolk a hawk has made a flight at a woodcock near thirty miles in an hour.

Hawks in general prove courageous or cowardly all their lives, as they are first quarried; and if they are taken out of the eyrie before they are fully fumed and well penned, their wings will never grow to perfection. Their legs also will grow crooked, and their train will be full of taints. Falcons of one and the same kind are called by the sportsmen by very different names, and esteemed of several different kinds, according to the places and time of their reclaiming, and the countries from whence they came. Thus the names mewed-hawk, ramaged-hawk, soar-hawk, and eyesse, first commenced; and these are again divided into large hawks, wean hawks, and slender hawks. All these have different mails and plumes, according to the country from whence they come; some are black, some brown; they have also each its different disposition, some being best for the field, and others for the brook or river. Different names are also given to falcons according to their different age and time of taking. The falcon is called an eyesse, as long as she remains in the eyrie; these are always troublesome in their feeding; they cry very much, and they are not entered without great difficulty; but being once well entered, they prove excellent hawks for the heron and all the large fowl, and are very hardy and full of courage. The second name given this bird is the ramage-falcon. This name she retains from the time of her leaving the eyrie, during the months of June, July, and August. These are always hard to be manned; but being reclaimed, they are not inferior to any hawk. The third is the soar-hawk, so called in September, October, and November. These birds keep for a whole twelvemonth the first feathers, which they have on when they leave the eyrie, and do not molt them. These are therefore called the soar-feathers. The fourth is termed the murzarolt or carvist, quasi carry-sit; for they may at this time be almost continually carried on the fist. They are thus called from January to the middle of May. These are usually great baters, and very little eaters; they are subject to several troublesome disorders,

particularly to the flanders, more than any other hawk, and they are very seldom brought to be good for any thing. The fifth name is the entermeiv. They are called by this name from May till December, because all that time they are casting their coats. These would be excellent hawks if they could be trilled; but they are unsteady. They must be kept hard under, and the falconer must make his fist their perch. The hawk newly taken must be feeded, have all new furniture, and must be often stroked with a stick to accustom her to be gentle. She must also have two good bells, that she may be well heard when she stirs or scratches; and her beak and talons must be cut a little, but not so near as to make them bleed. If there be a soar-falcon taken that has already crossed the seas, she is usually very hard to be broken; but that being well done, she is the best of all hawks. Her food must be good and warm, and it must be given her at least three times a day. It should be pigeons, larks, or other live birds; for she must be broke by degrees from her accustomed manner of feeding. The hawk must always be fed with hoop and lure, that she may always know when you will give her meat. She must then be gently unhooded, and two or three bits being given her, she must be hooded again; and in the night let her roost on a perch near some person's bed, that she may be often waked in the night. When by these means she becomes tame and gentle, her usual food may be changed, and a sheep's heart given her. After this she may be unhooded in the day time, but not in company, and after giving her a bit or two, she must be hooded again, and then a little more given her. After this, by degrees, she will be taught to eat before company, and then the business of taming her will soon be accomplished. Till she is thoroughly manned, she must be borne continually on the fist, and fed in company, giving her in the morning about sun-rise the wing of a pullet, and every morning the foot of a hare or rabbit cut off above the joint, stead, and laid in water, which having squeezed give it her with the pinion of a hen's wing. It is best to give the hawk washed meat, and after this plumage, according as she seems to be foul within. She is then to be hooded, and nothing more should be given her till she gleams after casting; but when she has gleamed and cast, she should then have some hot meat given her, toward evening especially, and be made to eat in company. When she is well reclaimed, manned, and sharp-set, she may be fed on the lure.

But three things are to be considered before your lure be shewed her. 1. That she be bold and familiar in company, and not afraid of dogs and horses. 2. Sharp-set and hungry, having regard to the hour of morning and evening when you would lure her. 3. Clean within, and the lure well garnished with meat on both sides. When you intend to give her the length of a leash, you must abscond yourself; she must also be unhooded, and have a bit or two given her on the lure, as she fits on your fist. That done, take the lure from her, and so hide it that she may not see it; when she is unfeeled, cast the lure so near her, that she may catch it within the length of her leash; and as soon as she has seized it, use your voice as falconers do, feeding her upon the lure on the ground.

After having lured your falcon, in the evening give her but little meat, and let this luring be so timely, that you may give her plumage, &c. next morning on your fist; when she has cast and gleamed, give her a little beaching of warm meat about noon, tie a creance to her leash, go into the field, there give her a bit or two upon the lure, and unfeel her. If you find she is sharp-set, and has eagerly seized on the lure, let a man hold her, to let her off to the lure; then unwind the creance, and draw it after you a good way,

FALCONRY.

way, and let him who has the bird hold his right hand on the tassel of her hood, ready to unhood her as soon as you begin to lure; to which if she come well, stoop roundly upon it, and hastily seize it; let her cast two or three bits thereon; that done, take her off the lure and deliver her again to the person that held her; and, going farther off the lure, feed her as before; and so daily farther and farther off the lure. Afterwards you may lure her in company, but do not fright her: and having used her to lure on the foot, do it also on horseback; which may be sooner accomplished, by causing horsemen to be about you, when you lure her on foot: it is also sooner done, by rewarding her upon the lure on horseback among horsemen. And when she is grown familiar this way, let somebody a-foot hold her, and he that is on horseback must call, and cast the lure about his head, while the holder takes off the hood by the tassel; and if she seize eagerly on the lure without fear of man or horse, then take off the creance, and lure at a greater distance. Lastly, if you would have her love dogs as well as the lure, call dogs when you give her plumage. See *HAWKING*.

The Abbé le Pluche, in his description of falconry, represents it as one of the noblest, and also the most profitable of pleasures. For the various kinds of this diversion, the falcon, the jer-falcon, the lanner, the faker, the goshawk, the merlin, and the sparrow-hawk are used; but in general the falcon and hawk are more frequently used than the rest. The falcon, jer-falcon, and goshawk are in great repute; and are trained up to various flights, some of which are pointed against the heron, others against the kite, the curlew, or the owl. The hawk is used in low flights, and is sagacious and successful in attacking the partridge. The manner of training up hawks, and employing them in the field, is very agreeable. Such as are taken in the nest are called "Rias," and such as are taken when full-grown, and at full liberty, are called "Haggards," or old birds. When hawks are too wild, they are neither fed, nor suffered to sleep for three or four days and nights, and are never left alone; by which means they come familiarized to the falconer, and obedient to all his commands. An unquiet hawk has been sometimes placed in a smith's shop, where, by the continued noise of the hammering, he has been made gentle and tractable. The principal care of the falconer is to accustom these birds to settle in his fist, to spring when he throws them off; to know his voice, his singing, his whistle, or any other signal he gives them, and to return to order on his fist. At first they are tied with a string about 30 fathoms in length, to prevent them from flying away; from which they are not released till they are completely disciplined, and return at the proper call or signal. For this purpose they must be lured. The lure is a piece of red stuff or wool, on which are fixed a bill, talons, and wings. To this is likewise fastened a piece of that flesh on which the bird feeds, and the lure is thrown out to him. When they intend to reclaim or recall him, the sight of food brings him back; and in time the voice will be sufficient. The various plumage with which the lure is set off is called a "Drawer." When they accustom the hawk to fly at a kite, a heron, or a partridge, they change the drawer according to the kind of game to which he is to be devoted. When this is a kite, they fix the bill and feathers of that bird to the lure; and so of the rest: and in order to entice the bird to his object, they fasten beneath the drawer or plumage the flesh of a chicken, or other fowl, occasionally seasoned with sugar and spices, together with marrow and other delicacies. Thus he is prepared for springing at real game, which he does with surprising precipitation. Having

been accustomed to a month's exercise in a chamber or garden, the bird is tried in the open fields, when little bells are fastened to his feet, in order to be informed of his motions. He is always capped or hooded, that he may see no object but his game; and as soon as the dogs either stop or spring it, the falconer unhoods the bird, and tosses him into the air after his prey. His various motions in the air furnish much diversion; at length he descends and launches upon his prey with the rapidity of an arrow, and bears it to his master, who recalls him. By these first essays, he is presented with the neck and entrails of the prey which he has brought. These gratuities, and the caresses of the falconer, animate the bird to the performance of his duty, and prevent him from "bearing away his bells;" that is, from flying off, and not returning, which, however, is sometimes the case.

When falcons are taught to fly at rabbits, hares, &c. it is called "flying at the fur;" and some are instructed to fly at the fur and the plume, or to the pursuit of hares and rabbits, as well as of pheasants and partridges, &c. For this purpose, when the falcon is very tame, they either take a live hare, and break one of its legs, or else a hare's skin stuffed with straw; and having fixed to it a piece of chicken's flesh, or such food as the falcon is most fond of, they tie this skin, with a long cord, to the girth of a horse, and as the skin is thus dragged along, the bird imagines it to be a hare in flight, and is allowed to dart upon it; and is thus taught to distinguish the animal. Falcons of the larger kind have been taught to fly at the roebuck, and even at the wild boar, and the wolf. With this view they should be accustomed to feed, when young, from out of the sockets of the eyes of a wolf's or boar's head; the whole skin of the animal being stuffed, so as to make it appear alive. While the bird is feeding, the falconer begins to move the figure gradually; in consequence of which the bird learns to fasten itself so as to stand firm, notwithstanding the precipitate motions which are gradually given to the stuffed animal. He would lose his meal if he quitted his hold, and therefore he takes care to secure himself. When these first exercises are finished, the skin is placed on a cart, drawn by a horse at full speed; the bird follows it, and is particularly feeding; and then, when they come to fly him in the field, he never fails to dart on the head of the first beast of the kind he discovers, and begins to scoop out the eyes. This puts the animals into such distress, that the hunters have time to approach, and dispatch it with their spears.

In order to obtain birds fit for instruction, they should, if possible, be taken from the nest; but as this is not always practicable, the wild and full-grown bird must undergo the troublesome process of education. Falcons, like all other birds, may be taken by means of nets, such as are used in catching larks; but the main difficulty is that of instructing the bird. If a falcon is pursuing his prey in the air, he will not descend to an immoveable and lifeless bait on the ground.

As this is the case, the experienced falconer fixes in the centre of his net a pulley, or a strong iron wire bent into a ring, through which he passes a string, 30 or 40 fathoms long, and at its extremity ties by its legs a live pigeon, which he carries with him into his hut or cover; and as the falcon sometimes flies so high as not to be seen, the falconer is informed of his motions by means of a butcher-bird, which is fastened by a string tied to a stick fixed near the net. This bird by its movements indicates the kind of hawk which is hovering above; if it be a buzzard, or any kind of sluggish hawk, the butcher-bird's motions are but slight; bit

but if it suddenly flies down and hides itself, it is a sign that some large kind of falcon is above. The falconer, therefore, lets out the pigeon, whose apparent state of liberty attracts the sight of the falcon. If it approach readily, the man withdraws the pigeon, and, after a very short interval, lets it out again. This second appearance of the pigeon never fails to invite the falcon, which darts upon it as his prey, and is consequently caught in the net, which the man instantly draws over it. The above-described method of taking falcons, and, indeed, the art of falconry in general, seems to have been held in no high estimation by Linnæus, since, by way of note to his specific character of "*Falco gentilis*," he adds "*ars capiendi falcones columba et lanio, instituenti, venandi gazellas, ardeas, aviculas, &c. propriis artificibus commissa, in luxuriam magnatum, ridenda etiam a stulto.*"

Among the oldest writers on falconry we may reckon Demetrius, who, about the year 1270, was physician to the emperor Michael Paleologus. His book, written in Greek, was first printed at Paris in 1612, by Nicholas Rigaltius, from a MS. in the king's library, and with the Latin translation of Peter Gyllius. (See Fabr. Bibl. Græc. l. i. c. 25. vol. i. 155.) A curious precept occurs in the book of Demetrius, which requires sportsmen to say their prayers before they go out to the field. Some other works, of unknown antiquity, were printed at the same time.

The writers of reputation on falconry are Desparon, Franchiere, Tardiffe, Artelouche, Dalagona, Latham, &c. M. de S. Martha has put the principles of the art into fine Latin verses, in his Hierascophion, five *De Re Accipitraria, libri tres.*

There is also a treatise on hunting, hawking, and heraldry, printed at St. Alban's by Caxton, and attributed to dame Julian Barnes. Beckmann's *Hist. of Inventions, &c.* vol. i. Shaw's *Zoology*, vol. vii. part. i.

FALCZI, or FALTSCHI, in *Geography*, a town of Moldavia, on the Pruth; 32 miles E. N. E. of Birlat.

FALDAGE, a term which was formerly employed to signify an old privilege reserved by different lords of manors to themselves, for setting up sheep-folds or pens in any fields within their manors, for the purpose of having them better manured, not only with their own, but likewise with their tenants' sheep. It was also frequently termed *sesta faldæ*, and in some particular old charters *fold-fæca*, which in some places implied a fold course, or free-fold.

FALDELLÄ, in *Surgery*, rolled or twisted lint, used for compresses.

FALD-FEE, or FEY, in *Rural Economy*, is a term which was formerly used to denote a rent or fee paid by certain customary tenants for the liberty of folding their sheep upon their own lands.

FALDUSTOR was anciently used to signify the highest seat of a bishop, inclosed round with a lattice.

FALDWORTH, among the *Old Writers*, was used to signify a person of age, sufficient to be reckoned of some decennary.

FALE, in *Geography*, a river of England, in the county of Cornwall, which rises about five miles S. E. from St. Columb Major, and runs into the sea at Falmouth.

FALEMI, a river of Africa, which runs into the Senegal; 20 miles W. of Gallam.

FALERA, a town of Switzerland, in the Grisons; four miles N. N. E. of Hantz.

FALIGE, a town of Germany, in the principality of Culmbach; five miles S. S. E. of Hof.

FALIN, a river of Chinese Tartary, which runs into the sea of Japan. N. lat. $43^{\circ} 5'$. E. long. $133^{\circ} 16'$.

FALIOS, a town of Asiatic Turkey, on the Black sea; 24 miles W. of Amafrek.

FALKANAU, a town of Silesia, in the principality of Neisse; four miles S. of Grotkau.—Also, a town of Bohemia, in the circle of Saatz, on the Egra, in which are manufactures of alum, sulphur, and vitriol; 12 miles N. E. of Egra. N. lat. $50^{\circ} 9'$. E. long. $12^{\circ} 37'$.

FALKENAW, a town of Prussia, in Oberland, 22 miles S. E. of Marienwerder.—Also, a town of Prussia, in Ermland; nine miles S. W. of Marienburg.

FALKENBERG, a town of the duchy of Stiria; 10 miles N. of Oberwoltz.—Also, a sea-port town of Sweden, in the province of Holland, situated at the mouth of the Athron, on the Scaggerac. The chief employment of the inhabitants is fishing, 52 miles N. of Helsingborg. N. lat. $56^{\circ} 56'$. E. long. $12^{\circ} 19'$.—Also, a town of Germany, in the county of Lippe; two miles S. of Horn.—Also, a town of Saxony; five miles N. W. of Leibenwerda.—Also, a town of the Middle Mark of Brandenburg; seven miles E. N. E. of Farftenwald.—Also, a town of Silesia, called *Niomollin*, in the principality of Oppeln; 14 miles W. of Oppeln. N. lat. $50^{\circ} 35'$. E. long. $17^{\circ} 22'$.

FALKENBURG, a town of Brandenburg, in the New Mark, on the Drage; 124 miles N. E. of Berlin. N. lat. $53^{\circ} 28'$. E. long. $16'$. See also FAUQUEMONT.

FALKENHAGEN, a town of the duchy of Pomerania; five miles S. of Ramelsburg.—Also, a town of the Middle Mark of Brandenburg; 40 miles E. of Berlin. N. lat. $52^{\circ} 25'$. E. long. $14^{\circ} 30'$.

FALKENSTEIN, JOHN HENRY, in *Biography*, was born in 1682. He received his education at some of the Dutch or German universities, and was, in the year 1714, appointed director of the academy of Erlangen. After this he entered into the service of John Anthony, bishop of Eichstadt, by whom he was employed to write a history of the bishopric. By the death of his patron he lost his employment in the year 1730, and was taken into the service of the margrave of Anspach. In this situation he remained till the time of his death in Feb. 1767. He was buried in a tomb, which he caused to be built in his life time, and which he often visited. Falkenstein wrote much, but his works contain a deal of matter collected without taste and judgment, but which will be found useful to the future historian. His principal performances are, "*Antiquitates Nordgavienfes*," or researches respecting the antiquities and every thing remarkable in regard to the town of Nordgau; in three vols. fol.; "*Deliciae topographicæ Norimbergenses*," or a geographical description of the imperial city of Nuremberg, &c.; "*Antiquitates Sudgavienfes*," or an historical description of those districts which in the seventh and eighth centuries were known under the general name of Sudgau, &c. *Gen. Biog.*

FALKENSTEIN, in *Geography*, a town of Austria, with a castle, the proprietor of which has a right to coin money; 10 miles N. W. of Zistersdorff.—Also, a town of Austria, 10 miles S. of Aigen.—Also, a town of Upper Bavaria, on the Inn; 24 miles S. W. of Traunstein.—Also, a small county of Germany, ceded to France by the treaty of Campo Formio, and confirmed by the peace of Luneville. It contains the town of Winweiler, a town of its own name, and about 15 villages. The inhabitants are partly Roman Catholics, but chiefly Lutherans.—Also, a town of Germany, in Lower Bavaria, 13 miles N. of Straubing.—Also, a town of Germany, in the Vogtland, called *Elleford*; two miles S. of Aarbach.—Also, a town of France, in the department of Mont Tomerre, but in the county of Falkenstein; 10 miles S. of Mont Tomerre.

kenstein; 24 miles W. of Worms, and 27 N. E. of Deux Ponts.

FALKIA, in *Botany*, so named by Thunberg in commemoration of John Peter Falk, professor at Petersburg, whom he celebrates as a highly meritorious and very sound botanist. Linneus in his *Supplementum* says professor Falk was a Swede, and famous for his botanical tour in the eastern parts of Russia. Thunb. Nov. Gen. 17. Linn. Suppl. 30. Schreb. 237. Willd. Sp. Pl. v. 2. 248. Mart. Mill. Dict. v. 2. Juss. 132. Class and order, *Pentandria Digynia*. Nat. Ord. *Borragineis affine*, Juss.

Gen. Ch. *Cal.* Perianth of one leaf, bell-shaped, with five angles, in five ovate, bluntish, equal segments. *Cor.* of one petal, twice as long as the calyx, funnel-shaped, spreading, plaited, its margin in ten regular segments. *Stam.* Filaments five, thread-shaped, erect, rather shorter than the corolla and inserted into its tube; anthers ovate, compressed. *Pist.* Germens four, superior, smooth; styles two, capillary, divaricated, the length of the corolla; stigmas capitate, obtuse. *Peric.* none. *Seeds* four, globose, in the bottom of the calyx.

Eff. Ch. Calyx of one leaf, inferior. Corolla of one petal, plaited, funnel-shaped, with ten segments. Seeds four, naked.

1. *F. repens*. Linn. Suppl. 211. Ait. Hort. Kew. v. 1. 325. (*Convolvulus Falkia*; Thunb. Prod. Cap. 35.) Native of watery places at the Cape of Good Hope. *Stems* perennial, woody, creeping, branched, leafy. *Leaves* on long stalks, clustered, heart-shaped, obtuse, entire, rather fleshy, slightly downy. *Flowers* on simple, solitary, axillary stalks, white or pale flesh-coloured, exactly like those of a *Convolvulus*, to which genus professor Thunberg has now reduced this plant. Consequently his own description of the fruit, as given above, must be excessively erroneous. The learned editors of the *Hortus Kewensis* had long ago corrected another mistake in the number of the stamens, which they found to be five only, as analogy would lead us to expect; not six, except from occasional luxuriance.

FALKIRK, in *Geography*, a considerable town in the shire of Stirling, Scotland, is situated on an eminence near the river Carron on the high road from Edinburgh to Glasgow, and commands an extensive prospect of the adjacent country. It was formerly a royal borough; but is now governed by a baron-bailie, appointed by the lord of the manor. This town is noted for several fairs, and three celebrated tryfts, at which are sold on an average 60,000 head of black cattle, and a great number of sheep and horses. Falkirk is 12 miles distant from Stirling, and 24 from Edinburgh; the whole parish, which includes several villages, was returned, in 1801, as containing 1767 houses, and 8838 inhabitants. The great canal, which forms a communication between the British ocean and the north channel, intersects this parish. A degree of celebrity attaches to Falkirk from a battle fought in its vicinity July 22, 1298, when the Scots, under sir William Wallace, were defeated by the English under Edward I.; and the town was again distinguished by an engagement between the royal and rebel forces January 18, 1746.

FALKLAND, a town in the shire of Fife, Scotland, was erected into a royal borough in 1458. The government is vested in three bailies, 14 counsellors, a treasurer, and town clerk. The town is neatly built, and plentifully supplied with water by leaden pipes: and carries on a considerable manufacture of coarse lincens and Osnaburghs. The vicinity abounds with coal and lead-ore. Falkland is 15 miles distant from Edinburgh, and about the same distance from Perth; the population of the parish was returned in

1801 as 2211, inhabiting 460 houses. This town was formerly the residence of the kings of Scotland, and the remains of the palace, though in ruins, evince its former magnificence.

FALKLAND'S *Islands*, a group of islands, situated in the southern Atlantic ocean, eastward of the straits of Magellan. The first discoverer of these islands is said to be Captain Davies, the associate of Javedilla, in 1592. In 1594 sir Richard Hawkins saw land, supposed to be the same, and from observing fires he concluded that it was inhabited. In honour of his mistress, queen Elizabeth, he called it "Hawkins's Maiden-land." Long afterwards these islands were seen by some French ships, from St. Maloes, and Frezier, probably for that reason, called them the "Malouins," and by the Spaniards they are denominated "Malinos." The two principal islands of this group, each of which is about 40 miles square, were probably distinguished by the name of Falkland's islands by captain Stroug, or Strahan, in the year 1639, in honour of viscount Falkland; and this name has been continued ever since. Roggwein, who passed by these islands in the year 1721, called them "South Belira," and they have likewise been called "Islands of St. Lewis," "Pepys's islands," and "Sebald de Wert's islands." The name of "Pepys's" island was given to this land by Cowley, who had only a distant view of it in January 1683, who erroneously makes its latitude to be 47. But the true position and extent of these islands, and every circumstance which could render their existence of any consequence, remained absolutely undecided till commodore Byron visited them in 1765. Lord Anson considered Pepys's island and Falkland's isles as distinct places, distant from each other about 5 degrees of latitude. But Byron's researches have rectified this capital error; and it is now decided, beyond all contradiction, that as captain Cook observes, "future navigators will mispend their time, if they look for Pepys's island in latitude 47; it being now certain that Pepys's island is no other than the islands of Falkland." Byron took possession of Port Egmont, (which see,) and all the neighbouring islands, January 1765, for his majesty king George III., by the name of Falkland's islands: and captain Macbride, who followed him thither two years after, having circumnavigated their coasts, and taken a complete survey, a chart of Falkland's islands has been constructed, with so much accuracy, that the coasts of Great Britain itself are not more authentically laid down upon our maps. "We found," says captain Macbride, "a mass of islands and of broken lands, of which the soil was nothing but a bog, with no better prospect than that of barren mountains, beaten by storms almost perpetual. Yet this is summer; and if the winds of winter hold their natural proportion, those who lie but two cables' length from the shore must pass weeks without having any communication at all." In 1763 the French having lost Canada, turned their attention towards these islands, with a view to an American settlement; and the account of Bougainville's voyage for that purpose, published by Pernety, contains ample details concerning these islands. From these we learn, that there is little herbage except on the N. E. and E., the southern antarctic winds being extremely cold. The rocks are of quartz, with some pyrites and traces of copper. Grey and reddish slate is common, with red and yellow ocher. In these islands, the soil and climate of which are unfavourable, there is a considerable variety of fowls and fish; and the plants seem somewhat to resemble those of Canada. The walrus, and other animals of the seal kind, frequent the shores. Although Byron made a small establishment at Port Egmont, it was found to be of little or no value, and

in the year 1774 it was ceded to Spain. These islands, which seem to be unfit for the habitation even of savages, occasioned some ridiculous disputes; and this circumstance is the more extraordinary, as they are covered with reeds and moss, and are subject to perpetual fogs, and furious tempests from the antarctic pole. The extreme cold cannot be relieved by fire, as there is no material for fuel, though Cowley says, that it abounded with woods; and even a ship in the port is covered with perpetual snow. The penguins supply a scanty and miserable food. S. lat. $51^{\circ} 6'$ to $52^{\circ} 30'$. W. long. $56^{\circ} 30'$ to $62^{\circ} 16'$.

FALKLAND'S *Sound*, a strait or bay, separating the two largest of the Falkland islands.

FALKOPING, a town of Sweden, in West Gothland; 56 miles E. of Uddevalla. N. lat. $58^{\circ} 12'$. E. long. $13^{\circ} 16'$.

FALL, a river of Scotland, which rises in the S.W. part of Perthshire, and runs into Loch Lomond.

FALL Indians, Indians of North America, who occupy a territory, through which runs Red Deer river in N. lat. between 51° and 52° , and between 110° and 115° W. longitude. These Indians, called also "Big-bellied Indians," amount to about 600 warriors. They seem to have migrated from the south-eastward, and belong to a people who inhabit the plains from the north bend of the Mississippi river, N. lat. $47^{\circ} 32'$. W. long. $101^{\circ} 25'$, to the south bend of the Assiniboin river, to the number of 700 men. Some of them occasionally come to the latter river to exchange dressed buffalo robes, and bad wolf skins for articles of no great value. These Fall Indians, intermixed with the Assiniboins, resigning the territory next lake Winipic, and about its source, to the Algonquins and Knisteneaux, occupy the more central parts of the country. They do not exceed 500 families. They are not beaver-hunters, like those last mentioned, but confine themselves to the hunting of the buffalo, and trapping wolves, which cover the country. What they do not want of the former for raiment and food, they sometimes make into "pemican," or pounded meat, while they melt the fat, and prepare the skins in their hair, for winter. The wolves they never eat, but produce a tallow from their fat, and prepare their skins; all which they bring to exchange for arms and ammunition, rum, tobacco, knives, and various baubles, with those who go to traffic in their country. Mackenzie's Voyage, &c. Introd.

FALL River, a town of America, in Bristol county, Massachusetts, lately the southerly part of Freetown, incorporated in 1803; 50 miles S. of Boston.

FALLS, a township of Bucks county, in Pennsylvania; containing 1680 inhabitants.

FALL, *Descent*, in *Physics*, the tendency of any heavy body towards the centre of the earth.

Galileo first discovered the ratio of the acceleration of falling bodies; viz. that dividing the whole time of falling into equal parts, the body will fall thrice as far in the second moment as in the first; five times as far in the third; seven times in the fourth, &c. and so on in the order of the uneven numbers. See ACCELERATION.

FALL of bodies, for the cause of the. See GRAVITY.

FALL of bodies, for the laws of. See ACCELERATION, DESCENT, and FORCE.

FALL, *Water*. See CATARACT.

FALL is also used in a moral sense: as the fall of Adam, See ORIGINAL SIN; the fall of the Roman empire, &c. Authors contend, that Plato had a notion of Adam's fall, which he had learnt from Moses. Eusebius, De Preparat. Evægel. lib. xii. cap. 11. quotes a fable from Plato's Sym-

pos. wherein he thinks he finds the whole history allegorically related.

FALL, in *Music and Poetry*. See CADENCE.

FALL, in *Agriculture*, a measure of length, which in some places signifies the same as the rod; but in others, as the northern parts of the kingdom of Scotland, it denotes a measure which contains six of the ells of that country, each of which is equivalent to thirty-seven two tenths English inches. See MEASURE, and WEIGHTS and MEASURES.

It is a measure also frequently made use of in the application of marle, and other similar earthy substances to land, especially in the northern counties, in which cases, from two to four or five falls are considered a proper set. See MARLE.

FALL, a superficial measure, is the Scotch pole of land = 36 Scotch ells, = 342.25 Scotch feet, = 38.027 Scotch yards, = 345.96 square English feet, = 38.44 square English yards, = 1.27 English perches.

FALL, a solid measure, is used in Lancashire in measuring marle, and is a cube, whose side is four yards, = 64 cubic yards,

FALL, among *Seamen*, denotes the rope that connects the blocks of a tackle; and sometimes it signifies that part of the rope of a tackle which is haled upon. They say also that a ship hath falls when she is not flush, but hath risings of some parts of her decks more than others. Also, a ship is said to fall off, when, being under fail, she keeps not so near the wind as she should do.

FALL *not off*, at sea, a word of command from him that conducts the ship, signifying as much as keep the ship near the wind.

To FALL *aboard of*, is to strike or encounter another ship, when one or both are in motion; or to be driven upon a ship by the force of the wind or current.

To FALL *astern*, is to be driven backwards, or to retreat with the stern foremost; and is expressed of the motion of a ship, either under fail or at anchor.

To FALL *calm*, expresses a total cessation of the wind.

To FALL *down*, is to fail or be conducted from any part of a river, towards some other part nearer its mouth or opening.

FALL, *Cat*. See CAT-heads.

FALL of the Leaf, in *Vegetable Physiology*, is that spontaneous separation of the leaves of trees and shrubs from their branches, which regularly takes place every autumn in such species as are, for that reason, termed deciduous, and which happens, sooner or later, to all leaves whatever (See DECIDUOUS.) Leaves commonly undergo considerable changes before they fall, ceasing to grow for a long time previous to their decay, they become gradually more rigid and less juicy, often parting with their pubescence, and always changing their healthy green colour to more or less of a yellow, sometimes a reddish hue. American trees and shrubs in general, and such European ones as are botanically related to them, are remarkable for the rich tints of red, purple, or even blue, which their leaves assume before they fall. Hence the autumnal foliage of the woods of North America is, beyond all imagination, rich and splendid. In tropical countries, though many trees lose all their leaves regularly in the rainy season, or winter, the generality are evergreen, parting with them in succession only, so as never to be naked. Even these trees, however, if injured by transplantation, or any other cause not absolutely fatal, cast their leaves prematurely, by an effort of the vital energy, which is thus able to withdraw itself with more vigour

vigour into the most important organs. On this principle we have, under the head above cited, explained the fall of leaves as a sloughing, or casting off diseased or exhausted parts. S.

FALLACY, FALLACIA, a deception, or false appearance, or report.

The Epicureans deny that there is any such thing as a fallacy of the senses. According to them, all our sensations, and all our perceptions both of sense and phantasy, are true; they add, that sense itself is the first grand criterion of truth. That the senses are never deceived, they argue from their being incapable of all ratiocination and remembrance: hence they can neither add, take away, couple, nor disjoin; they cannot, therefore, infer, conclude, or invent; and consequently they cannot deceive by any inference or invention. This the mind may do, but not the sense, whose business is only to apprehend what is present, *e. gr.* colours; not to discern or distinguish between this body and that. But a thing that barely apprehends, without pronouncing any thing, cannot deceive; add, that there is nothing to convict our senses of falsehood. The right eye, *e. gr.* cannot convict the left; nor Plato's eyes those of Socrates; since the reasons or pretensions of each are equal; and the purblind person sees what he sees as much as the lynceus. Nor can a sense of one kind convict another; as the sight the smell; because their objects are different, and consequently their reports or judgments are not of the same things. Thus, again, if I see a stick straight when out of the water, but when in it, crooked, my perception is altogether as true in the latter as in the former case; *i. e.* it is as true that I have the perception or idea of the crooked stick as of the straight one; and this idea is all that the sense suggests, so that it does not deceive. Lastly, reason cannot shew our senses mistaken, since all reasoning depends on previous sensations, and the senses must first be true, before any reasoning, founded thereon, can be so. Thus the Epicureans, whose system is strongly confirmed by what we have already laid down from Dr. Berkeley, concerning existence.

The Cartesians, on the other hand, are continually exclaiming against the senses, as the great sources of all deception. Every thing with which our external senses present us, they say, should be suspected as false, or, at best, dubious, till our reason has confirmed the report. They add, that our senses, as being fallacious, were never given us by nature for the discovery of the truth, but only to point out what things are convenient or hurtful to our bodies.

The Peripatetics keep a middle course: they hold, that if a sensible object be taken in its common and generical view, the sense cannot be deceived about it; for the sight can see nothing but what is visible, nor can it err in perceiving what is visible, *quatenus* such. But they add, that if the object be taken under its specific view, the sense may be mistaken about it; *viz.* from a want of the dispositions necessary to a just sensation; as a disorder in the eye, or something uncommon in the medium, &c.

FALLACY, in *Logic*, or *sylogistic fallacy*, is a captious argument, called also a sophism.

Fallacies either arise from words or things: the foundation of an illusion and fallacy in words is ambiguity, which is of two kinds; *viz.* simple homonymia, and amphibology.

The kinds of fallacy in things are very numerous; but they may be reduced to seven general heads; *viz.* ignoratio elenchi, *petitio principii*, *falsa causa*, *inter-*

rogatio multiplex, *limitatio vitiosa*, *accidens*, et *consequens*.

FALLAJAJEEA, in *Geography*, one of the Friendly islands, in the Southern Pacific ocean. S. lat. 20' 30'. E. long. 185° 16'.

FALLATTY, a town of Abyssinia; 56 miles W.N.W. of Gondar.

FALLEN, a small river of the county of Longford, Ireland, which runs into the Shannon, a few miles north of Lanesborough.

FALLEN City, or *Old Jerusalem*, a range of rocks among the Virgin isles, in the West Indies; S. W. of Virgin Gorda. N. lat. 18° 13'. W. long. 62° 53'.

FALLERN, a town of Sweden, in the province of Smaland, noted for its mineral springs; 3 miles from Wexio.

FALLERONE, a town of Italy, in the marquise of Ancona; 14 miles W. of Fermo.

FALLERSLEBEN, a town of Germany, in the principality of Luneburg, on the Ailer; 27 miles S. E. of Zella.

FALLET, a town of Sweden, in Helsingland; 15 miles N.W. of Hernosand.

FALLING-SLICES, in *Engineering*, are gates contrived to fall down of themselves, and enlarge the water-way on the increase of a flood, in a mill-dam, or the pound of a river navigation; sluices of this sort were some years ago to be seen on the Ouse river, below Redford. See **CANAL**.

FALLING-in of strata, in *Geology*, is a term used by Dr. Townson (*Philosophy of Mineralogy*, p. 81.) to denote those sinkings of particular and small tracts of strata which are in some places observable, particularly where caverns abound in the strata beneath, as Mr. Mawe has observed (*Mineral. of Derby*, p. 126.), in accounting for Elden hole, and other openings or swallow-holes in the peat limestone district of Derbyshire. (See **DEPRESSION** and **ABSORPTION**.) A very remarkable instance of strata which have fallen in, that has not, we believe, been noticed by any writer, is to be seen at Dowall, or Dower, a hamlet of Hartington parish, Derbyshire, situate by the side of the Dove rivulet, which there separates the counties of Derby and Stafford. Dowall is remarkable for the very dislocated state of its strata, and for the very singular conical and wedge-like hills which it contains. It is situate upon or very near to the great fault which almost surrounds the Derbyshire and Staffordshire mineral limestone district, and the same seems to have occasioned the falling-in or absorption of larger pieces of strata in this place than are usually to be met with. Dove pit, one of the chasms here, occasioned by a sunken piece of the fourth lime-rock, is little if at all inferior to Elden hole in curiosity, although hitherto overlooked by tourists. Near to this cavern a sunken piece of strata, about a mile in length and 300 yards or more in width, is seen so much depressed, that the limestone-strata remain upon it in the hollow, surrounded on all sides by high and precipitous hills of the fourth limestone (see the section and thicknesses of the strata here mentioned in *Philosophical Magazine*, vol. xxxi. plate 2.) This sunk or fallen piece of strata is surrounded by a line of shake-holes, or swallows, into which the water which collects on the surface drops and disappears. Croom hill, near this place, seems to owe its very singular wedge like form to one half of it having slipped off or sunk down, with the superincumbent strata on it, and which now occupy the adjoining vale or bay between the hills. The only distance of this very singular place from Buxton, will, we hope, occasion its be-

ing frequently visited and examined in future by those who travel to view nature in these her grandest scenes.

FALLING Springs, in *Geography*, a branch of James river, in Virginia, where it is called *Jackson's river*, which see.

FALLING-off, in *Sea Language*, denotes the movement or direction of the ship's head to leeward of the point whither it was lately directed, particularly when the sails near the wind, or lies by. See *FALL not off*.

FALLING-off is also the angle contained between her nearest approach towards the source of the wind, and her farthest declination from it when trying.

FALLING-evil, in *Veterinary Science*, is a disease to which horses are subject, proceeding from ill blood and cold thin phlegm collected in the fore part of the head, between the pineal gland and the brain, which, being dispersed over the whole brain, causes the horse suddenly to fall, and bereaves him for a time of all sense. Spanish, Italian, and French horses are more subject to this disease than the English.

For the cure of this disorder, bleed the horse in the neck, and again in the temple-veins and eye-veins, four or five days after; anoint his body all over with a comfortable friction, and bathe his head and ears with oil of bay, liquid pitch and tar mixed together, and keep his head warm, by covering it with a canvas cap, quilted with wool, and give him a purging or scouring.

FALLING-sickness, in *Medicine*. See *EPILEPSY*.

FALLING Stones. Of these bodies, the most general opinion now is, that they are really of celestial origin. But a few years ago nothing could have appeared more out of the reach of human investigation than the analysis of any part of the solar system beyond the planet we inhabit. The heavenly bodies, revolving at a distance so inconceivably remote, seemed relatively to us to be rather inaccessible visions than objects of chemical examination; the only medium that appeared to connect them with us was that of sight: to be able to see them, and be conscious of their existence, was the utmost boundary of human expectation. How little was it to be expected that beyond this we should ever be able to examine the most minute fragment of the sidereal system; and it must no doubt be reckoned among the wonders of the age in which we live, that considerable portions of these heavenly bodies are now known to have descended to the earth. So wonderful and unexpected an event was at first received with incredulity and ridicule, but we may now venture to consider the fact as well established as any other hypothesis of natural philosophy, which does not actually admit of mathematical demonstration.

The attention of the philosophers of this country was first called to this subject by the falling of one of these masses of matter near Flamborough Head, in Yorkshire; it weighed about fifty pounds: and for some years after its descent was announced did not excite the interest it deserved, nor would perhaps that attention have been paid to it which was required for the investigation of the truth, if a similar and more striking phenomenon had not happened a few years afterwards at Benares, in the East Indies. Some fragments of the stones which fell in India were brought to sir Joseph Banks by Major Williams, and sir Joseph being desirous of knowing if there might not be some truth in these repeated accounts of falling stones, proposed that they should be chemically analysed, to see if any peculiarity could be detected in their composition. He therefore gave them to Mr. Howard, a gentleman eminently qualified for this investigation, who found, by a very skillful analysis, published in the *Transactions* (1802), that the stones collected in various countries, and to which a similar history is attached, contained very peculiar ingredients, and all of the same kind.

The earthy parts of these were all of them flux and magnesia, in which were interspersed small grains of metallic iron. Upon a more minute examination of the metallic particles they were found connected with another metal, nickel. It is a curious circumstance, and not remarked, we believe, by any writer on this subject, that iron and nickel are the only two magnetic metals; but whether this coincidence is accidental, or relates to their mode of formation, we shall not presume to determine.

The peculiarity of this composition, which was the same as large masses of native iron found formerly in Siberia, excited a suspicion that they might all have had one common origin. The great mass of iron found by Pallas in Siberia, contained within its spongy substance small drops of a transparent body, resembling chrysolite. Mr. Howard was, therefore, desirous of ascertaining whether these transparent particles, though differing in appearance from the stones he had already analysed, might not contain similar ingredients, and on making proper experiments he found they actually contained the two earths above mentioned, flux and magnesia. Since these investigations of Mr. Howard the subject has attracted very general attention, and most of the fragments of stones said to have fallen from heaven, and which have been preserved in the cabinets of the curious on account of this tradition, have been analysed, and found to consist of the same ingredients, varying only in their different proportions.

The iron found in these masses differs from our artificial iron in containing no charcoal, and the proportion of nickel preserves it from rust. The mixture with nickel is not uniform in the same specimen, but it is unequally distributed, as if it were the effect either of pressure or imperfect fusion.

Several writers, particularly Dr. Chladni on the continent, and Mr. King of our own country, have been at great pains to collect the various testimonies that are to be found in different authors from the earliest times, in favour of the occasional descent of fragments and showers of stones.

Pliny relates, that a great stone fell near Egos Potamos, in the Thracian Chersonese, in the second year of the 78th Olympiad. Considering the immense time that these masses may remain undestroyed, it is not absolutely impossible, if ever that country becomes more civilized than at present, that some intelligent traveller may find vestiges of it still remaining. Anaxagoras the astronomer is said to have predicted this event; a circumstance that should teach us to receive with great caution the traditionary predictions of eclipses, such as that of the sun by Thales, most of these events, and others of the same nature, having been predicted most probably long after they happened. This weakness was not peculiar to the ancients; this very summer (1809) a belief has been very generally prevalent that the late unusual wet season was foretold by Dr. Herschel.

In the year 1706 another large stone is, on the authority of Paul Lucas, then at Larissa, said to have fallen in Macedonia: it weighed 72 pounds.

Cardan assures us, that a shower of at least 1200 stones fell in Italy, the largest of which weighed 120 pounds; and their fall was accompanied by a great light in the air.

In the *Phil. Transl.* for 1718 is a description of a fiery meteor seen at Jamaica, which struck the earth, and made several holes.

In the *Transactions* for 1725 an account is to be found of a fire-ball which burst at Mixburg, in Northamptonshire, and two holes were made, about a yard deep and five inches in diameter, in a gravelly soil. An iron ball shot perpendicularly from a mortar did not make a greater impression. In searching the holes, a very hard glazed stone was found, ten inches

inches long, six wide, and four thick, cracked into two pieces. A man was killed by what is called the lightning; he was much wounded, with some appearance of electric effects.

At Otumpa, in South America, in the Chaco Guabambra, far from any mines or rocks, a mass of about 300 quintals was found, and which was then supposed to be of volcanic origin. *Phil. Trans.* 1788.

Mr. Southey, in his *Travels through Portugal*, mentions the stones that fell in Portugal, 1796.

The caaba, or great black stone, preserved by the Mahometans in the temple of Mecca, had probably a celestial origin. It is said to have been brought from heaven by the angel Gabriel. Of its chemical nature we have no account, nor would it be very safe for a modern chemist to attempt to procure a piece to satisfy our curiosity.

The following are some of the best authenticated and most interesting of the accounts lately published relating to these bodies.

Process verbal of a shower of stones which fell near Avignon, in the department of Vaucluse.

On the 8th of September, 12th year of the republic, about half past ten in the morning, there appearing only a few light clouds in the heavens, and the weather being remarkably calm, a noise, resembling that of a cannon fired at the distance of a quarter of a league, was heard with the same force, and attended with the same circumstances, by a number of individuals in various places, but more particularly in the country, at the distance at least of seven or eight leagues from Apt, the principal town of the fourth district of the department of Vaucluse. This noise, however, could be the effect only of an unusual explosion, because it is certain that throughout the whole extent above-mentioned, and at that hour, no cannon was fired, nor was there any explosion of gun-powder. This circumstance, which at first surprised all who were witnesses of it, was accompanied by a phenomenon still more extraordinary. On the same day, and at the same hour, citizen Joseph Jully, a farmer in the district of Apt, and his wife, being about 500 paces from the country-house of citizen Bartholomew de Vaux, situated north of the town of Apt, at the distance of about a quarter of a league, in the limits of Saurette, having heard the noise above-mentioned, immediately afterwards heard for the space of six or seven minutes a whistling, which increased in sound as it approached, and announced the fall of some solid body. Being terrified, and casting their eyes upwards, the wife of Jully perceived a black substance, whose fall to the ground both she and her husband heard distinctly, after which the whistling ceased. The wife of Jully states, that this black substance must have fallen in the vineyard of citizen de Vaux: the wife of the latter being then in the fields heard the same noise and subsequent whistling, but being alarmed she ran into the house, and neither saw nor heard the fall of the above substance. Her son, being then at work 3 or 400 paces from the house, also heard the noise, the whistling, and the sound of the fall of a body, which, however, he did not see. At the same instant, Margaret Hugues, widow, and Marie Jean, wife of Jacques Julien, being on the road from Villeurs to Apt, heard the same noise, the whistling, and the fall of some substance in de Vaux's vineyard, which adjoins the same road. After the sound of the fall the whistling ceased. It appeared to them that the above substance did not fall at more than 30 paces from them.

As soon as the report was spread that some considerable substance had fallen in the above vineyard, a great eagerness was manifested to search for it. The attempt was at first

fruitless, but on the 10th De Vaux's son, crossing the vineyard, perceived, at the distance of about thirty paces from the house, a large hole newly made between two rows of vines, which denoted the place where the substance must have fallen. He was confirmed in this opinion when he perceived that some small pebbles near the mouth of the hole had been ground to powder. He then dug and found an extremely hard stone, weighing seven pounds six ounces: and could not doubt that this was the substance, the fall of which had alarmed the neighbourhood. *Phil. Mag.* vol. xvi.

Extract of a memoir of M. De Dree, read in the National Institute, 11th April, 1803. M. De Dree, being at Lyons, received the following account from Dr. Petetin.

About four years ago, said he, during the evening twilight, in the month of March, the weather being serene, and not at all cloudy, there passed over Lyons, nearly in a direction from east to west, a luminous ball, which, as it attracted attention by the strong light it emitted in its passage, was almost generally observed. He added, that he learned, a few days after, that this luminous globe had been seen by some travellers on mount Cenis, and he was informed at the same time that it had fallen in the environs of Ville Franche under the form of an incandescent stone, a small fragment of which was sent to him.

He assured me also that a comparison he then made of the periods at which the meteor had been observed at Mount Cenis, at Lyons, and at Ville Franche, positively announced that it was the same ball which had traversed that line, and shewn itself in these three points.

I expressed to Dr. Petetin a desire of seeing the fragments of this stone which he had in his possession, and the doctor, judging, no doubt, from the anxiety I shewed to obtain information respecting this phenomenon, how much I was interested in it, was so kind as to offer me this fragment in case he should find it.

I was the more desirous, indeed, to see the specimen of this mineral mass, as I had it in my power to compare it with analogous specimens, one of which fell near Wold cottage, in Yorkshire, on the 13th of December, 1795, and another near Benares, in Bengal, on the 19th of December, 1798, a fragment of which I brought with me a few years ago from London, where I received it from count de Bournon, F. R. S. a very celebrated mineralogist.

Some time after, Dr. Petetin sent me the fragment in question, and I was much surprised to find that it had a perfect similarity to specimens of those which fell at Benares and at Wold cottage, a similarity manifest, not only in regard to the genus of the stones, but to the mineralogical species which enter into their composition, and also in regard to the effects resulting from their motion in the atmospheric fluid.

As I had reason to hope I should be able to discover the exact spot where this globe fell, I made researches in the neighbourhood of Ville Franche, and was directed towards the commune of Sales; at about the distance of a league and half to the north-west of Ville Franche, in the department of the Rhone, where I learned that most of the inhabitants had been witnesses of, and frightened by the arrival of this luminous body which had fallen in a vineyard within three hundred paces of the village, and near the house of a vintager, called Pierre Crepier.

I proceeded with two of the inhabitants, best acquainted with the fact, towards the house of Crepier, and on the spot where the stone buried itself received every information respecting it, and obtained the last specimen which Crepier had remaining.

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The following are all the circumstances I collected in regard to this singular phenomenon, omitting the useless reasoning in regard to its authenticity.

On the 12th of March, 1798, about six in the evening, the weather being calm and serene, a luminous globe, of an extraordinary appearance, attracted towards the east the eyes of the inhabitants of the commune of Sales, and of the neighbouring villages, as they were returning from their labour; and by its rapid approach and horrid noise, like that produced by an irregular and hollow body traversing the atmosphere with rapidity, threw all the inhabitants of that commune into the greatest terror, especially when they saw it pass over their heads at a very little elevation.

According to their report this ball left behind it a long train of light, and emitted, with an almost continual crackling noise, small blue sparks, like small stars.

Its fall was observed by three workmen, who were not more than fifty paces from it; one of them was so much alarmed, that he dropped his coat and a billet of wood, that he might escape as fast as possible. The other two fled to Sales, where a general alarm prevailed. These three witnesses agree that the body moved with astonishing rapidity, and that after its fall they heard a hissing noise, proceeding from the spot where it buried itself.

In regard to Crepier he was at home, where he was so much terrified with the hissing of the body and noise of its fall, that he shut himself up, and spent the night without daring to go out.

Next morning he was called out by the two workmen who had observed it, and they went with M. Blondel, adjunct of Sales, and several other persons, to the place where the substance buried itself. At the bottom of a hollow, eighteen inches in depth, they found a large, black, irregular ovoid mass, entirely covered with a blackish crust; it was no longer warm, and had the smell of gunpowder. It was split in several places, so that thrusting a stick into one of the fissures made it fall to pieces. The weight of this stone was about twenty pounds.

M. Place, a merchant of Ville Franche, assured me he was a witness, as well as many other inhabitants, of the passage of this luminous globe over the town; that he heard its humming noise; that its elevation could not exceed 500 toises, and that its direction was from east by south to west by north.

It since appears that this meteor was seen by M. Picquet, and other inhabitants of Geneva, and of the neighbouring towns as far as Berne; they observed a luminous body which suddenly appeared in the southern regions proceeding rapidly from west to east. This phenomenon was then considered as a meteor, but M. Picquet is now persuaded it is the same body which fell at Sales.

M. Biot, the celebrated astronomer and mathematician, has drawn up a very accurate memoir of the meteoric mass that fell in the neighbourhood of Laigle; the most interesting particulars of which we have extracted, and are as follow.

July 20, 1803. I went first to Alençon, fifteen leagues west-south-west of Laigle, and in going thither I learned that a globe of fire had been seen proceeding towards the north; the appearance of this globe had been followed by a violent explosion. This took place on the 26th of April, 1802, at one in the afternoon. By the direction of this phenomenon, the day, and particularly the hour, I judged that this had been the commencement of the meteor of Laigle. At Alençon nothing had been heard, in consequence, no doubt, of the noise which usually prevails in a large town, but I learnt by the mineralogical

collections of the country that nothing exists in the neighbourhood of Laigle which has any resemblance to the meteoric stones. From Alençon I proceeded to Laigle, traversing the villages conducted by the accounts given me by the inhabitants. All of them had heard the meteor on the day, and at the hour mentioned. In this manner I reached Laigle, and proceeded to the house of our colleague, Le Blond.

The meteor did not burst at Laigle, but at the distance of half a league from it I saw the awful traces of this phenomenon. I traversed all the places where it had been heard, and collected and compared the accounts of the inhabitants. At last I found some of the stones themselves on the spot, and they exhibited physical characters, which admit no doubt of the reality of their fall.

If we first consider the physical testimonies, no meteoric stones had been in the hands of the inhabitants before the explosion on the 26th of April.

The mineralogical collections formed on the spot with the greatest care, for several years, contained nothing of the kind.

The founderies, iron-works, and mines in the neighbourhood which I visited exhibited nothing in their productions, or their scoriae, which had the least affinity to these substances. No traces of a volcano are found in the country.

Suddenly, and only since the time of the meteor, these stones have been found on the ground, and in the possession of the inhabitants, who are better acquainted with them than any other persons.

These stones are only found in a certain extent, in ground foreign to the substance they contain, and in places where, from their size and number, it is impossible they could have escaped notice.

The largest of these stones, when broken, still exhale a strong sulphurous smell from their interior parts. That of their surface has vanished, and the smallest exhale no sensible odour, so that the odour of the former seems likely to be dissipated in the course of time.

Traces, which strongly attest the fall of these stones, never mentioned without terror, are still shewn. The inhabitants say they saw them descend along the roofs of the houses like hail, break the branches of the trees, and rebound on the pavement. The earth smoked round the largest of them, and they still burnt after they had them in their hands. These accounts are given, and the traces shewn only in a certain extent. It is there only that meteoric stones are found on the ground: not a fragment is found beyond that district.

From the aggregate of the testimonies, we have deduced the following account of the phenomenon.

On Tuesday, April 26th, 1802, about one in the afternoon, the weather being serene, there was observed from Caen Pont, Audemer, and the environs of Alençon, Falaise, and Verneuil, a fiery globe of a very brilliant splendour, which moved in the atmosphere with great rapidity. Some moments after there was heard at Laigle, and in the environs of that city, to the extent of more than thirty leagues in every direction, a violent explosion, which lasted five or six minutes.

At first there were three or four reports like those of a cannon, followed by a kind of discharge resembling a firing of musketry; after which there was heard a dreadful rumbling, like the beating of a drum. The air was calm, and the sky serene, except a few clouds, such as are frequently observed.

This noise proceeded from a small cloud which had a rectangular

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rectangular form, the largest side being in a direction from east to west. It appeared motionless all the time the phenomenon lasted, but the vapour of which it was composed was projected momentarily from the different sides, by the effect of the different explosions. This cloud was about half a league to the north-north-east of the town of Laigle; it was at a great elevation in the atmosphere, for the inhabitants of two hamlets, a league distant from each other, saw it at the same time above their heads. In the whole canton over which this cloud hovered, a hissing noise, like that of a stone discharged from a sling, was heard, and a multitude of mineral masses, exactly similar to those distinguished by the name of *meteoric stones*, were seen to fall at the same time.

The district in which these stones fell forms an elliptical extent of about two leagues and a half in length, and nearly one in breadth; the greatest dimension being in a direction from south-east to north-west, forming a declination of about 22°. This direction, which the meteor must have followed, is exactly that of the magnetic meridian, which is a remarkable result.

The largest of these stones fell at the south-east extremity of the large axis of the ellipse, the middle ones fell in the centre, and the smallest at the other extremity. It thereby appears that the largest fell first, as might naturally be supposed.

The largest of all those which fell weighed 17½ pounds; the smallest I saw weighed two gros, which is the thousandth part of the former. The number that fell is certainly *above* two or three thousand.

On the 5th of April, 1804, another stone of this kind fell near Glasgow, the particulars of which were very well ascertained by several professional gentlemen belonging to the university of that place. They are related in the 18th volume of the Philosophical Magazine. On the day above mentioned three men, at work in a field at Possil, about three miles north of Glasgow, were alarmed with a singular noise, which they think continued about two minutes, seeming to proceed from the south-east to the north-west. At first it seemed to resemble four reports from the firing of cannon; afterwards, the sound of a bell, or rather gong, with a violently whizzing noise; and lastly, they heard a sound, as if some hard body had struck with great force the surface of the earth. On the same day, in the forenoon, sixteen men were at work in the Possil quarry, thirty feet below the surface of the ground, and there, too, an uncommon noise was heard, which, it is said, seemed at first to proceed from the firing of some cannon; but afterwards the sound of hard substances hurling downwards over stones, and continuing, in the whole, for about the space of a minute.

By others who were at the quarry, *viz.* the overseer of the quarry, and a man in a tree, to whom he was giving directions, the noise is described as continuing about two minutes, appearing as if it began in the west, and passed round by the south towards the east; along with these people there were two boys of ten and four years old, and a dog; the dog, on hearing the noise, ran home in a great fright. The overseer, during the continuance of the noise, looking up at the atmosphere, observed in it a misty commotion, which alarmed him, and he called to the man in the tree. "Come down, I think there is some judgment coming upon us;" and he says that the man in the tree had scarcely got on the ground, when something struck with great force in a drain made for turning off water, about ninety yards distance, splashing mud and water about twenty feet round. The elder boy, led by the noise to look up to the atmosphere, says, that he observed the appearance of smoke in it, with

something of a reddish colour moving rapidly through the air from the west, till it fell on the ground. The younger boy, at the instant before the stroke was heard, called out, "Oh, such a reek!" and says he saw an appearance of smoke near the place where the body fell. The overseer immediately ran up to the place where the splashing was heard, when he saw a hole made at the bottom of the drain. The hole was filling with water from a small stream, and about six inches of it remained empty: he thrust his hand into the hole, (which was nearly perpendicular, the bottom a very little inclined to the east, and the upper part to the west,) and felt something hard at the bottom, which he could not move. The hole was cleared out, expecting a cannon-ball, but nothing observed except the natural stratum of soil, and the rock on which it lay, and two pieces of stone that had penetrated a few inches into the rock; he thought they were whinstone, and that they were eighteen inches below the bottom of the drain, and the hole fifteen inches diameter; no particular heat was observed in the water, nor in the pieces of stone, nor any uncommon smell in the latter. The one piece of stone was about two inches long; the other six inches long, four broad, and four thick, blunted at the edges and end; the fractures coincided; he did not know whether the fracture was caused by the fall or the mattock; and says that he never saw any such stone about the quarry.

Some days after, when the particulars came to be known, a search was made for these stones, and the first mentioned piece was soon found; the other, having fallen among rubbish, was missing; a few days after a fragment of it was found: the two fragments make the two extremes of the stone; on the surface they are pretty smooth, of a black colour, internally of a greyish appearance: the intermediate part seems as yet to be lost. It may be proper to remark, though the overseer did not observe any particular smell in the stone, that when Mr. Craufurd obtained the first piece it had a fishy and fœtid smell; and the second had the same, but in a less degree. No warmth, however, was perceived in them at any period.

Account of a stone lately fallen in Russia.—On the 13th of March last, in the afternoon, the inhabitants of the canton of Juchnow, in the government of Smolensk, were alarmed by an uncommon loud clap of thunder. At the moment of this explosion two peasants, belonging to the village of Peremeschajeu, in the canton of Werreje, being out in the fields, perceived, at the distance of forty paces, a black stone of considerable magnitude falling to the earth, which it penetrated to a considerable depth below the snow. It was dug up, and found to be of an oblong square figure, of a black colour, resembling cast-iron; its surface was very smooth, shaped like a coffin on one side, and it weighed about 160 pounds. *Philosophical Magazine*, 1807.

But one of the best authenticated accounts we have yet received is from Connecticut, in America; the circumstances of which were communicated by Charles Greville, of F. R. S. to whom they were originally transmitted.

The particulars of this phenomenon were collected with great care by Messieurs Silliman and Kingley, who visited and carefully examined every spot where the stones had been ascertained to have fallen: they conversed with all the principal original witnesses, and spent several days in the investigation of all the important facts that could be collected on this occasion. The substance of the account is as follows. The meteor, which has so recently excited alarm in many, and astonishment in all, first made its appearance in Western, about a quarter or half past six o'clock A. M. on Monday the fourteenth instant (Dec. 1827.) The morn-

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ing was somewhat cloudy, mingled with spots of clear sky, a space of 15° along the northern horizon perfectly clear; there was little or no light except from the moon just setting. Judge Wheeler was passing through the enclosure adjoining his house, with his face towards the north, and his eyes on the ground, when a sudden flash across the northern sky made him look up; he immediately discovered a globe of fire, passing behind the first cloud, which was very dark, and obscured the meteor. In this situation its appearance was distinct, like the sun seen through a mist. It rose from the north, and proceeded in a direction nearly perpendicular to the horizon, but inclining by a very small angle towards the west, deviating from the plane of a great circle, but in large curves, sometimes on one side of the plane, and sometimes on the other, but never more than four or five degrees; it appeared about one-half or two-thirds the diameter of the full moon, but it was impossible to ascertain what angle it subtended. Its progress was not so rapid as that of common meteors and shooting stars; when it passed the clear sky it flashed with a vivid light, not so intense as lightning in a thunder storm, but like what is called *heat lightning*. Its surface was apparently convex. When not too much obscured by clouds, a conical train of paler light attended it, waving, and in length about 10 or 12 diameters of the body. In the clear sky there was a brisk scintillation about it, like a fire-brand carried against the wind. It disappeared about 15° short of the zenith, and the same number west of the meridian; it did not vanish instantaneously, but grew fainter, as a red-hot cannon ball would do, cooling in the dark, only much more rapidly. There was no particular smell in the atmosphere, nor any luminous masses seen to separate from the body; the whole period between its appearance and extinction was estimated at 30 seconds.

About 30 or 40 seconds after this, three loud and distinct reports, like those of a four pounder, near at hand, were heard; they succeeded each other rapidly, and did not occupy above three seconds; then followed a continued rumbling, like a cannon ball rolling over a floor, sometimes louder and sometimes fainter; some compared it to a waggon running down a stony hill, others to a running fire; this noise continued about as long as the body was in rising, and died away in the directions from which the meteor came. A Mr. Elihu Staples said, that when the meteor disappeared, there were three successive efforts or leaps of the ball, which grew more dim with every throw, and disappeared with the last.

We now proceed to the fall of a number of masses of stone, in several places principally within the town of Weston. The places which had been well ascertained at the period of our investigation were six, the most remote nine or ten miles distant from each other, in a line differing little from the course of the meteor. It is, therefore, probable, that the successive masses fell in this order, the most northerly first, the most southerly last. We think we can point out the three places where the stones fell, corresponding with the three reports and leaps of the meteor. In every instance, immediately after the explosions had ceased, there was observed a loud whizzing at all the places, and at the moment of the fall; after this was heard an abrupt noise, like a ponderous body striking the ground. Excepting one, the stones were more or less broken.

The most northerly fall was within the limits of Huntingdon, on the borders of Weston, about 50 rods east of the great road from Bridgeport to Newton, in a cross road, near the house of Mr. Burr; he was standing in the road when the stone fell; the noise produced by its collision with

a rock of granite, on which it fell, was very loud; Mr. Burr was within 50 feet, and searched for the body; but it being dark did not find it till an hour after. By the fall some was reduced to powder, and the rest broke in small fragments, thrown round to the distance of 30 feet; the granite was stained at the place of contact with a deep lead-colour; the largest fragment did not exceed the size of a goose egg, and this was still warm; there was reason to suppose the stone must have weighed 25 pounds.

The masses of the second explosion fell in the vicinity of Mr. Prince's, in Weston, about five miles south of Mr. Burr's. The family were in bed when "they heard a noise of the fall of a heavy body after the explosion." They would have paid no further attention to the circumstance, had they not heard that stones had fallen in other parts of the town; this induced them towards evening to search a hole newly made in the yard, where they found a stone buried in the loose earth which had fallen on it; it was two feet from the surface, the hole 12 inches diameter, and as the earth was soft the mass was little injured, only a few small fragments being detached. It weighed 35 pounds.

Six days after another mass was discovered, half a mile north-west of Mr. Prince's; the search was induced by the persuasion of the neighbours that they heard it fall near the spot where it was found buried. It weighed from seven to ten pounds, and was split in fragments, having fallen on a detached mass of gneiss rock which it had split in two. We found another mass, of thirteen pounds weight, half a mile north-east of Mr. Prince's; it was broken only in two pieces, one of which we purchased, for it was now become an article of sale.

A fifth mass fell two miles south-east of Mr. Prince's at the foot of Tashowa hill. Its fall was heard by Mr. Porter and his family. They saw a smoke rise, from the spot where they found a stone, in the road, which had penetrated two feet in the deepest place, the hole twenty inches diameter, and the margin coloured blue from the powder of the stone, which weighed 25 pounds.

It is probable that the four last stones were projected at the second explosion, and one has been since found on the neighbouring hill, weighing 35 pounds, which must be referred to the same.

A mass of stone, far exceeding the united weight of all we have described, fell in a field belonging to Mr. Seely, within 30 rods of his house.

A circumstance attended the fall of this which seems peculiar to it. Mr. Staples lives on the hill, at the bottom of which this body fell. After the last explosion a noise like a whirlwind passed to the east of his house, and over his orchard; at the same instant a streak of light passed over it in a large curve, and seemed to pierce the ground; a shock was felt, and a report heard like that of a heavy body striking the earth.

Three or four hours after this, Mr. Seely went to look after his cattle. Some had leaped into the adjoining enclosure, and appeared frightened; passing on he was surprised to find a spot of ground all torn up, and the earth looking fresh. Coming to the place he found a great mass of fragments of a strange looking stone.

Here were striking proofs of a violent collision; a ridge of micaceous schistus, lying nearly even with the ground, and somewhat inclining like the hill to the south-east, was shivered to pieces to a certain extent by the impulses of the stone, which thus received a still more oblique direction, and forced itself into the earth to the depth of three feet, leaving a hole of five feet in length, and four and a half in breadth; throwing

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throwing large masses of turf, and fragments of stone and earth, to the distance of 50 and 100 feet.

This stone was all in fragments, none of which exceeded the size of a man's fist. From the best information we could obtain of the quantity of fragments of this last stone, compared with its specific gravity, we concluded that its weight could not have fallen much short of 200 pounds. All the stones when first found were friable; this was especially the case where they had been buried in the moist earth, but by exposure to the air they gradually hardened.

The specimens obtained from all the different places are perfectly similar. The most careless observer would instantly pronounce them portions of a common mass, different from any of the stones commonly seen on this globe.

Of their form nothing certain can be said. Few of the specimens weigh one pound; most of them less than half a pound, from that to the fraction of an ounce. On many of them, however, may be distinctly perceived portions of the external part of the meteor.

It is every where covered with a thin black crust, destitute of splendour, and bounded by portions of the large irregular curve, which seems to have enclosed the meteoric mass. This curve is far from being uniform; it is sometimes depressed with concavities, such as might be produced by pressing a soft substance. The surface of the crust feels harsh, like prepared fish skin or shagreen. It gives sparks with steel. There are certain portions of the stone, covered with the black crust, which appear not to have formed a part of the outside of the meteor, but to have received this coating in the interior parts, in consequence of the fissures or cracks produced by the intense heat to which the body seems to have been subjected.

The specific gravity is 3.6, water being 1.

The colour of the mass of the stone is principally a dark ash or leaden colour. It is dispersed with distinct masses, from the size of a pin's head to the diameter of one or two inches, which are almost white, resembling the crystals of feldspar in some varieties of granite, and in that species of porphyry known by the name of *verd antique*.

The texture of the stone is granular and coarse, resembling grit stone. It cannot be broken with the fingers, but gives an irregular fracture with the hammer.

On inspecting the mass four distinct kinds of matter may be perceived by the eye.

1st. The stone is thickly interspersed with black globular masses, most of them spherical, some oblong. The largest are of the size of a pigeon shot; but generally much smaller; they can be detached, and leave a concavity in the stone. They are not attractable by the magnet, and can be broke by the hammer.

2d. Masses of yellow pyrites may be observed.

3d. The whole stone is thickly interspersed with metallic points, many of them visible to the eye, and numerous with a lens. Their colour is whitish, and mistaken by the discoverers of the stone for silver. They appear to be malleable iron alloyed with nickel.

4th. The lead-coloured mass which cements these together has been described already, and constitutes by far the greater part of the stone. After being wet and exposed to the air, the stone becomes covered with reddish spots, which do not appear in a fresh fracture, and arise from the rusting of the iron.

Finally, the stone has been analysed in the laboratory of this college, according to the instructions of Howard, Vauquelin, and Fourcroy. The analysis was hasty, the exact pro-

portions and the steps of the analysis are reserved for more leisure.

It is sufficient to observe that the stone appears to consist of the following ingredients; silic, iron, magnesia, nickel, and sulphur.

The two first constitute by far the greatest part of the stone; the third in considerable proportion, but much less than the others; the fourth probably still less, and the sulphur exists in a small but indeterminate quantity.

Most of the iron is in a perfectly metallic state; the whole stone attracts the magnet, and this instrument takes up a large proportion of it when pulverized. Portions of metallic iron may be separated so large that they may be easily extended under the hammer. Some of the iron is in combination with sulphur in the pyrites, and probably most of the iron is alloyed by nickel.

In the Transactions for 1803 is an account by C. Greville, esq. of three specimens in different museums in France, of stones which have fallen to the earth, all similar in their general character to those described by Mr. Howard; and also of a mass of native iron found in Persia in the year of the Hegira 1030, according to the annals of the empire, written by the emperor, and of which he is stated to have made some sabres and daggers; but until other iron was mixed with that of the mass described, the iron was not malleable.

But the most beautiful specimen of perfect iron was brought from the Cape of Good Hope. Barrow, in his travels into that country, describes the original mass as existing in the interior of Africa, and it is thought that some traditionary superstition is connected with it by the natives.

Notwithstanding every doubt seems now to be removed as to the general authenticity of the above relations, yet philosophers are not perfectly agreed either as to their origin or mode of formation. Of the different theories that have been proposed, that which supposes them formed in the air, that is, in our atmosphere, is certainly the least analogous to our present state of chemical knowledge. Others are more inclined to assign them an astronomical origin, though great doubts still exist as to the particular class of bodies from which they are most probably derived. Some astronomers imagine they have been thrown from a lunar volcano: there is nothing, perhaps, philosophically inconsistent in this theory, for volcanic appearances have been seen in the moon; and a force such as our volcanoes exert would be sufficient to project fragments that might possibly arrive at the surface of the earth. It is demonstrated by mathematicians, that if a ponderable body be projected from the earth's surface with a force sufficient to give it a certain initial velocity, it will never return. This velocity is about seven miles an hour. From the moon, the velocity requisite to produce a similar effect is about four times as great as that of a cannon-ball, so that there is nothing impossible in the supposition of these bodies having been projected from the moon. But probability is certainly against it, and it seems more likely that they are fragments of comets; because these bodies, from their great numbers, render the question of mere probability favourable to this hypothesis; and besides, from their own nature they must be subject to chemical changes of a very violent nature; add to this, that from the smallness of their dimensions, a fragment projected from them with a very slight velocity would never return to the mass to which it originally belonged, but would traverse the celestial regions till it met with some planetary or other body sufficiently ponderous to attract it to itself. Many arguments likewise concur, which

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lead to the conjecture that the comets themselves are nothing more than larger fragments of matter, which have been themselves separated by volcanic violence from other celestial bodies of greater magnitude than themselves; perhaps from fixed stars. The theory of the new planets, as suggested by Olbers, likewise continues to gain ground in the estimation of astronomers; these are by him supposed to be only portions of a large planet which once revolved about the sun in an entire form. Warranted by such strong indications, why should we hesitate to extend the analogy from our own earth to the great sidereal system? On our own planet, not only the volcanoes at present existing, but the indubitable vestiges of the past, are sufficient to convince us that great and marvellous changes are continually taking place in consequence of the chemical and mechanical action of the different elements on each other: so it is, probably, throughout the whole creation. The immensely long periods in which these changes are accomplished appear relatively to our limited scale of existence to be of great importance; but contemplated by intellect of a higher order than our own, the whole history of the sidereal universe may be a phenomenon almost instantaneous. To return, however, to this sublunary world, it still remains to add a few words on the different theories that have been suggested to explain the sudden ignition of these meteors, and the violent electric or stormy appearance which has been observed to accompany them.

Of the number of theories that have been suggested to explain the ignition of these bodies, and the explosions that often attend their arrival, very few deserve even to be noticed. So imperfect is our meteorological knowledge, that we must content ourselves with mere conjecture. The least improbable opinion of those that have been hazarded seems to be this, that the inflammation and combustion of the stones proceeds from the heat necessarily extricated by the sudden compression of the air, in consequence of the great velocity they possess on their first entering our atmosphere, which velocity is afterwards much diminished by the constant resistance of the air. In this case, however, we must suppose them of the nature of pyrophori, an hypothesis far from satisfactory. Mr. Davy's late discoveries seem likely to lead us nearer to the truth. If these earthy bodies were in their metallic state of existence previous to their arrival on the confines of our world, their sudden inflammation would be easily accounted for, and would at the same time afford us a curious circumstance in their history, as it would be evident they came

from a place where no oxygen was to be found; they could not, therefore, come from the surface of a habitable world like ours. They may, however, even on this hypothesis, have been part of the internal nucleus of some planetary or cometary body having an atmosphere, but not of sufficient thickness to have produced that inflammation which takes place when they enter ours. The electrical appearances that so often accompany these bodies in their descent indicate that the equilibrium of the atmosphere is more easily deranged than otherwise might be imagined; for certainly it is much more rational to suppose that this disturbance is rather the effect of the meteor than the cause of it. If there be any truth in the prevailing opinion of seamen, that the firing of cannon stills the wind, this fact will strengthen the opinion that great apparent changes may take place in the atmosphere by the various chemical operations that may accidentally take place within it. But we shall abstain, however, from farther conjecture, and trust, that one day the future progress of science will enable philosophers to explain, in a satisfactory manner, all the circumstances which at present seem to be involved in such complex obscurity.

But whatever be really their origin, the history of these productions we must acknowledge to be highly interesting; from the earliest times these fragments have been continually arriving at the surface of the earth, though it is only lately that they have attracted the notice of philosophers, and their history been authenticated by the superior lights of modern science. From the most ancient period of history there are repeated accounts of stones falling from heaven, which, but for the careful investigations above described, would for ever have been confounded with the fabulous prodigies so familiar to ancient credulity. And this affords a singular and striking instance, in which the true hypothesis was embraced by the ignorant and credulous part of mankind at the same time that it was rejected by philosophers. In favour of learning, however, we should observe, that it could only have been by the superior science of the present age, that facts of such an extraordinary nature could have been authenticated and separated from the multitude of fabulous and wonderful events which have been believed and recorded by the same historians.

We subjoin the following epitome of the analysis of these bodies from Thomson's Chemistry, and a table is subjoined from a French work of M. Izarn.

Substances.	Places where they fell.	Period of their fall.	Testimony.
Shower of stones	At Rome	Under Tullus Hostilius	Livy.
Shower of stones	At Rome	Consuls C. Martius and M. Torquatus	J. Obsequens.
Shower of iron	In Lucania	Year before defeat of Crassus	Pliny.
Shower of mercury	In Italy		Dion.
A very large stone	In Thrace	2d year of 78th Olympiad	Pliny.
Three large stones	In Thrace	B. C. 452	Ch. of count Marcelli.
Shower of fire	At Quesnoy	January 4th, 1717	Geoffroy le Cadet.
Stone of 72 lbs.	Near Larissa, Macedonia	January, 1706	Paul Lucas.
About 1200 stones, one of 120 lbs.	Near Padua, in Italy	In 1510	Cardon Varet.
Another of 60 lbs.			
Another of 59 lbs.	On Mount Vaife, Provence	November 27th, 1627	Gassendi.
Shower of sand for 15 hours	In the Atlantic	April 6th, 1719	Pere le Feuilles.
Shower of sulphur	Sodom and Gomorrah		Moses.
Sulphureous rain	In the duchy of Mansfeld	In 1658	Spangenberg.
The same	Copenhagen	In 1646	Olaus Durmius.
Shower of sulphur	Brunswick	October, 1721	Siegesfer.

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TABLE continued.

Substances.	Places where they fell.	Period of their fall.	Testimony.
Ditto of a viscid unknown matter	Ireland	In 1695	Muschenbroek.
Two large stones, weighing 20 lbs.	Liponas, in Bresse	September, 1753	De la Lande.
A stony mass	Niort, in Normandy	In 1750	De la Lande.
A stone of 7½ lbs.	At Luce, in Le Main	September 13th, 1768	Bachelay.
A stone	At Aire, in Artois	In 1768	Gurson di Boyaval.
A stone	In Cotentin	In 1768	Morand.
Extensive shower of stones	Environs of Agen	July 24th, 1750	St. Amand Baudin, &c.
About 12 stones	Sienna, Tuscany	July, 1794	Earl of Bristol.
A large stone, 56 lbs.	Wold Cottage, Yorkshire	December 13th, 1795	Captain Topham.
A stone of about 20 lbs.	Sale, department of the Rhone	March 17th, 1798	Le Lievre and De Drée.
A stone of 10 lbs.	In Portugal	Feb. 29th, 1796	Southey.
Shower of stones	Benares, East Indies	Dec. 19th, 1798	J. Lloyd Williams, esq.
Shower of stones	At Plum, near Taber, Bohem.	July 3d, 1753	B. de Born.
Mafs of iron, 70 cubic feet	America	April 5th, 1800	Phil. Magazine.
Mafs of ditto, 14 quintals	Abakank, Siberia	Very old	Pallas, Chladni, &c.
Shower of stones	Barboutan, near Boquefort	July, 1789	Darcet, jun. Somet, &c.
Large stone, 200 lbs.	Ensisheim, Upper Rhine	November 7th, 1492	Butenschoes.
Two stones 200 and 300 lbs.	Near Verona	In 1762	Acad. de Bourd.
Stone of 20 lbs.	Sales, near Ville Franche	March 12th, 1798	De Drée.
Several ditto, from 10 to 17 lbs.	Near L'Aigle, Normandy	April 26th, 1803	Fourcroy.
Large stone	Glasgow	April 5th, 1804	
Shower of stones	Connecticut	Dec. 1807	

The stony bodies, when found, are always hot. They commonly bury themselves some depth under ground. Their size differs from a few ounces to several tons. They are usually roundish, and always covered with a black crust. In many cases they smell strongly of sulphur. The black crust, from the analysis of Howard, consists chiefly of oxyd of iron.

The outer surface of these stones is rough; when broken, they appear of an ash-grey colour, and of a granular texture, like sand-stone. When examined with a microscope, four different substances may be discovered, of which the stone is composed: 1st, a number of spherical bodies, varying in size from a pin-head to a pea, of a greyish-brown colour, opaque, breaking easily in every direction, of a compact texture, capable of scratching glass, and of giving a few feeble sparks with steel; 2d, fragments of pyrites, of an indeterminate shape, of a reddish-yellow colour, granular, and easily reduced to powder; the powder has a black colour; 3d, grains of iron in the metallic state, scattered like the pyrites through the stone; 4th, the three substances just mentioned are cemented together by a fourth, of an earthy consistence, and so soft that all the other substances may be easily separated by the point of a knife, and the stone itself crumbled to pieces between the fingers; this cement is of a grey colour. The proportion and size of these different constituents vary considerably in different specimens; but all of them bear a striking resemblance to each other. Their specific gravity varies from 3.352 to 4.281.

From the analysis of Howard, which was conducted with much precision and address, and which has been fully confirmed by Vauquelin and Klaproth, we learn that the black crust consists of a compound of iron and nickel, partly metallic and partly oxydated. The pyrites consist of iron, nickel, and sulphur. The metallic grains consist of iron, combined with about a third of its weight of nickel, and the yellow globules are composed of siliceous, magnesia, iron, and

nickel. The count Bournon observes, that these globules resemble the chrysolite of Werner, and that their chemical analysis corresponds exactly with Klaproth's analysis of that mineral. The earthy cement consists of the very same substances, and nearly in the same proportion, as the globular substances. But it will be necessary to exhibit a specimen of some of the analyses, as published by the philosophers to whom we are indebted for them. A stone which fell at Benares in India was analysed by Howard. The pyrites consisted of

2.0 Sulphur
10.5 Iron
1.0 Nickel
2.0 Earths and foreign bodies.

15.5

The spherical bodies consisted of

50.0 Siliceous
15.0 Magnesia
34.0 Oxyd of iron
2.5 Oxyd of nickel.

101.5

The earthy cement consisted of

48.0 Siliceous
18.0 Magnesia
34.0 Oxyd of iron
2.5 Oxyd of nickel.

102.5

A stone which fell in Yorkshire, deprived as much as possible of its metallic particles, gave Mr. Howard, from 150 grains,

75 Siliceous

75 Silex
37 Magnesia
48 Oxyd of iron
2 Oxyd of nickel.

162

The increase of weight was owing to the oxydizement of the metallic bodies.

Stones which fell at P'Aigle in France, in 1803, yields, by the analysis of Vauquelin and Fourcroy,

54 Silex
36 Oxyd of iron
9 Magnesia
3 Oxyd of nickel
2 Sulphur
1 Lime.

105

The celebrated stone which fell at Ensisheim in Alsace, in 1492, yielded to the same philosophers,

56.0 Silex
30.0 Oxyd of iron
12.0 Magnesia
2.4 Nickel
3.5 Sulphur
1.4 Lime.

105.3

FALLINGBOSTEL, in *Geography*, a town of Germany, in the principality of Luneberg-Zell; 14 miles N.E. of Rethem.

FALLOPIA, in *Botany*, named by Loureiro in honour of Gabriel Fallopius, the celebrated anatomist, who excelled in the knowledge of plants. He wrote several tracts on their virtues, and also a commentary on Dioscorides. Lour. Cochinch. 335. Class and order, *Polyandria Monogynia*. Nat. Ord. *Tiliaceis affine?*

Gen. Ch. *Cal.* Perianth inferior, of five ovate, coloured, somewhat spreading leaves. *Cor.* Petals five, ovate-oblong, small, equal, erect. *Stam.* Filaments about 50, thread-shaped, unequal, inserted into the receptacle; anthers roundish. *Pist.* Germen superior, roundish; style thick, awl-shaped, shorter than the stamens; stigma simple. *Peric.* Berry globular, of one cell, with four roundish seeds.

Ess. Ch. Corolla of five petals. Calyx of five leaves: Berry superior, of one cell. Seeds four.

Obs. We have presumed to correct, from analogy, the description of Loureiro, who considers as a nectary the five small leaves which we esteem petals, and takes our calyx for the corolla. He thinks there is no true perianth, but calls a common calyx what we judge by his description to be bracteas.

1. *F. nervosa*. Hai p'u ip of the Chinese. Found wild in the neighbourhood of Canton. A tree, eight feet high, with spreading branches, and a fibrous or hemp-like bark. Leaves scattered, ovato-lanceolate, somewhat serrated, ribbed, smooth. Flowers white, in small terminal clusters; partial stalks, each bearing three flowers, encompassed with twelve linear-lanceolate, deciduous bracteas.—As we have only Loureiro's account to direct us, we cannot aver that this plant is not already known to systematic botanists by some other name and characters, but we have not been able to refer it to any already published.

FALLOPIAN TUBES, in *Anatomy*, two small tortuous canals, connected to the fundus of the uterus. See GENERATION, *Organs of*.

FALLOPII LIGAMENTUM, the inferior border of the tendon of the obliquus externus abdominis, extended from the anterior superior spine of the ileum to the angle of the pubes. See OBLIQUUS.

FALLOPII *Aquæductus*, a canal in the temporal bone, through which the facial nerve passes. See the description of that bone in the article CRANIUM.

FALLOPIO, GABRIEL, or, with the Latin termination, FALLOPIUS, in *Biography*, a physician of Modena, celebrated for his knowledge of anatomy. His biographers are not agreed as to the year of his birth, and consequently as to his age at the time of his death, in 1563. Castellani, Guilandini, and Haller believe that he was born in 1523, and died in his fortieth year; which opinion seems to be the most correct. Fallopio exhibited, in his youth, the most ardent zeal in the pursuit of knowledge. After having studied anatomy under Bravavola, and others, he left Italy in order to profit by the instructions of the most eminent professors in other countries; and he is said to have attained to a depth and extent of information unusual at his age. Botany, chemistry, and astrology were among the studies to which, besides anatomy, he particularly directed his attention. He was appointed professor of anatomy at Pisa in 1548; and thence went to Padua, where the same honourable office was confided to him in 1551. He also taught botany at Padua, but with less celebrity. In fact, his anatomical excellence not only did honour to the university of Padua, where a crowd of pupils was annually induced to resort for the advantage of his instructions, but procured for himself the reputation of the most able physician of his age. He died at Padua in 1563, as already stated. Fallopio was not only distinguished as a physician and anatomist, he was also eminent in the practice of surgery; of which subject, however, he has left no writings, unless the notes written by some of the pupils who attended his lectures, and published in a careless manner by them, can be considered as such. Douglas has characterized him in a few words: "in docendo maxime methodicus, in medendo felicissimus, in secundo expeditissimus." He contributed to elucidate the science of anatomy by his unceasing industry, although he had certainly been anticipated in several of his discoveries, the credit of which he claimed. In attaching his name to the uterine tubes, which are believed to receive the ovum from the ovary, and to convey it to the uterus, and are in general called the *Fallopian tubes*, anatomists acknowledge his title to the discovery of them. It must be admitted, however, Eloy observes, that these tubes were known to the ancient anatomists, Herophilus and Rufus the Ephesian, who have left us very accurate descriptions of them. The character of this great physician, however, is little deteriorated by such circumstances; for, if he did not make all the discoveries usually attributed to him, he at least restored those of the ancients which had fallen into oblivion. The following is a catalogue of his works. 1. "Observationes Anatomicæ, in libros v. digestæ," Venice, 1561; one of the best works of the sixteenth century, in which some of the errors which had escaped his master, Vesalius, are modestly corrected. 2. "Libelli duo, alter de Ulceribus, alter de Tumoribus, præter naturam," *ibid.* 1563. 3. "De Thermalibus aquis, libri septem; de Metallis et Fossilibus, liber," *ibid.* 1564; being the substance of part of his lectures on Dioscorides, published by one of his pupils, André Marcolinus. 4. "De Morbo Gallico Tractatus," Venice, 1564.

5. "De simplicibus Medicamentis purgantibus," *ibid.* 1566; the substance of lectures in the form of commentary on the first book of Dioscorides. 6. "Opuscula varia," Padua, 1566. 7. "Expositio in librum Galeni de Ossibus," Venice, 1570; published by Francis Michini. 8. "De compositione medicamentorum," *ibid.* 1570. 9. "De parte Medicinæ quæ Chirurgia nuncupatur, necnon in librum Hippocrates de vulneribus capitis dilucidissima interpretatio," *ibid.* 1571. 10. "De Humani Corporis Anatomie compendium," *ibid.* 1571. 11. "Lectiones de partibus similibus Corporis Humani," Nuremberg, 1575; published by Coiter. 12. "Opera genuina omnia, tam Practica, quam Theorica, in tres tomos distributa," Venice, 1584. This work was published at Francfort in 1600, and a supplement, forming a fourth volume, in 1606. But the superior bulk of this Francfort edition is made up of a collection of notes taken from the oral lectures of the author, and which are not in a style calculated for publication. A work was published at Venice in 1650, entitled "Secreti racolti dal Falopia," respecting which it may be observed, that Fallopio was too caudid and communicative to conceal any information that might be useful to mankind, and that this was probably an instance of the advantages which quackery does not fail to take of posthumous reputation to foist its impositions upon the public. Eloy *Dict. Hist. Med. Pract.*

FALLOW, a colour of a palish red, like that of a brick half burnt: such is that of a fallow deer, &c.

FALLOW, in *Agriculture*, signifies such land as has been repeatedly ploughed over, and exposed to the influence of the atmosphere, for the purpose of rendering it mellow and clean from weeds, not being sown, but left to rest after the tillage it has undergone.

But fallows have different names given to them, and are of different kinds, according to the purposes for which they are intended, and the manner in which they are made. A naked fallow is that in which the ground is ploughed and harrowed at suitable intervals for several times, according to the kind of crop that is ultimately to be grown upon it, but without being sown till it has lain for some length of time afterwards. A green fallow is that where the land has been rendered mellow and clean from weeds, by means of some kind of green crop, such as turnips, tares, peas, potatoes, &c. In this mode of fallowing no time is lost by the land being left idle, or in an unproductive state.

They are also sometimes distinguished by the season of the year in which the business is either principally or wholly accomplished; hence we have summer, winter, and spring fallows, and likewise further, from their being in particular instances only performed in a partial manner, we have bastard fallows. They are also not unfrequently denominated from the particular crops which are grown upon them, or by which they are produced; consequently, we have wheat, turnip, potatoe, pea, bean, and other similar fallows.

Whatever the nature of the fallow may be, it is of great consequence that it be well made. See *FALLOWING of Land*.

FALLOW-Cleansing Machine, an implement contrived for the purpose of rendering fallows clean from weeds, roots, and other prejudicial matters. It was long since invented by a blacksmith of the name of Aaron Ogden, residing at Ashton-under-Line, near Manchester, in the county of Lancashire. It is a complex unwieldy tool, which has been superseded by those of a much more cheap, simple, and applicable kind, such as rakes, drags, cultivators, &c. By the use of these fallows can be rendered not only fine, but perfectly free from couch, and all other sorts of root weeds. But,

besides this, the introduction of green fallow crops, by preventing, in a great measure, the necessity of naked or summer fallowing, has contributed to render the use of this sort of machinery much less frequent than formerly. In improved husbandry implements of this nature are of course seldom or ever employed. A full representation of this machine is however given in the "Complete Farmer, or General Dictionary of Husbandry."

FALLOW *Deer*. See *DEER*.

FALLOW-Finch, or *Fallow-smick*, in *Ornithology*, a name of the oenanthe, more commonly called the *wheat-ear*, and by some authors *odiflora*. See *MOTACILLA*.

FALLOW *Hounds*. See *HOUNDS*.

FALLOWING of *LAND*, in *Agriculture*, is the operation or process of rendering tillage-ground proper for the growth of different sorts of crops of the grain or green kinds, by repeated ploughing, harrowing, and other similar means, during the summer, autumnal, or winter and spring months.

This is a practice which was had recourse to at a very early period of the art of husbandry, and which has prevailed in different countries. It was most probably first introduced and adopted as the means of bringing the more rough and coarse kinds of tillage-land into a state proper for the production of various sorts of grain crops, and afterwards continued for the purpose of keeping such as had been brought into that state free from those vegetable productions which have a tendency to injure and destroy such crops.

The more frequent introduction of green crops has since considerably lessened the necessity for this practice in different districts.

It has been observed, that in the preparation of land for the reception of grain or other sorts of crops, by repeated ploughings and harrowings, or the frequent exposure of new and fresh surfaces to the action and influence of the atmosphere, a variety of alterations and changes are produced in the earthy, as well as other kinds of materials that enter into the composition or constitution of the soils. "The heavier or more earthy particles of the land, by being under different circumstances of the air and seasons thus frequently stirred and turned over, are so effectually divided or separated from each other, and broken down, that even in most of the stiffer sorts of ground, as well as those of the lighter kinds, there is a degree of pulverization and mellowness effected that could scarcely have been induced by any other means: in consequence of which the portions of vegetable matter that are present, and that may have been reduced into the carbonaceous state, with the calcareous, the argillaceous, and other earthy ingredients, and such metallic substances as may exist in the condition of oxyds or calces, become so uniformly, and so extensively blended and incorporated, and the manures that are afterwards applied so minutely intermixed with them, that the fibrous roots of the growing crops, of whatever nature they may be, are enabled to penetrate and extend themselves more fully, and of course to draw more regular and varied, as well as more abundant supplies of nourishment." And that "on account of the extreme division and pulverization that take place, and the great irregularity of surface which is produced in this way, the dews and light refreshing rains that are so frequently occurring in the early spring months are more capable of being admitted and diffused through, and detained in the hollows and interstices of the ground, and thus of contributing powerfully to the support of the crops in the more incipient stages of vegetation." Also, "by the repeated turning-in and destruction of different sorts of plants of the weed kind, much vegetable mucilaginous and saccharine matter

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matter may also be added, as well as the land improved by the putrefactive fermentation that must from these causes be constantly taking place." It is added, that "there are also other modes in which advantages may be gained by the repeated turning over and breaking down of the particles of soils, as from much of the atmospheric air being by such methods of husbandry blended with the fine particles of the soils, and detained in the numerous hollows and cavities formed by such degrees of pulverization, a larger proportion of oxygen may be supplied, which, by its union with the carbon and other inflammable materials that are mostly contained in soils, may produce the carbonic or other acids, according to the circumstances of the cases in greater abundance, and in this manner aid the growth of vegetables in a high degree. And as the water, or moisture that is included in large quantities in the pores of soils in such powdery states may undergo the process of decomposition more fully, by coming more minutely in contact with the portions of atmospheric air that are covered up and imprisoned with it in them, the supplies of ammonia or volatile alkali, by the combination of its hydrogen with azote, may be more regular and copious, as well as those of nitre, by the more complete union of its super-abundant oxygen with some other portion of the abounding nitrogen, or azote of such air. And it has likewise been suggested, that as the atmospheric air consists, or is constituted of oxygen, azote, and the fluid matter of heat, if the heat that causes them to exist uncombined in the form of gases be drawn away from them by some other material, while they are confined in the cavities of the soil, they may, by their nearer approach to each other, combine so as to produce nitrous acid; or the oxygen, in its fluid state, not in its aerial one, may more readily unite with carbon, and thus constitute a fluid, not an aerial carbonic acid, which is supposed to be of great utility in promoting the growth of plants. And further, that if any process of the putrefactive kind be going on where atmospheric air is in this way confined in the interstices of the soil, and by the deprivation of its heat is converted from a gas to a fluid, the azote may combine with the hydrogen of the decomposing water, or contribute to decompose it, and in this manner form volatile alkali, which, like nitrous acid, may, either during the process of its formation, or after that has been completed, be of very material utility in promoting vegetation, while at the same time the oxygen afforded by the decomposing water may, like that of the atmosphere, contribute to the production of the carbonic, nitrous, or phosphoric acids; and in this way render carbon, phosphorus, and the basis of nitre, capable of being taken up by the absorbent roots of growing plants. From the great diminution of bulk that has been found from experiment to take place where atmospheric air is confined in contact with water, it is conceived that there may be a decomposition of both the water and the air, and a production of both ammonia and nitrous acid, which are known to be beneficial in promoting vegetation, or the growth of plants. It is conceived that in these different views the practice of fallowing may in various instances be highly beneficial, notwithstanding the objections that have been so repeatedly brought against it by writers on husbandry; but at the same time it must be admitted that in some sorts of soil it will, for similar reasons, be much more advantageous and useful than in others. On the lighter kinds of land, where full and luxuriant crops of different sorts of plants, as turnips, potatoes, &c. may be grown, that produce a close, thick foliage, and which, as has been shewn by experiment, afford under such circumstances much carbonic acid, which, from its being greatly

heavier than the common air of the atmosphere, must fall upon and be mixed with the soil in such stagnated situations, and thus, together with the more constant moisture that must be present in such cases, promote the solution and decay of various vegetable matters, and continually add carbonaceous and other materials so as to greatly improve the soils; it can but seldom be necessary. Besides, as in these soils, by the use of the drill, and repeated hand or horse-hoeing during the growth of the crops, the ground may be kept perfectly clean from weeds, and in a fine mellow or powdery state, without the danger of being injured by too much evaporation and exposure in the way of fallowing; and likewise in soils of the same nature, that are rich from the frequent applications of manure, and in which the processes by which the different nutritious substances that have been described are formed and prepared, are properly going on, it must be injurious and improper to expose their surfaces frequently to the influence of the air, sun, and rain, as is the case in fallowing, as by such means the portion of carbonic acid that may exist in the state of a fluid may be made to assume the gaseous form, and be more readily dissipated, as also the phosphorus and the other materials in their different conditions before they form nitrous acid or ammonia. Thus, besides the injury that may be done in fallowing such sorts of land, by the carbon and other inflammable materials which they contain, combining with the oxygen of the surrounding atmosphere, and afterwards by their further union with other substances so as to form insoluble compounds, such as phosphat of lime and calcareous nitre, as has been ingeniously suggested by lord Dundonald, there may be others of not less consequence arising from the dissipation and loss of the carbonic or nitrous acid, or of volatile alkali in the gaseous state, as shewn by Dr. Darwin.

But that in all the wet bottomed, stiff, adhesive, and clayey sorts of soil, which constitute a large proportion of the lands of the kingdom, where, from the closeness of their textures, and the great tenacity of their particles, but a very slight, or indeed scarcely any, degree of pulverization has been effected, the practice of naked summer fallowing may often be highly useful and advantageous, not only by the great mechanical alterations that must of necessity take place in them by the repeated ploughing or turning-up of their parts to the influence of the atmosphere, but by their admitting the particles of the manures that may afterwards be applied to be blended and incorporated with them in a more minute and extensive manner; and their becoming so perfectly aerated, as that the different processes that have been mentioned may take place and properly proceed, so as to form in them such substances as have been found of utility in aiding the growth of crops; and which could not possibly have been produced without such pulverization as is the effect of fallowing in the naked method.

It may be further stated likewise, that the degree of friability and mellowness that is produced in this way in such soils has also other advantages, such as those of admitting the roots of the growing plants to penetrate them with greater facility, and presenting a more extensive surface for them to draw their nourishment from. And as in lands of these kinds there is a constant tendency to throw up abundant crops of root and other weeds, it is, perhaps, only by the frequent turning over of the soil and the tearing of them up by harrowing, as is the case in summer fallowing, that they can be effectually eradicated and destroyed. It is principally in this view that the working of such soils in the early spring or summer months becomes so particularly necessary, as at the period in which the seed is to be put into the ground, neither the season nor the state of the weather

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they will admit of their being sufficiently broken down and reduced by ploughing, or the weeds to be destroyed. And it may be added, that wet lands, by being turned over during the winter season, are liable, in many cases, to become more stiff and adhesive, by which the roots of the crops must be more limited and confined in their means of acquiring nourishment from them. It has been lately well observed, that "when land of a dry gravelly quality gets foul, it may be easily cleaned without a plain summer fallow; as crops, such as turnips, &c. may be substituted in its place, which, when drilled at proper intervals, admit of being ploughed between as often as necessary; whereas, wet soils, which are naturally unfit for carrying such crops, must be cleared and brought into good order by frequent ploughings and harrowings during the summer months."

Indeed it is strenuously contended by the same writer, that the most judicious intermixture of crops upon clay soils will not preclude the necessity of a summer fallow; though it is admitted that it may go a great way in preventing the necessity of its being so frequently repeated. But another writer, whose experience has been considerable, while he allows that there is no question at all of the merit of fallowing when compared with bad courses of crops, and who thinks, that if the husbandry is not correct in this respect, the fallowist will certainly be a much better farmer than his neighbours, contends that there are courses which will clean the foulest land as well as any summer fallow, by means of plants which admit all the tillage of such a fallow. "Cabbages," he says, "are not planted before June or July: winter tares admit of three months' tillage, if tillage be wanted. Beans, well cultivated, will preserve land clean, which has been cleaned by cabbages; and in any case two successive hoeing crops are," he thinks, "effective in giving positive cleanness. These observations are not," he adds, "theory; they are practice: and it is high time that mankind should be well persuaded, that the right quantity of cattle and sheep cannot be kept on a farm, if the fallows of the old system are not made to contribute to their support. There are probably, however, many situations of clayey soils so exceedingly stiff and wet, that though turnips, cabbage, or bean crops, may be grown upon them, it cannot, from the great labour and difficulty of their preparation, and the high degree of injury that must be done in the eating them or carrying them off the land, be to much advantage, or such as to admit of that sort of culture during their growth that will keep the ground perfectly clean from weeds.

In such cases no course of cropping, however judicious, can probably be effectual in this respect; it is indeed well known to such practical farmers as have had the management of soils of this nature, that it is scarcely possible to be effected even by summer fallowing itself. It has also been justly observed, that soils of this description are so frequently, from necessity, ploughed over when wet, that an adhesion and soundness are produced that cannot be removed without exposure to the heat of the summer's sun, and the pulverization afforded by the repeated operations of the plough and the harrow. There is no sort of crop that can in such cases supply the place of fallow, as turnips are highly detrimental; and drilled beans, though they may answer in the way of an assistant to fallow, and have the tendency of keeping lands clean that are already in a proper condition, it is supposed, from the necessity there is of sowing them early, can never be beneficially substituted for the radical improvement that is produced by a clean naked summer fallow.

It is, however, added, that even if such sorts of land could be kept perfectly clean and free from weeds by the judicious interposition of bean, cabbage, or other similar

crops that might be cultivated on them, it is evident that the various beneficial products which have been mentioned, and which are the result, in a great measure, of the perfect pulverization and high degree of aëration that are produced by means of summer fallowing, could never be formed in such an abundant manner as to be of much utility in aiding the growth of crops: nor could they be in so suitable a condition for the admission and extension of the absorbent roots of the plants that may be cultivated upon them as crops.

But though these circumstances may demonstrate the practice of fallowing to be occasionally necessary and highly useful on such wet, adhesive, clayey soils, as the proper and most advantageous quantity of stock for the improvement of such farms can seldom be kept where it greatly prevails, the repetition of the practice should, in this view, be prevented as much as possible, by the cultivation and growth of green crops as often as the lands may be in a state for them, and they can be had recourse to with any chance of success. The ruta baga, or Swedish turnip, as being a plant somewhat more adapted to wet, stiff soils, than either the common cabbage or turnip, might probably, in such cases, be advantageously substituted as a green crop, and by being eaten off in the later spring months, when the ground became sufficiently dry to bear the cattle or sheep without injury, admit of a pea crop; after which, the land would probably be in a suitable condition for wheat; or a crop of clover might be taken, and then wheat. But in all such cases much must depend upon the degree of cleanness, pulverization and aëration, that has been accomplished by the occasional use of summer fallowing. And as there is much variety in the conditions of such soils as may occasionally require the aid of naked or summer fallowing, in order to render them suitable for the growth of clean grain or other crops; some, from the nature of their situations and the sub-soils on which they are placed, being more inclined to the retention of injurious moisture or wetness than others, consequently more disposed to be cold, and to the throwing up of large crops of weeds; while others, from the large proportion of clayey or tenacious loamy materials that may be mixed and incorporated with the pebbly or other ingredients, may be more stiff and retentive, and of course more difficult or more incapable of sufficient pulverization, and of admitting the roots of such plants as are capable of being cultivated upon them, to readily establish themselves, and draw from them proper supplies of nourishment. And besides the varieties of these different states, there may probably be others that have not hitherto been well ascertained or attended to, such as may proceed from the differences in the qualities or properties of the clays or loams as they enter into or exist in their compositions, upon each of which some diversity in respect to the necessity, repetition, or method of conducting the business of fallowing may depend. The correct farmer should, therefore, continually keep them in view, whenever it may be requisite for him to prepare land by means of summer or naked fallowing.

It is strenuously contended by a late writer that one great purpose of the fallow system is that of destroying weeds which, in consequence of previous bad management and of over-cropping, have increased to such a degree, as to render cultivation for grain no longer profitable. Land being allowed to rest for a season from yielding a crop, and being reportedly ploughed, the soil exposed to the influence of the different seasons, and at the same time completely pulverized, its fertility is a great deal restored, so that, by the application of a smaller portion of manure than would be otherwise necessary, it is rendered fit for a more productive valuable crops of grain or grass. It is universally acknow-

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ledged, that all soils, even those naturally the most fertile, are capable of being rendered unproductive by constant and severe cropping, and that the more improper the modes of cropping are, the sooner, and the more certainly, will a comparative barrenness ensue. Hence the propriety of fallowing, where imperfect modes of culture are adopted. Fallowing, in what may be called the infancy of improvements in agriculture, is also, it is conceived, essentially necessary. If land be greatly exhausted, no matter by what sort of previous mismanagement, fallowing is, it is supposed, the most expeditious, the most effectual, and every thing considered, the least expensive method that can be adopted for restoring its fertility, and rendering it productive. It is the most expeditious, because it is completely done in the course of one season, whereas several years of culture, and a great additional quantity of manure, would be requisite, were any other less effectual mode of tillage adopted. It is the most effectual, because the farmer has it in his power to destroy every weed, to turn over and expose the soil to the influence of the weather in the different seasons, and also to level and straighten the ridges, drain the land, and remove every obstruction to the introduction of better modes of husbandry, none of which could be so conveniently or effectually performed between the harvest of one year and the seed time of the next. Fallowing is also, upon the whole, the least expensive method by which the fertility of land greatly exhausted can be restored, and the only one that can be adopted with a certainty of success, for the removal of every obstacle to the introduction of more perfect agriculture. Manure operates more powerfully when applied to a field that has been properly summer fallowed than when laid on one that has been long under an improper course of cropping. The returns, after fallowing, will be to a certainty greater; and, therefore, although the actual expence of fallowing is considerable, yet the crop that succeeds is so much greater as to counter-balance that expence, while those that follow, if properly adapted to the soil, will yield the farmer a proper compensation for his extra trouble and expence. In the above statement it is observed, however, that the writer had chiefly in his eye the practice of fallowing as recently adopted in the southern parts of Scotland, and the principles on which the farmers regulate their conduct, where new and better modes of culture became general.

It is remarked by an able writer, in the second volume of "Communications to the Board of Agriculture," that many farmers regard fallowing as the greatest improvement that ever was introduced into the agricultural art; by others, it is either unknown, or is despised as an unnecessary waste of labour, and a sacrifice of the produce of the land. Much of the contrariety of opinions which prevails on this subject may, he thinks, be accounted for, from the quality of the soil on which the farmer operates, or from his local situation. Strong clays require a more frequent repetition of fallow than those soils that are dry and friable, from containing a great proportion of sand. In those districts where excessive rains abound during summer, it is seldom convenient for the farmer to be encumbered with too great a proportion of fallow, as it is often impossible to get it properly wrought, before the land is turned into a mire, if the finest parts of the soil be not washed away. In such situations green crops, adapted to the quality of the soil, are, in general, the most eligible mode of fallowing. As in such districts pasturage ought to be the principal object, so this mode of fallowing is calculated to provide for the wants of the live stock in winter as well as in summer. There is no soil or situation, it is supposed, where naked fallowing might not be rendered less frequently necessary, if not wholly superseded, by

adopting a proper rotation of crops. Were a drilled green or pulse crop interposed between every two corn crops, the land would always be kept clean and in fine tilth, and a much greater value would be extracted from the same quantity of manure. As the quality of the soil ought ever to be considered in deciding the species of fallow for which it is best adapted, so the quality of the soil ought also to determine the mode by which the fallowing ought to be conducted. Some soils ought always to be turned up before winter, that their parts may be split and pulverized by the frost: others should not be stirred until spring, as excessive pulverization renders them liable to become miry with rain, which chills the crop, and they consolidate into a hard mass at the approach of drought. Thus it is more convenient to have such soils rather broken into small pieces than reduced to a fine powder; but where the object in view is a drilled crop, it is always advantageous to turn over the land before winter, or even to give it a stirring or two during that season, because working it in drills afterwards prevents the effects already stated.

For land already in cultivation, the great uses of fallow are, it is conceived, to reduce or preserve the land in a state of fine tilth, to clean it of weeds, and, by turning it up to the air, to cause a more perfect putrefaction of the animal and vegetable matters it may contain. This last effect is so clearly ascertained, that the most experienced farmers have assured the writer, that land which has been repeatedly dunged has been found to yield a much better crop, in consequence of a fallow without dung, than from a complete dose of dung without a fallow; and this too after the productive power of the land had been much exhausted by cropping. But for land that is to be reclaimed from a natural state, or from a rude and imperfect state of cultivation, a fallow is always indispensably necessary for various reasons, and particularly those of affording a convenient opportunity to level the inequalities, and to lay the land in the most proper form for future cultivation.

And it is stated by the intelligent authors of the "Agricultural Survey of the County of Northumberland," that the practice of making naked fallows on all kinds of soils, once in three or four years, was general through that county, till the introduction of turnips; in a few years the fallows of the dry-lands were covered with this valuable plant. On such other soils as were found improper for this root, the naked fallows still prevail with an almost universal opinion that it is absolutely necessary to the fertility of the land; yet there are some few, they say, who dare to doubt this long established doctrine, and presume to think that naked fallows might be dispensed with in many situations, by cultivating leguminous crops drilled at wide intervals, to admit being ploughed or horse-hoed between; to which, if proper hand-hoeings be added, the land will be as well prepared for wheat as if it had been a complete naked fallow. This is not, they say, advanced on speculation or theory; instances can be produced where no naked fallows have been made on fields of strong loam for twelve years, yet they are as clear of quickens, couch-grass, or other pernicious weeds as any fields in the district that have been under naked fallow two or three times in the same period. It may, however, be necessary to observe, they think that, previous to the adoption of this system, the land was cleared of quacken or couch-grass, by a complete summer fallowing.

But though they are diffident in giving a decided opinion in respect to the necessity of fallowing, yet, from observations made on the above facts, they cannot help being inclined to think that the quantity of naked fallow might be very much reduced, and in another century, they suppose,

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will probably be totally abolished, if no fortuitous circumstances arise to check the exertions and spirit for improvement, which have been so prevalent of late years, and so generally diffused through that district.

In the Report of the County of Mid-Lothian in Scotland, it is stated, that fallowing is practised there not so much as making part of a rotation, as from other circumstances, which render it sometimes necessary. Thus when lands are rendered foul, from the occurrence of a bad season, or barren, from too frequent repetition of exhausting crops, summer fallow is introduced as a corrective, and its effects are always salutary. On light or dry lands, however, it is seldom found necessary to fallow; for these can be got into good order for a crop of potatoes, or of barley, or of turnip; or even more early in the season for beans and peas: but heavy or wet lands are not so pliable; and although it is clearly possible to labour them also, without fallowing, yet it is found to be more profitable to have recourse from time to time to that expedient, and its operation is generally more effective and lasting on such soils, so that it is seldom necessary to be repeated oftener than once in seven years.

And it is asserted by the author of the "New Farmer's Calendar," that the practice of fallowing, the miserable substitute of former times for manure, and the hoe-culture, can be no longer necessary on any soils, under the present improved state of husbandry. In those parts where judicious cropping has been substituted to fallows, every species of product including the rental, has experienced a wonderful increase, to the certain emolument of all parties concerned, the landlord, the tenant, and the public. The same kind of land in all respects, whether rich or poor, has been proved, in numberless instances, equally, or more fruitful under constant crops than under the fallowing system, including those particular species of soil which it was pretended could never be successfully tilled without fallows. How often does it happen that, upon these very soils, an enlightened cultivator shall be found cropping his lands according to the improved practice, and making larger crops of wheat than the surrounding fallowists; upon the self-same soil, parted but by the hedge, one man shall make an extensive fallow for wheat, and gain two quarters and a half: his neighbour shall also obtain the same quantity of wheat, after a fallow crop of cabbages or carrots, the acreable profit of which shall far exceed that of the wheat itself, and his land shall be at the same time left in the best heart and cleanest tith. The writer speaks of facts, which he has himself often witnessed; and were proofs necessary, he could fill his book with them, drawn from the most authentic records. The advocates for fallowing within his knowledge, and he has reason to believe in general, have contented themselves with mere assertions of the superiority of their practice, without ever once deigning to make trial of any other, or with making only a few desultory and ill-conducted essays; after which they have again relapsed, unconvinced, unconvincing, and unimproved, into their old habits. By indolent men like these, and by landed gentlemen, who are so ill advised as to commit the management and the letting of their farms to persons totally ignorant of any principle of agriculture, is the vexatious and unprofitable system of fallowing perpetuated. There seems ever to have been a striking deficiency both of solid argument and experimental proof for the necessity of fallows. The fallowists have, in his opinion, contented themselves with simply asserting that their lands will not do without rest, and with exclaiming against innovation and new-fangled practice. If they have brought forth any arguments at all, those have been generally of that well-known class which men are wont to use in

the service of a favourite hypothesis they have previously determined to support. It has, he conceives, been taken for granted, and with a confidence such a notion never merited, that the earth, like a system of animal organization, stands in need of rest, and that it may be totally exhausted by the action of perpetual vegetation; a notion which the earth herself, by her constant and invariable habits, has saved us the trouble to refute. It may be very properly demanded of fallowists, how it happens that a defect of this singular kind should inhere in their lands exclusively? And why the poorest lands in foreign countries, as well as our own, should prosper under continual cropping? Whence arises the difference between their farms and their gardens? And why do the latter never stand in any need of respite, but produce exuberantly under perpetual feeding? They are well manured and well tilled. Should the garden culture be rejected as a parallel example, from its presumed superiority, he insists it is entirely without reason; for the open field has the advantage, both in point of air, and even the possibility of superior tillage, from the improved implements and increased population of the present times. The earth is destined by nature to an everlasting round of vegetation; and whilst confined to her spontaneous exertions, requires no assistance from the hand of man. The seeds of these productions she possesses in her own bowels, and the waste and loss of substance she has sustained are amply returned to her in their falling and putrid remains, and in the rains, dews, and fat vapours of her atmosphere. Thus production, maturity, corruption, and re-production, run in a necessary and everlasting circle. But if more be required than the earth would spontaneously produce, and the substance itself be withdrawn from the soil which produced it, an artificial amend must be made for the consequent exhaustion; hence the use of tillage and manure. This amend, however, being made to the necessary amount, the vegetable process will go on unimpeded, and the land continue to produce for ever, without demanding truce or respite. Experiences of a date too ancient for chronology to ascertain have evinced the truth of this theory, on soils of every possible description. Land, then, of a quality however inferior, can never want to be fallowed under the idea of giving it rest, which it will at the instant reject by spontaneous labour, to produce a crop of weeds; and as it must and will produce something, that something had surely better be such as will repay the expence of culture. But the truth is that, excluding the idea of rest, the general system of tillage is so defective, and the operation of that most useful and necessary implement the hoe, so much neglected, that in the course of two or three crops the farmer finds himself totally at a stand. He has been painfully and foolishly cultivating weeds as well as corn; the farmer has so far occupied and exhausted his land, as no longer to leave either space or nourishment for a crop of corn, sufficient to defray the attendant expence, exclusive of all expectation of profit. He must, indeed, in this case, have recourse to a fallow, as the only method now left to extirpate a part of the weeds, that he may again crop his land; and this measure is at the expence of a year's rent, taxes, and labour, to fail as a surcharge in the product of the succeeding crops. That such surcharge is totally thrown away, and a positive loss to all parties, he contends, irrefragably proved by the new practice; and if a landlord should suppose that he spares his lands by making a covenant for fallows, he also ought to take into the account that, unless he permits the new practice, he can have no title to expect a new rent.

After supposing the following hints and observations,

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which are contained in the Agricultural Reports of Staffordshire and Kent, to be erroneous, namely, that "fallowing for wheat, on cold, wet, or strong lands, and on all such as are unfit for turnips, is absolutely necessary; and that he who shall attempt to manage such land without fallowing will have occasion to repent his mistake;" and that as "the mixed soil now in question, which are too moist for turnips, have a particular propensity to the protection of the root-grasses, summer fallowing becomes absolutely necessary, and every attempt to crop without it, for any length of time, on such land, has terminated to the injury of the land, and the loss of the occupier;" the writer contends, that, if these farmers will be at the pains to search out of their own counties, they may find numerous practical refutations of the above doctrines, in the very converse of which he really believes the truth to reside. He has never observed couch to be eradicated by fallowing; a portion only is destroyed, and a sufficient quantity of roots left to produce a crop, which will speedily demand another fallow, and so on for ever. Regular periodical fallows may, in truth, he thinks, be styled the nurseries and hot-beds of couch, since, on lands subject to the practice, we ever see the greatest quantity of it. Not that he entirely agrees with the too sanguine advocates of the hoe, that it will, of itself, entirely root out couch-grass; at best, such would be a long and tedious method, at which, he said, even Tull himself hesitated. Nevertheless, after a good dragging, and burning the roots, during a month or two of dry weather, to the hoe only we must look for their gradual and total extraction; and this method he has never known to fail in the worst possible cases of couch, colt's-root, and other similar kinds; with the reserve, however, that the lands must never be withdrawn from the hoe culture, whatever be the crop, until the enemy appear to be totally extinct, which will seldom be delayed beyond the third year. It seems singular to admit that fallowing may be superseded by turnips, and yet not by cabbages and beans, the appropriate hoe-crops of strong lands; surely the latter will bear constant tillage, at least equally well with the light and weak. But whilst he contends that the earth requires no rest, but rather exercise and good nourishment, he would not thence be understood that she derives no benefit from rest: all experience declares the contrary; her spontaneous growth being returned to her bosom, this also laid open by tillage to the absorption of the fattening dews, there can be no question but she is so nourished and restored. All intended to be proved is, that the price is infinitely too high for the benefit received, and which, in truth, to its fullest extent, may be otherwise obtained gratis, and even with a premium annexed. Nor is he at all prepared to say, that those styled ameliorating crops, whether carrots, turnips, cabbages, grasses, or what not, are such, in the simple and restricted sense of the word; that they are really the vehicles of nourishment to the earth, like a fallow, or that the putrid fermentation occasioned by their shade enriches, since, if it really have that effect, themselves are extracting the benefit of it. No, all vegetable productions carried off the land, although not in equal degrees, detract, he contends, from the strength of the soil, which may be impoverished by the scythe as well as the sickle; yet grass surely exhausts it the least. Those plants abounding most in vegetable gluten, in weight and substance, are the greatest exhausters: at the head of them, undoubtedly, wheat ought to be placed; potatoes, perhaps, next. Crops, then, can only be said to be ameliorating, on the score of their being hoed, and of a considerable part of their produce being returned to the land, in the dung of the animals which they feed. Omit the hoe, and sell the

crop, and, instead of amelioration you would soon, he thinks, find galloping consumption; and then, if in want of a convenient phrase, you might say your land was tired of such or such a crop. Even the best tillage under the fallow-system, he supposes, stands self-convicted of deficiency, since it needs the invariable repetition of that expensive aid; it evinces a defect of crops for the support of cattle, of consequence a defect of manure and of hoe-tillage. If the sowing of white corn by broad-cast must be persisted in, there is no possibility of keeping the land clean (generally speaking) but by the intermixture, in due course, of pulsecrops which are hoed; with the aid of which, and a strict attention to hand-hoeing and weeding the broad-cast corn, the necessity of fallowing will be for ever precluded. It will be understood, that a summer's respite is necessary at first, in order to clear the soil of root-weeds; and afterwards, the usual intervals between the crops, the weather being dry, will afford opportunities of again using the drag, or cultivator, to the same end. These occasions always being diligently laid hold of, the roots will soon be totally destroyed. As to the seed-weeds, contrary to the common custom of farmers, those ought to be encouraged by all possible means of pulverization, to make their appearance, that they may be drawn or cut off previous to their bloom. Various circumstances in tillage may induce the necessity of an occasional winter fallow, which, by the land being laid up clean, will always be beneficial. It is, on the whole, concluded, by the practical author of "Modern Agriculture," that the practice of fallowing may, no doubt, be adopted with propriety in some cases, while a slavish adherence to it in every instance would be highly improper.

In respect to the manner of performing the process or operation of fallowing, it should always, like most other processes in husbandry, be conducted with a due attention to the circumstances and qualities of the soil, as more pulverization or breaking down will evidently be required where the land approaches to the nature of a perfect clay, than where it has more of the loamy quality; and where the retention of moisture is considerable, more regard will be necessary to the destruction of weeds, than where there is a greater tendency to dryness. In most cases where the practice of naked fallowing is thought necessary to be performed, the most general method of proceeding is, for the land to be first ploughed up in the autumn, a second time after the barley seed season is finished, and two or three times, or oftener, afterwards, as circumstances may render necessary; the ground being well broken and reduced by means of harrowing in the intervals of the different ploughings. But it has been observed, that "in many districts seldom more than three ploughings are given to lands in a course of summer fallow: one in autumn, or early in the spring; another during the summer; and afterwards the seed-furrow." This preparation appears, however, it is further contended, extremely defective; as in an ordinary season it is scarcely possible that with so few ploughings either the root or seed weeds can be completely destroyed; and when the summer happens to be wet or rainy, the lands under such management must certainly be in a very bad state for receiving the seed-corn. It has likewise been long since judiciously recommended, both in the preparation of lands by winter fallowing, for barley crops, and summer fallowing for those of wheat, that when it is first ploughed up after the harvest is over, (which should always be done as deep as possible,) no time should be lost in rendering the new-turned-up soil as fine as possible by harrowing; as repeated trials and attentive observation have fully shewn, that such lands as are made fine before the sharp frost and winter rains come on, receive

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receive a much larger share of their influence than any others. But that if the land be left in a rough state, there is seldom time for the rains and frost to penetrate or affect more than merely the outside of the large clods or lumps that are present. The outside may thus, indeed, be pulverized, or broken down, but the middle of the lumps, wherever they are large, are found nearly in the same hard stiff state, as when turned up by the plough. Hence it is evident, that the benefit of the air, winter rains, and frosts, on lands thus left, must be only partial; and that of course the harrowing it in the spring, especially when the latter of these are over, is too late for its receiving the full benefits which might otherwise have accrued from them, and the power of promoting vegetation not being nearly so great. Therefore, to make winter fallows as fine as possible in autumn, and ridge them up in that pulverized state, is acting most agreeably to nature; the greatest possible quantity of surface being thereby exposed to the atmosphere, and the land left in the state wherein the rains and the frosts are most easily admissible; they are consequently more capable of penetrating and enriching the whole mass to a much greater extent. By this means, too, a larger proportion of atmospheric air is involved and incorporated with the mould, and of course a more perfect degree of aëration effected. It is contended, that it has been invariably found, that the frost penetrates a quantity of earth, formed into a large hard clod, only partially, on account of its bulk and hardness, and that the same clod broken into four parts would be thereby penetrated four times as much, or, in other words, that four times the quantity of earth would be affected, and on a thaw be pulverized by it: for it is always found, after the breaking up of a severe frost, that all the small clods crumble easily into powder, while the large ones are only slightly reduced by the crumbling off of a portion of their external surfaces. It is suggested, that there cannot be much doubt but that by reducing such stiff, adhesive soils, as require fallowing well, on their being first ploughed up, great advantages in the way of pulverization may be accomplished, as in the spring and summer months they are apt to cake, and become so hard and lumpy as to be wrought with difficulty. But in order fully to ascertain the utility of this method of preparing fallows, one half of a field of ten acres was left as nearly of an equal quality as possible, in the rough state after ploughing; while the other was made very fine, by harrowing and beating in pieces any large hard clods which the harrows could not reduce. In the following spring it was observed, that that part which had been harrowed was much finer without any additional working, than the other could be rendered by repeated harrowings. It is consequently concluded, that upon most sorts of stiff, clayey soils, where fallowing becomes necessary, the first ploughings should be given, if possible, before the commencement of the winter season, and that they should also be well reduced by means of harrowing, in order to promote the decay of such vegetable matters as may be upon the surface of the land, as well as to promote a more complete state of pulverization and aëration of the soil at the time. This is often most usefully performed by gathering up the ridges, as in that way the ground is not only laid more dry, but the furrows more effectually opened for the draining off of the injurious moisture.

In the second ploughing in the spring, which is generally before the cross-ploughing is given, these ridges ought to be cloven or turned back again, and after lying a suitable length of time, be well harrowed down for several times, and occasionally rolled, that sufficient opportunity may be given to collect and remove every sort of weed that may be

brought up to the surface of the ground. After this business has been properly performed, the land may be again ridged up by means of the plough, by which it is rendered less affected by wetness, and the portions of soil that had not been touched in the cross-ploughing stirred. In this way a perfectly clean fallow may soon be produced in most cases. It has, however, been maintained by some writers who have had much opportunity of examining the matter, that ploughing only is necessary; the collecting the roots of the weeds and removing them being useless and improper. But in the stiffer sorts of clayey, wet soils, where we have conceived the fallowing system to be chiefly occasionally necessary, it is almost impossible to get perfectly clear of different sorts of root weeds in this way, from the caddy manner in which such lands break up in the operation of the different ploughings, the earthy lumps often containing many that are not in the least degree injured in their power of taking root, by the heat to which they have been exposed under such ploughings of the land.

In these cases, they can only perhaps be effectually eradicated and destroyed, by the high degree of pulverization that may be accomplished by means of frequent harrowings and rollings; the weeds being afterwards carefully removed by the hand. In this way there may also frequently be a considerable saving of expence by the lessening of the number of ploughings. The frost in the winter months has also, as has been seen, a much more powerful action where such reductions in the clods of such soils have been effected. In such soils there can seldom be any danger of their being made too fine by operations of this nature, as the seed furrow, when given sufficiently deep, constantly leaves the land lumpy and irregular enough for the purposes of covering the grain, and protecting the young plants during the severity of the winter season. The benefits of affording as high a degree of pulverization or fineness as possible to the land in the management of this process, has been fully shewn by the results of many well-conducted experiments. The produce of a field of barley and broad clover, one-half of which had been prepared in the most perfect mode of fallowing, and the other half in the common method, on being harvested and kept separate, was in the following proportions; that which had been conducted in the latter way only affording twenty-four bushels to the acre, while the former yielded thirty-one, and the grain considerably better in quality.

There was also an equal superiority in the clover crop the succeeding year; that on the most perfectly-prepared part being heavier by nearly half a ton on the acre. In addition to this, it cannot have escaped observation, that in large fields of wheat, where, from accident or other causes, some portions of them have received more frequent ploughings than others, that in these parts the crops generally appear, for a great length of time, more perfect and promising than on the other parts.

There is another mode of performing this process, which has lately been practised in some places, which is to plough the land over first with a deep, broad, clean furrow, in a dry season in the autumnal months, leaving it in this state till the early spring, when, immediately after the seed period, it should be harrowed down as fine as it can be made, clearing off all the couch and other refuse matters at the same time, and consuming them by fire. Then ploughing the land in exactly the same direction back again, breaking the root weeds as little as possible; after which letting it be well harrowed over again in the lengthways of the ridges, as crossing them would be injurious; collecting and burning the whole of the refuse materials as before. In this local condition of the soil, a powerful cultivator or scarifier is to

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be immediately passed in the cross direction of the ridges and furrows to the full depth of the plough, by which means the roots of the couch and other weeds will in a great measure be drawn out at length, without being much broken, and the lumpy parts be brought to the surface to be reduced by the action of the harrows afterwards. When not sufficiently broken down and cleared by these operations, the scarifier and harrows must be again had recourse to as before; and when the root-weeds have been collected and burnt, any clods that may remain on the surface may be fully reduced by rolling, and afterwards another harrowing.

In this way it is found that in the foulest land a perfectly clean fallow may be made. In the execution of the business, however, much depends upon the work being performed when the land is in a proper dry condition, as when wet it cannot be done to advantage. The harrowing should be so managed as to have the refuse weedy matters in such a situation as not to prevent the whole of the land from being operated upon, and as well as the scarifying be executed as soon as possible after it is left light by the second ploughing. The scarifier, though an excellent tool for this purpose, cannot indeed perform its work properly, except when the soil is in this loose state of mould. Where this implement is to be used, there should never be any cross ploughing made, as that renders it incapable of performing its work in the most effectual manner. And where the land is inclined to the retention of moisture, it should be well drained to prevent the stagnation of water upon it, as it would thereby be greatly injured during the winter season. By this method of preparing a fallow, the soil is reduced into a fine state of mould, and rendered perfectly free from weeds, without having its parts so much exposed to the influence of the atmosphere as to rob it of a large portion of its fertility.

In Essex, and many other districts where the soils are very stiff and heavy, it is usual to plough the fallow lands over a great number of times, frequently even eight or ten, in different directions, in order that they may be rendered perfectly clean and mellow. In some cases the first ploughing is given deep before Christmas, then two clean cross ploughings early in the spring; after this the land is ploughed up into ridges or fitches of different breadths, according to circumstances, then split out again, and lastly ploughed back for the seed furrow; different harrowings being practised in the times between the several ploughings.

In the second volume of "Communications to the Board of Agriculture," Mr. Headrick speaks of a mode of fallowing by drills, invented by Mr. John M'Kenzie of Glasgow, which, he says, is certainly the best of any yet attempted by the plough, either for levelling cold-bottomed ridges, or for pulverizing stubborn clay-soils already in a level state; but it requires considerable dexterity in the ploughman. In performing this operation, the water furrows, he observes, are first gone round, and ploughed in on each side, so as to form a drill, when the third fur-slice from the rut thus made, on each side is raised, and thrown upon the second: this a skilful ploughman can do by his eye with great exactness; but if he cannot trust his eye, he may have a cross spar nailed on the beam of his plough to mark out the distance from the former rut at which a slice ought to be raised. As the plough only flirs a third of the land by this first operation, it may go over about three acres in one day, laying it all dry, and in a condition to be fallowed ever after, in the wettest weather that cattle can work, without any danger of poaching. After the land is thus marked out, the cat-

tle ever after walk in the ruts between the drills, and hence their feet never poach the flirred land. We have then, says he, got the third fur-slice, from the rut at which the operation commenced, raised and laid upon the second, while the first and second remain unstirred, and the first is also uncovered. The plough, in its second passage, throws the first slice upon the back of the third, previously laid upon the top of the second. This converts all the land into red earth, and the third passage of the plough flirs the remaining second fur-slice, with the third that rests upon it throwing them in the same direction. Thus all the land is flirred, and assumes the appearance of three-furred drills, the equality and neatness of which depend much upon the accuracy of the first operation in marking them out. The land may now be wrought either backwards or forwards, as may be necessary, to bring it to a complete level, the horses all the while walking in the bottoms of the ruts between the drills.

The figure annexed, (in *Plate Agriculture, Fallowing*,) No. 1, is the section of a ridge to be levelled, or, if the land be already level, it is a bout or strich of land that has undergone the first operation of drill fallow. If it be a ridge, the water furrows, *a, a*, are first ploughed in, so as to form single bout drills; then the third fur-slice from the rut on each side is raised by the plough, and laid upon the second, and this is continued until the whole ridge or strich is marked out. This lays the land perfectly dry, having a rut at every third furrow. Figure No. 2 is the same land, after being twice gone through with the plough. In this second operation the fur-slice, No. 4, is flirred, and all the land becomes red earth; because, though No. 2 yet remains unstirred, it was previously covered by No. 3. Figure No. 3 is the same land after the third ploughing. In this No. 2 is flirred, and the whole soil is now moved by the plough. The land now assumes the appearance of three furred drills. If it be now level, the drills may be reduced by a brake-harrow, and marked out again in some other direction, so as to have the effect of cross-ploughing; only the direction must be such, that the water may be discharged from them. In this way the land may be ploughed in various directions, and wrought in drills during the whole course of a fallow. This mode of fallow, it is observed, causes a violent vegetation of weeds, because, by exposing more surface to the air, it brings more of their seeds within that distance from the atmospherical influence, where their vegetation commences. By stirring only one fur-slice out of three at a time, every slice has full opportunity of meliorating by the influence of the sun and air before another is thrown upon its back; it also renders the fallow wholly independent of excessive rains; which often render fallowing impracticable. When the land is brought to a perfect level, the weeds should be destroyed by a strong brake-harrow dragged across the drills. This will reduce the land to a smooth surface, in which state it may be allowed to remain until more weeds spring up; but if excessive rains should surpise the land in this state, a plough can be sent through to mark out new drills as before, which will render the whole dry. In fallowing, he says, cross-ploughing is essentially requisite to cut the roots of weeds in an opposite direction, and to present new surfaces of the soil to the air. Now, by this mode of fallow, cross-ploughing can be effected with greater advantage by drills crossing the former, and marked out after the land is laid smooth by the brake: such drills should always be so drawn as to discharge the water. Thus a field may be ploughed in several different directions, always keeping it in drills, and remain independent of the weather. After land is cross-ploughed in the ordinary way, it often happens that excessive rains render it a perfect mire,

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mire, and it is frequently unworkable during that season. In the fallow by drills, this, the writer thinks, can have no place; and should the weather be too wet, at the time it comes to be ridged, to admit of smoothing the drills, the ridges can be formed of a certain number of drills thrown together. In executing this mode of fallow, care should be taken always to make the furrows clean, so that no clods or earth may fall back and cause water to stagnate in the ruts. When very high ridges are suddenly levelled by this mode of fallow, it is obvious that the good soil will be buried down, as happens in every mode of levelling with the plough; but the fresh soil that is turned up, being brought in succession within the influence of the atmosphere, and always worked in drills, is much sooner meliorated than by the method of close ploughing. If, however, the ridges be very high, it is safest to split and reduce them considerably in the course of cropping, previous to their being effectually levelled. When the levelling at last commences, it is proper to get through as much of it as possible before winter, that the new soil which is turned up may receive the benefit of the frost. With these precautions high ridges levelled by a drill fallow will discover no inequality in their subsequent fertility. It is hardly necessary to observe, that in all modes of levelling high ridges the old water furrows should be raised somewhat higher than the old crowns of the ridges; as the soil in the former, being very loose, subsides, and if not in sufficient quantity would again become a hollow.

It is further remarked, that, in many parts of the Lothians, they have a practice somewhat similar to this mode of fallow, of *ribbing* the land that is intended for barley before winter sets in. This is done by laying one furrow upon another, which remains unfurrowed, and it divides the whole land into very narrow drills. These keep it perfectly dry during winter, and admit the frost to the bottom of the soil. On clay lands, and such as have a cold bottom, this is found to be very beneficial, for barley does not thrive on such soils unless they be finely pulverized in the mould.

This mode of fallowing is probably best adapted to the bringing of such lands as have been in the state of waste into a condition fit for the growth of grain crops.

When dung is applied on the fallows, it is generally laid on, Mr. Donaldson says, about the end of August, immediately after the last ploughing has been given; but in many cases, where the soil is naturally good, it is forborne till the second ensuing crop, as it is found that the first crop is in danger of being too rank, and of course lodged before it is ripe, if the land be dunged the same year that it is in summer fallow.

It has been remarked, that though the advantages that have been stated to arise from the perfect pulverization, aëration, and cleanness, occasioned by summer fallowing in those soils where it has been found to be occasionally requisite, can seldom be so fully obtained by other methods of cultivation; yet as that method is constantly attended with a heavy expence to the farmer, and as many of the benefits that are produced by it may be effected by the repeated partial fallowings that must occur in the hoe culture of different sorts of crops, it should be constantly the aim of the farmer, where the climate will admit of it, to lessen the necessity of summer fallowing even on the wet clayey as well as the light kinds of soil, by the judicious interposition of such sorts of close, thick, green crops, as can be grown and cultivated on them under the hoe system. This is still more necessary, on account of the loss that must be sustained from the land often remaining such a great length of time totally unproductive where the fallowing process is going on. It cannot, indeed, be disputed, but that the practice of summer fallowing may

be greatly lessened in many districts by the proper substituting of green fallows, or what are termed fallow crops, such as beans, peas, cabbages, tares, and rape for the heavier sorts of land; and buck wheat, potatoes, and turnips, for such as are of the lighter kind. It is likewise maintained as a fact, that where large and luxuriant crops of these preparatory kinds are grown, those by which they are succeeded the following season are for the most part still larger, so that the lands are more improved by large crops than such as are poor. This amelioration or increase of fertility has been attributed to different causes: as the prevention of evaporation from the soil by the shade produced by such large crops; the putrefaction of the various vegetable matters, which may be more abundant after such large crops, taking place more completely and more effectually under such circumstances; and lastly, to the repeated pulverization and aëration that are produced by the different hoes; but it is probable that advantages may be derived in each of these ways, as well as from the carbonic acid or fixed air that is afforded by the shaded leaves of the plants being deposited upon or united with the soil. That the melioration in such cases must depend on causes of this kind there can be little doubt, as much of the nutritious properties of the land must obviously have been consumed during the growth of such crops, which must have been again restored to it by some such processes. But in whatever manner this effect may be produced, as it is constantly found that land is in a better condition, and when turned up in a more friable and mellow state after such crops as are large, than those that are poor and light; it is of course evident, that if ground can be covered with smothering crops of the fallow kind, or those that will admit of frequent pulverization by means of the plough or hoe, so as to keep it clean and free from the growth of useless plants, it may be more beneficial to the farmer, not only for the sake of the immediate crop, but also on account of the increase of manure produced by such means, and the advantageous condition of the land for the reception of such crops as may be afterwards cultivated upon it. In these different views, as well as those that have been already mentioned, the introduction of green crops of some sort or other should probably be more frequently attempted on all descriptions of soils; and it would seem probable, that on the stiff and heavy kinds of land, from its having been found, that in many well cultivated districts, by the growing of proper leguminous crops in drills or rows, so as to admit of the ground between them being frequently stirred, either by means of the plough or the hoe, such kinds of land, after they have been once well cleaned by a summer fallow, may be kept perfectly clean and in suitable tilth for the production of good grain crops; they may be much more generally had recourse to than has commonly been the case: but on such sorts of land great attention is necessary to introduce such kinds of green crops as are adapted to them, and that as little injury as possible be done by the trampling of animals in the feeding them upon or taking them from the ground. But as neither the full effects of pulverization or aëration, nor the complete destruction of root weeds, can in some cases be so perfectly obtained by the cultivation of fallow crops as by the making of naked summer fallows, it may be advantageous to the farmer to have recourse to them occasionally with these intentions on the heavy and more wet sorts of land, as well as those that have been injured by improper methods of cropping, as is frequently the case in particular districts.

Yet though fallowing may be useful and necessary in altering the textures of particular kinds or qualities of soils, there are numerous facts that shew, in the most clear and satisfactory

fatisfactory manner, that great injury and disadvantage are often the result of exposing land in its naked state too much to the action of light and heat, as happens in the fallow process, and which can only be avoided by having recourse to sheltering crops of the green kind.

FALLUM, in some of our *Law Lexicographers*, is said to be a sort of land; and for proof of this, they quote the *Monasticon Anglicanum*. "De duobus acris et viginti fallis in, &c." Jacob. But from this passage it would rather seem that fallum signified a measure of land as well as acra. And to this day a fall is a measure of length in Scotland.

FALMOUTH, in *Geography*, a market and sea-port town in the hundred of Kerriar, and county of Cornwall, England, is seated beneath a high hill, on the southern shore of a harbour, which has long been noted for the safe accommodation it affords to shipping in tempestuous weather, having sufficient depth to contain the largest vessels, and being defended by the two castles of Pendennis, and St. Maw's. About two centuries past, Falmouth consisted of only a few fishing huts, till increasing in population it was known as the village of Smithwick, but it did not acquire its present name till the restoration, when the king issued a proclamation that it should, after the 20th of August 1660, be called by the name of Falmouth, and granted it a charter of incorporation in the following year, by the description of "our town of Falmouth." By this charter the government was vested in a mayor, aldermen and burgesses; and the privileges of a market and two fairs were granted. The new town gradually extended: in 1664 the houses amounted to two hundred; in 169 they were three hundred and fifty; and in 1801 they were returned as four hundred and sixty-eight, inhabited by three thousand six hundred and eighty-four persons, included within the boundaries of the town. Previous to the year 1664, Falmouth was part of the chapelry of Budock and parish of Gluvias; but was, by an act passed in that year, separated and made a distinct parish. Such were the origin and growth of Falmouth. Its improvement and progress during the last century have, in a considerable degree, been connected with the establishment of the packet-boats here for Spain, Portugal, and the West Indies. From the facilities these vessels have afforded to the merchants, of transporting their respective commodities, and receiving returns in a short time, the commerce of the town has very much increased, and it is now the residence of many opulent families. The houses are principally disposed in one street, nearly a mile in length, and running by the side of the beach. The quay is exceedingly convenient, as the water will admit vessels of considerable burthen to land their goods upon the wharf. The custom-house and salt-office for most of the Cornish towns are established at Falmouth. Great quantities of gold, both in specie and in bars, are brought into this port by the packets from Spain and Portugal. The pilchard trade has likewise been a source of much emolument. Falmouth is situated 273 miles S. W. from London: has good markets on Tuesdays, Thursdays, and Saturdays; and two annual fairs. At the eastern extremity of the town stands Arwinnick house, the ancient mansion of the Killebrew family.

On the western side of Falmouth harbour Pendennis castle occupies the brow of a hill, which forms a peninsula between the British channel and this harbour, and appears to rise from the bay like an island. The fortress is proudly exalted on a rock upwards of three hundred feet above the sea, and, from its elevated situation, has a complete command over the entrance to the bay. The fortifications are of an irregular shape, including an area of rather more than

three acres. On the north, or land front, the hill is defended by four cavaliers, mounted with seventy pieces of cannon, in excellent order, and at a short distance are some traces of a horn and crown-work, which was constructed in the time of Oliver Cromwell. The banks and ditch of the citadel still remain, the situation of which was admirably calculated to protect the castle from the approach of an enemy over the isthmus. On the east face is an half-moon battery; and close to the water's edge another battery of five guns, called the Crab quay. On the south the hill slopes to the sea, and forms a kind of natural glacis. Within the works are barracks for troops, and various store-houses and magazines; and in the south part of the garrison stands the old castle, built in the reign of Henry VIII. It consists wholly of granite, and over the door-way are the arms of that monarch. The works were afterwards strengthened and enlarged by queen Elizabeth, but have undergone many alterations and repairs of late years.

On the eastern side of Falmouth harbour is St Maw's castle, opposite to Pendennis, to which it is very inferior, both in size and situation, though erected nearly at the same time, and by the same monarch. The works are completely commanded by a hill, which rises immediately behind it. The adjoining hamlet, honoured with the appellation of Borough town, and represented by two members, consists of scarcely twenty houses, inhabited only by a few fishermen; and has neither church, chapel, or meeting-house. The chief magistrate is the portreeve, who is complimented with the title of mayor. *Polwhele's History, &c. of Cornwall, 410.*

FALMOUTH Harbour, on the south coast of Cornwall, is a considerable extent of creeks and inland waters, forming a safe harbour for ships of the royal navy, and others, the farthest of any in England towards the south-west. The towns of Falmouth, Puryrn, Tracilian-bridge, Truro, Tregony, St. Maw's, and others, are situate near to these waters. The eastern side of the main harbour is deep and commodious for large ships, which go up as far as Kea: the western branches to Fernan and Myler-bridge are shallow, and only navigable for barges. The Falmouth tram-road connects with this harbour at Restronguet and at Pile.

FALMOUTH Tram Road, in Cornwall, is one of those branches of inland communications which have been carried into effect since our general account of these important establishments were presented to our readers in the article CANAL. It was constructed without an act of parliament, in the year 1806. At the expence of Messrs. Fox and Co.; Vivian and Co.; Ralph Allen Daniel, esq. and others, according to a survey made by Mr. Mofs, an engineer. This tram-road has a course of nearly ten miles, almost in a N.W. direction; it commences at two points, viz. the Pile and Restronguet shipping wharfs, in Falmouth harbour, (above,) and proceeds by a regular inclination, (steep, inclined planes being unnecessary,) to the copper-mines, near Camborne, to which mines a recent tram-road has also been constructed from Portreath harbour on the north coast of the county. The shelly sand with which this coast abounds is now, by these tram-roads, carried cheaply up into the interior of the county, by which the agriculture thereof cannot fail of being much improved, as well as the mines, which thus receive coals to work their steam-engines, and send down their ore for exportation to the coal districts of South Wales, where it is smelted and manufactured.

FALMOUTH, a township of America, formerly including Portland county, in Cumberland county, Maine, containing 3422 inhabitants. It is situated on Caser bay, 120 miles N.N.E.

N.N.E. of Boston, and was incorporated in 1718.—Also, a township in Hants county, Nova Scotia; situated on the S.E. side of the basin of Minas, opposite to Windsor, 28 miles N. W. of Halifax.—Also, a maritime post-town, in Barnstable county, Massachusetts, situated on the N.E. part of the Vineyard Sound, on the west side of the bay of its name; 77 miles S.E. by S. of Boston. About 60 vessels are employed in this town, some as fishing vessels, others coasters, and more than 30 for carrying lumber to the southern states, and West India islands. It was incorporated in 1686, and contains 1882 inhabitants. N. lat. $41^{\circ} 33'$. W. long. $70^{\circ} 35'$.—Also, a post-town in Stafford county, Virginia, situated on the north bank of Rappahannock river, almost opposite to Fredericksburg. It contains an episcopal church, and about 40 compact houses; 23 miles S.W. of Dumfries, and 207 south-westerly of Philadelphia. Considerable quantities of tobacco are inspected here.—Also, a town in Lancaster county, Pennsylvania, on the S.E. side of Conawago creek, 20 miles westerly of Lancaster.—Also, a town and harbour on the south shore of the island of Antigua; having English harbour on the E., and Rendezvous bay on the W., and situated in St. Paul's parish, at the N.W. corner of the harbour, which is well fortified. N. lat. $17^{\circ} 9'$. W. long. $61^{\circ} 28'$.—Also, a town of Jamaica, more commonly called the "Point;" situated on the S. side of Martha-Brae harbour, and including the adjoining villages of Martha-Brae and the Rock, and containing 220 houses. This town and its vicinity have been wonderfully increased; for in 1771 the three villages of Martha-Brae, Falmouth, and the Rock, contained together but 18 houses, and the vessels which entered annually at the port of Falmouth did not exceed ten. It has since boasted of upwards of 30 capital stationed ships, which load for Great Britain, exclusively of sloops and smaller craft. N. lat. $18^{\circ} 31'$. W. long. $77^{\circ} 31'$.—Also, a small low island in the Chinese sea. N. lat. 11° . E. long. $112^{\circ} 12'$.

FALONICHI, or FILANIKE, a large town towards the eastern coast of the island of Majorca, containing near 6000 inhabitants, in which the monks of St. Augustine have built a handsome monastery: the land about it is rich and fertile. The inhabitants procure more corn than is sufficient for their own consumption, and have, besides, large herds of cattle, and furnish the island with excellent brandy.

FALOUR, a town of Hindoostan, in Lahore; 50 miles E. S. E. of Sultanpour.

FALSA QUINTA, *Ital.* in *Musick*, false 5th. See SEMI-DIAPENTE.

FALSE RIBS, in *Anatomy*, are the five inferior ones on each side, and are distinguished from the true ribs by not having their cartilages articulated to the sternum. See TRUNK.

FALSE BAY, in *Geography*, a bay to the east of the Cape of Good Hope, and frequented by ships during the prevalence of N. W. winds, which begin to blow in May, and make it dangerous to lie in Table bay. S. lat. $34^{\circ} 10'$. E. long. $18^{\circ} 30'$.—Also, a bay on the west coast of the northernmost island of New Zealand. S. lat. $36^{\circ} 33'$. W. long. $185^{\circ} 38'$.

FALSE CAPE, or *Falso*, the E. point of False bay, E. of the Cape of Good Hope. S. lat. $34^{\circ} 16'$. E. long. $18^{\circ} 44'$.—Also, a cape, called *Falso Point*, on the E. coast of Hindoostan, at the mouth of the river Mahawada. N. lat. $20^{\circ} 20'$. E. long. $86^{\circ} 48'$.—Also, a cape on the S. coast of Hispaniola, a little W. of Cape Beata.—Also, a cape on the coast of Yucatan, in the bay of Honduras. N. lat. $20^{\circ} 52'$. W. long. $87^{\circ} 45'$.

FALSE Cape Horn, the south-western point of Terra del Fuego.

FALSE Island, an island in the bay of Bengal, near the coast of Ava. N. lat. 18° . E. long. $94^{\circ} 15'$.

FALSE River, one of the mouths of the Ava.

FALSE Alarm, in *War*. See ALARM.

FALSE Arms, in *Heraldry*, are those wherein the fundamental rules of the art are not observed: as if metal be put on metal, or colour on colour. See ARMS.

FALSE Attack, in *War*. See ATTACK, *Falso*.

FALSE Braye, in *Fortification*. See FAUSSEBRAYE.

FALSE Claim, in the *Forest Laws*, is where a man claims more than his due, and is amerced or punished for the same.

FALSE Conception. See CONCEPTION.

FALSE Flower, a flower which does not seem to produce any fruit, as those of a hazel, mulberry-tree, &c.

A flower of this kind does not arise from any embryo, and does not knit; such are the male flowers of the melon, cucumber, &c.

FALSE Galena. See BLIND and GALENA.

FALSE Gallop, in the *Manege*. See GALLOP.

FALSE Imprisonment, in *Law*, is a trespass committed against a man, by imprisoning him without sufficient authority; which authority may arise either from some process from the courts of justice, or from some warrant from a legal officer, having power to commit, under his hand and seal, and expressing the cause of such commitment (2 Inst. 46.); or from some other special cause, warranted, on account of the necessity of the thing, either by common law, or act of parliament; such as the arresting of a felon by a private person without warrant, the impressing of mariners for the public service, or the apprehending of wagoners for misbehaviour in the public highways. (Stat. 13 Geo. III. cap. 78.) False imprisonment also may arise by executing a lawful warrant or process on an unlawful day, as on a Sunday, (lat. 29 Car. II. cap. 7. Salk. 78. 5 Mod. 95.) or in a place privileged from arrests, as in the verge of the king's court. The means of removing the actual injury of false imprisonment are fourfold; *viz.* by a writ of mainprize, by writ de odio & atia, by writ de homine replegiando, and by writ of habeas corpus. The satisfactory remedy for this injury is by an action of trespass, *vi & armis*, usually called "an action of false imprisonment;" which is generally, and almost unavoidably, accompanied with a charge of assault and battery also; and therein the party shall recover damages for the injury he has received; and also the defendant is, as for all other injuries committed with force, or *vi & armis*, liable to pay a fine to the king for the violation of the public peace.

FALSE Judgment. See FALSO *Judicio*.

FALSE Keel, in a ship, is a second keel, which is sometimes put under the first, to make the vessel deeper, and to preserve the lower side of the main keel. In our largest ships of war the false keel is generally composed of two pieces, which are called the upper and the lower false keels. See KEEL.

FALSE Muster, is when such men pass in review, as are not actually listed as soldiers. See FUGGOT, &c.

FALSE News, *spreading of*, in order to make discord between the king and nobility, or concerning any great man of the realm, is punishable by common law with fine and imprisonment (2 Inst. 226. 3 Inst. 198); which is confirmed by statutes Westm. 1. 3 Edw. I. cap. 34. 2 Ric. II. lat. 1. cap. 5. & 12 Ric. II. cap. 11.

FALSE Oath. See PERJURY.

FALSE, or *Falso Positum*, in *Arithmetic*. See POSITION.

FALSE Prophecies. See PROPHECIES.

FALSE Quarters of a Horse. See FALSE QUARTERS.

FALSE Relation, in Music. In the beginning of counterpoint, before the ear was tired with consonance, every perfect concord, rendered sharp or flat, was called false relation, "and absolutely forbidden." (See PEPUSCH, p. 8.) Such as the flat 5th and sharp 4th; but at present those intervals produce effects more agreeable to the ear, than in their most perfect state; even a flat and sharp unison and octave have been successfully hazarded by Emanuel Bach, Haydn, and Mozart.

FALSE Roof of a House, is that part between the upper room and the covering.

FALSE Return. On a false return by a mayor, &c. to a mandamus, or by a sheriff, &c. to a writ, a special action on the case will lie. See MANDAMUS.

FALSE Root, is that of which the value is negative. *E. gr.* in the equation $a^2 + b^2 = x^2$, if x be a negative quantity as -5 , the root is said to be false; if it be a positive quantity it is called a real or true root; if it be the root of a negative quantity, it is said to be imaginary; as $\sqrt{-5}$.

FALSE Sheat, on board a ship. See SHEAT.

FALSE Stem, in a ship. See STEM.

FALSE Tokens, in Law, is used where persons get money or goods in their hands by forged letters, or other counterfeit means. This is punishable by imprisonment by flat. 33 Hen. VIII. cap. 1. By 30 Geo. II. cap. 24. a farther penalty is inflicted on those who obtain money or goods by false tokens and pretences. See CHEATS.

FALSE Tone, in Music. Some call the interval of two semi-tones major by this name; but others more properly call it a diminished third.

FALSE Verdict. See ATTAINT.

FALSE Weights. See WEIGHTS.

FALSET, from FALSETTO, *Ital.* a feigned voice, an octave above its natural pitch, to supply the want of sopranos or feeble voices. "Before the year 1600, when Castrati were first employed in the service of the Papal chapel, at Rome, to sing the soprano, or highest part, it was the custom to have it performed by Spaniards in falset." Santarelli. But long before that period, in early times of dissonant, the upper part used to be sung in falset. Du-Cange derives the word falset from *fausctum*, a term used, during the middle ages, in the same sense; and this, he supposes, from *faucibus*, whence the high tones of voice proceed. *Pipeth* was sometimes used in a similar sense to express piping, or such high singing as imitated the sound of pipes or small flutes.

FALSHOOD, FALSITY, in Philosophy, an act of the understanding, representing a thing otherwise than it is, as to its accidents; or a false enunciation, or judgment of any thing.

The circumstance, as to its accidents, is of absolute necessity in the definition, because a thing cannot be represented otherwise than it is as to essentials; for in such case the essence of the thing would not be represented; and since the essence is the thing itself, it would not be that thing which is represented, but another.

There is no falshood in apprehension or sensation; our ideas of sense are all just and true, so far as they go; and all our delusions arise from our reasonings and conclusions from them.

FALSI, CRIMEN, in the Civil Law, is a fraudulent subornation or concealment, with design to darken or hide the truth, and make things appear otherwise than they are.

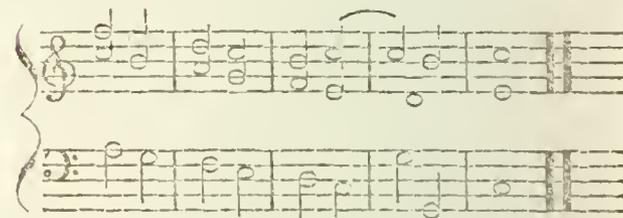
The crimen falsi is committed three ways. By words, as when a witness swears falsely. By writing, as when a man frames or alters something, antedates a contract, or the like. (See FORGERY.) And by deed, as when he sells by false weights and measures, debases the coin, &c.

FALSIFY, in Law, is used for proving any thing to be false. Hence we find

FALSIFYING a Record, for shewing it to be erroneous. Thus lawyers teach, that a person purchasing land of another, who is afterwards outlawed of felony, &c. may falsify the record, not only as to the times wherein the felony is supposed to have been committed, but also as to the point of the offence. But where a man is found guilty by verdict, a purchaser cannot falsify as to the offence: though he may for the time where the party is found guilty generally in the indictment, because the time is not material upon evidence. 2 Hawk. Pl. Crown, 45. We also meet with

FALSIFYING a Recovery. Thus, it is said, the issue in tail may falsify a recovery suffered by a tenant for life, &c. And also the terms of falsifying an attainder, the coin, judgment, &c. occur. See the several articles.

FALSO-BORDONE. See FAUX-BOURDON. Plain music, of note against note, with which the psalms and canticles are often chaunted. But the Italians particularly style falso-bordone a manner of singing in three parts, composed of a succession of 8ths, 3ds, and 6ths.



FALSO Judicio, in Law, a writ which lies for false judgment, given in the county-court, court-baron, or other court, not of record.

FALSO Retorno Brevium, a writ which lies against the sheriff, who has execution of process, for making false returns of writs.

FALSTER, in Geography, an island of Denmark, situated at the entrance of the Baltic, S. of Zealand, from which it is separated only by a narrow sea; about 60 miles in circumference, very fertile, and abounding in game. The principal towns are Nyekioping and Stubbekioping. N. lat. $54^{\circ} 50'$. E. long. 12° .

FALSTERBO, a sea-port town of Sweden, in the province of Schonen, noted for its light-house and herring-fishery; 22 miles S. S. W. of Lund. N. lat. $55^{\circ} 21'$. E. long. $12^{\circ} 34'$.

FALVATERRA, a town of Italy, in the Campagna; 15 miles S. E. of Frusino.

FALUGA, a small island in the Mediterranean, near the W. coast of Sardinia; 12 miles S. of cape Argentera.—Also, a town of the Arabian Irak, on the W. bank of the Euphrates, whence an arm of that river issues to join the Tigris; 25 miles S. E. of Bagdad.

FALUN. See FAHLUN.

FALUN, a river of Switzerland, which runs into the lake of Neuchatel, near Yverdon.

FALUN, a word used in many parts of France, as the name of a particular sort of manure of lands, which is dug out of the earth, and is no other than fragments of sea shells buried at considerable depths, and amassed in prodigious

The term *hide* is by our writers sometimes rendered a manse, sometimes a family, and sometimes *carucata*, or plough-land; containing as much as one plough and oxen could cultivate in a year. See *HIDE*.

FAMILIA, in *Natural History*, a term used by authors to express a certain order of animals, or other natural productions, agreeing in their principal characters, and containing numerous individuals, not only different from one another, that in whole sets, several numbers being to be collected out of the same family, all of which have the family character, and all some subordinate distinction peculiar to that whole number, or though found in every individual of it, not found in those of any others.

It has been too common to confound the words class, family, order, &c. in natural history. But the determinate meaning of the word familia seems to be that larger order of creatures, under which classes and genera are subordinate distinctions. Among the quadrupeds, the several genera of the unguiculated creatures agree one with another in many general characters common to all; and in which they differ from the ungulated animals, which have also their several peculiar characters common to all, and yet different from all those of the others. These naturally constitute certain larger divisions into families, and no one would ever break through these, or bring the cat and the horse into the same family.

In the same manner, in *Ichthyology*, there are several genera of fishes, which agree perfectly in certain common characters, and disagree from all others in them.

The arrangement of natural bodies into these families, or general and larger classes, is of the utmost use to natural history, when it is properly done, and the divisions are genuine and natural; when otherwise, it is hurtful.

These divisions of animals into families are of two kinds, the one artificial or hypothetical, the other natural.

In the systematic arrangement of organic fossils, particularly of the relics of the plants of the primary race which inhabited this globe or its waters, it is found impracticable to ascertain the genera on the principles of Linné, owing to the entire absence of the parts of fructification; hence the families in the arrangement of such reliquia by Mr. W. Martin (*Outlines*, &c. p. 187 and 202) answer in some degree, to the genera of recent plants, of which the fossil remains make but one genus, *viz.* *Phytolithus*, which see.

FAMILIARS of the Inquisition, persons who assist in apprehending such as are accused, and carrying them to prison. They are assistants to the inquisitor, and called familiars, because they belong to his family. In some provinces of Italy they are called cross-bearers, and in others the scholars of St. Peter the Martyr; and they wore a cross before them on the outside garment. They are properly bailiffs of the inquisition; and the vile office is esteemed so honourable, that noblemen in the kingdom of Portugal have been ambitious of belonging to it. Nor is this surprising, when it is considered that Innocent III. granted very large indulgences and privileges to these familiars; and that the same plenary indulgence is granted by the pope to every single exercise of this office, as was granted by the Lateran council to those who succoured the Holy Land. When several persons are to be taken up at the same time, these familiars are commanded to order matters, that they may know nothing of one another's being apprehended; and it is related, that a father and his three sons, and three daughters, who lived together in the same house, were carried prisoners to the inquisition without knowing any thing of one another's being there till seven years afterwards, when they that were alive were released by an act of faith. *Geddes's Tracts*, vol. i.

p. 425—429. *Limborch's Hist. of the Inquis.* by Chandler, p. 187.

FAMILY of Curves. See *Family of CURVES*.

FAMILY of Love, in *Ecclesiastical History*, the name of an anabaptist sect, founded in Holland, in 1555, by Henry Nicholas, a Westphalian. This deluded fanatic maintained that he had a commission from heaven to teach men, that the essence of religion consisted in the feelings of divine love; that all other theological tenets, whether they related to objects of faith, or modes of worship, were of no moment; and that it was a matter of perfect indifference what opinions Christians entertained concerning the Divine nature, provided their hearts burned with the pure and sacred flame of piety and love. Dr. Henry More wrote against this sect, in his "Grand Explanation of the Mystery of Godliness," book vi. cap. 12—18. George Fox, the founder of the sect of quakers, also exposed them, and called them a motley tribe of fanatics, because they took oaths, danced, sung, and made merry. The principles of this sect were propagated in England, and produced no small confusion. The form of abjuration tendered to them, and the severe proclamation issued against them by queen Elizabeth, in 1580, may be seen in *Wilkins's Concilia Magnæ Brit. &c.* vol. iv. p. 296, 297.

FAMILY Islands, in *Geography*, a cluster of small islands near the N.E. coast of New Holland, 12 miles N.W. of cape Sandwich.

FAMILY Lake, a lake of North America. N. lat. 52° 35'. W. long. 93 2'.

FAMINE, or *FAMENE*, a small country of the Netherlands, in the western part of the duchy of Luxemburg, on the borders of the bishopric of Liege; the principal towns are Marche and Roche. It is now ceded to France.

FAMINE, Port, a fortrefs situated on the N.E. coast of the straits of Magellan, in South America; now neglected in consequence of a Spanish garrison having perished for want. In the year 1581, the Spaniards built a town at this place, which they called *Philipperville*, and left in it a colony, consisting of 400 persons. When our celebrated navigator, Cavendish, arrived here in 1587, he found only one survivor, all the others having died through famine, except about 23 persons, who set out for the river Plata, and were never afterwards heard of. Cavendish called the place *Port Famine*. It is a very fine bay, in which there is convenient room for many ships to moor in great safety. Here are also good wooding and watering, and plenty of fish and different sorts of fowl. The place also abounds with wild celery. S. lat. 53 42'. W. long. 71 28'. Variation 2 points westerly.

FAM-TAM-HOTUN, a town of Asia, in the kingdom of Corea; 625 miles E.N.E. of Peking.

FAN, *FLABELLUM*, a machine used to raise wind, and cool the air, by agitating it.

The effect of fanning ourselves when warm, in order to cool us, though the air is itself warm which we drive with the fan upon our faces, may be thus explained: the atmosphere round, and next to our bodies, having imbibed as much of the perspired vapour as it can well contain, receives no more, and the evaporation is therefore checked and retarded till we drive away that atmosphere, and bring drier air in its place, that will receive the vapour, and thereby increase and facilitate the evaporation, and thus contribute to cool us.

That the use of the fan was known to the ancients is very evident from what Terence says,

"Cape hoc flabellum, et ventulum huic sic facito;"

and

and from Ovid, Art. Amand. 1. 161.

“Profuit et tenues ventos movisse flabello.”

The fans of the ancients were made of different materials; but the most elegant were composed of peacock's feathers, or perhaps painted, so as to represent a peacock's tail.

The custom that now prevails among the ladies, of wearing fans, was borrowed from the East, where the hot climate renders the use of fans and umbrellas almost indispensable.

In the East they chiefly use large fans made of feathers, to keep off the sun and the flies. In Italy and Spain they have a large sort of square fans, suspended in the middle of their apartments, and particularly over the tables: these, by a motion at first given them, and which they retain a long time, on account of their perpendicular suspension, help to cool the air and drive off flies.

In the Greek church, a fan is put into the hands of the deacons in the ceremony of their ordination, in allusion to a part of the deacon's office in that church, which is to keep the flies off the priests during the celebration of the sacrament.

Wicquefort, in his translation of the embassy of Garcias de Figueroa, gives the name fans to a kind of chimneys or ventiducts in use among the Persians, to furnish air, and wind into their houses; without which the heats would be insupportable. What is called a fan amongst us, and throughout the chief parts of Europe, is a thin skin or piece of paper, taffety, or other light stuff, cut semi-circularly, and mounted on several little sticks of wood, ivory, tortoise-shell, or the like.

If the paper be single, the sticks of the mounting are pasted on the least ornamental side: if double, the sticks are placed betwixt them. Before they proceed to place the sticks, which they call *mounting the fan*, the paper is to be plaited in such manner, as that the plaits may be alternately inward and outward.

It is in the middle of each plait, which is usually about half an inch broad, that the sticks are to be pasted; and these again are to be all joined and rivetted together at the other end: they are very thin, and scarce exceed one third of an inch in breadth; and where they are pasted to the paper, are still narrower, continuing thus to the extremity of the paper. The two outer ones are bigger and stronger than the others. The number of sticks rarely exceeds twenty-two. The sticks are usually provided by the cabinet-makers or toy-men: the fan-painters plait the papers, paint, and mount them.

The common painting is either in colours or gold-leaf, applied on a silvered ground, both prepared by the gold-beaters. Sometimes they paint on a gold ground, but it is rarely; true gold being too dear, and false too paltry. To apply the silver leaves on the paper, they use a composition which they pretend is a great secret, but which appears to be no other than gum Arabic, sugar-candy, and a little honey melted in common water, and mixed with a little brandy. This composition is laid on with a sponge; then laying the silver leaves thereon, and pressing them gently down with a linen ball stuffed with cotton, they catch hold, and adhere together. When, instead of silver, gold ground is laid, the same method is observed.

The ground being well dried, a number of the papers are well beaten together on a block, and by this means the silver or gold get a lustre, as if they had been burnished.

FAN Machine, in *Agriculture*, an instrument, or machine, contrived for the purpose of winnowing, or cleaning different sorts of grain, seeds, &c. from the chaff and other injurious matters. There are several different machines of this kind in use. It has been remarked by Mr. Donaldson,

in his *Treatise on Modern Agriculture*, that wind is essentially necessary in cleaning grain, or feed of any kind. The husks, or chaff, being lighter than the seeds which they inclose, are, by the force of wind, carried to a greater distance, and thereby a complete separation takes place. The natural action of the winds being so extremely inconstant, no doubt, he thinks, induced the ancients to construct instruments by which the operation of cleaning grain was rendered less difficult and precarious. What these instruments were, except the shovel for throwing grain from one part of the barn, or threshing-floor, to another, is now uncertain; probably, however, the sail-fan, formerly so commonly used in this country, was among the number. It was not, he conceives, till little more than thirty years ago, that any other means were thought of in Scotland for separating grain from the chaff, than the action of the natural wind operating between the two doors of the barn. There a person stood for the purpose of dropping the undressed grain from a kind of scuttle, or sieve, and in quantities proportioned to the force of the wind at the time. About the above period the fan, fan-machine, or fanner, was introduced from Holland, where that kind of machine had been for a considerable time in common use, having been first brought to that country from the East Indies, where these machines had been long used in cleaning rice.

The fan, which is the acting part of the machine, is capable of being turned round on its axis with a greater or less degree of velocity, according to the force of wind necessary to answer the intended purpose. One man works the machine easily by means of a winch, or handle; another is employed in filling the hopper; and a third in riddling and laying aside the grain, if not measured up at the time: when that is the case, more hands are necessary. Since threshing-mills, or machines, have been introduced, the fan-ners are generally connected with, and wrought by them, in place of being set in motion by manual labour, by which means the unthreshed grain, after entering between the feeders of the threshing-mill, becomes invisible, till it again appears in three divisions, each entirely separate from the other; the grain being forced to one place, the chaff to another, and the straw to a third, a degree of perfection in regard to barn management, the writer suggests, which was unknown in any other age or country.

These machines are well constructed in many parts of Lancashire, and other more northern counties, both for being employed separately, and in combination with the threshing-machine. A representation of one is given in the *Plate of Agriculture*.

FAN Palm. See *CHAMÆROPS*.

FAN, Sea. See *GORGONIA*.

FAN, in *Geography*, a town of China, of the third rank, in Chan-tong; 17 miles N.E. of Po.

FANAES, an island in the Atlantic, near the coast of Africa, about nine or ten miles in circumference, a little to the south of the Line.

FANANO, a town of Italy; 18 miles S. of Modena.

FANATIC, a wild, extravagant, visionary, enthusiastical person, who pretends to revelation and inspiration, and believes himself possessed with a divine spirit.

The word is formed of the Latin *fanum*, a *heathen temple*; for which reason the Christians called all the Gentiles fanatics; and accordingly the ancient chronicles of France call Clovis fanatic and pagan.

Among the heathens themselves there was a sort of prophetic priests, called fanatici, from whom the denomination since passed to all the rest. They had their name from the Latin *fanum, temple*, because they lived all together

gether in temples. Struv. Antiq. Rom. Synt. cap. 6. p. 312.

Of this kind, particularly, were the priests of Isis, of the mother of the gods, of Bellona, and some others, who were called fanatici. In Gruter, p. 312. d. vii. we have an inscription, wherein one L. Cornelius Januarius is called Fanaticus, AB. ISIS. SERAPIS. ARAEMED BELLONE. And, p. 645. n. vii. Fanaticus de æde Bellonæ.

What might give occasion to the appellation of fanatics was, that they performed their sacrifices in a wild, enthusiastical manner: and the appellation has been generally applied in modern times to those who have made pretences to inspiration, and who have conducted their worship or practice in an extravagant and licentious manner. Such were some of the German anabaptists and English quakers, at their first rise, and the modern prophets, Muggletonians, Belmenists, &c. And the name fanatics, as well as sectaries, has been often invidiously applied to dissenters from the church of England.

FANATIO, in our *Ancient Customs*, the fawning-time, or fence-months in forests.

FANBYN, in *Geography*, a town of Sweden, in the province of Angermanland, near the gulf of Bothnia. N. lat. 63 24'. E. long. 19°.

FANCOURT, SAMUEL, in *Biography*, was born in the west of England about the year 1678. Of his early life we have no account, but in the beginning of the last century he was settled with a congregation of Protestant dissenters at Salisbury, a situation which he was obliged to quit on account of some change in his sentiments. He came to London, and about the year 1740, or, as others think, 1745, he set on foot the first circulating library in the metropolis, at a subscription of a guinea a-year for reading. He afterwards changed the plan, and made the subscribers proprietors; but he was unsuccessful in almost all his projects. The public are, however, indebted to him for the first idea of establishments which have been, and still are, exceedingly useful to the community; and we may hope, of great advantage to the morals and improvement of almost all classes of society. Mr. Fancourt, after experiencing a thousand changes, which poverty too frequently inflicts, was obliged to part with his library, and retire to Hoxton, where his necessities were relieved by some of his brethren till his death, which took place in 1768, when he was in the 90th year of his age. Gen. Biog.

FANCY. See PHANTASY AND IMAGINATION.

FANDANGO, the name of a riotous Spanish dance.

This is a very ancient national dance: and is supposed to be that of which Martial speaks, when he aims the whole force of his invective against the wanton dances of Bœtica; especially of the district of Cadiz, and the voluptuous manner in which they are performed by the women. Baretti justly defines it, "a regular and harmonious convulsion of all parts of the body." The "bolero" is an imitation of it, but shortened, modified, and stripped of all those accessories which give to the fandango so very free a character. The passion of the Spaniards for these dances is extreme. Accordingly, Mr. Towsead, in his "Travels," observes, that if a person were to come suddenly into a church, or a court of justice, playing the fandango, or the bolero, priests, judges, lawyers, criminals, audience, one and all, grave or gay, young or old, would quit their functions, forget all distinctions, and all set themselves a dancing. The fandango and bolero are danced in couples, to the sound of the guitar, and the noise of castanets, which the men employ with equal precision and sportiveness to mark the time and animate their motions. In the bolero the men and women

perform the same motions, but those of the women are more lively, more animated, and more expressive. The fandango is graver than the bolero: the steps are neither so lively, nor is their time so strongly marked; they more resemble different modes of balancing; but the inflexions of the body are more varied, and add to its gracefulness. Motions of the eyes and features mark all the postures of this dance; the most lively expression of all the passions that agitate the heart is then exhibited. The fandango and bolero are also executed in the form of a ballet or a figure dance; they are then danced by eight, four men and four women; and at intervals each couple in its own corner goes through all the motions of these dances: these are what they call "sequidillas." These dances are usually performed to the sound of the guitar, accompanied by the voice of the player. The women mark the time very correctly with the heel: these dances are not in general practised in genteel society.

FANECA, a measure in Spain, containing, in the vicinity of Carthagea, 3312 solid inches, and weighing a quintal, or 102 avoirdupois: and among the merchants 5½ fanegas are reckoned equal to eight Winchester bushels of 2178 solid inches: but upon a rough calculation, two fanegas of grain may be reckoned equal to three bushels; and one fanega of land, being that quantity on which they sow one fanega of wheat or two of barley, may be considered as three-quarters of an acre.

FANFARE, *Fr.* a kind of military air, or flourish, generally short and spirited, either performed by trumpets, or by other instruments in imitation of them. The fanfare is usually sounded by two trumpets, accompanied by kettle-drums, and, if well executed, it has a certain martial and animated effect perfectly suited to its use. Of all the troops in Europe, the Germans in 1768 were those which had the best military instruments, consequently their marches and fanfares had an admirable effect. It is worthy of remark, that in the whole kingdom of France there was not a single trumpet that played in tune; so that the most warlike nation in Europe had the most discordant instruments, which was not without its inconvenience. During the last war the Bohemian, Austrian, and Bavarian peasants, all born musicians, unable to imagine that regular troops had instruments so false and so detestable, took all the old corps for new-raised troops, whom they began to despise, and it is incredible how many brave men lost their lives by false intonation. So true it is, that in preparations for war, nothing should be neglected that occupies the senses. Rousseau. All Europe seems now convinced of the wisdom of this remark; and all the regiments of every nation have either German bands or German masters to instruct their young musicians.

FANFOUE, in *Geography*, one of the Navigator's islands, in the South Pacific ocean, about five miles in circumference. S. lat. 14 4'. W. long. 70 25'.

FANG, a town of China, of the third rank, in Hou-quang; 40 miles S. of Yuan-gang.

FANG, in *Mining*, signifies a truck or case of wood, made to convey wind or fresh air down into a mine. It also signifies, in some places, a flask, or shelter, to screen the ore-dressers or miners from wind, or the dropping of water.

FANGOOMBA, in *Geography*, a town of Africa, in Kaarta. N. lat. 4 15'. W. long. 70 30'.

FANGS, or *Lee-fangs*, in *Rigging*, a rope fastened to a cringle, near the foot of a ketel's wing-sail, to haul in the foot of the sail for lacing on the bonnet, or taking in the sail.

FANJEAUX, a town of France, in the department of the Aude and chief place of a canton in the district of Castelnau; 13 miles W. of Carcassone. The place contains

contains 1807, and the canton 9015 inhabitants, on a territorial extent of 232½ kilometres, and in 16 communes. N. lat. 45° 11'. E. long. 2° 7'.

FANIMBOO, a town of Africa, in Bambara. N. lat. 14° 40'. W. long. 4°.

FANIONS, in *Military Language*, small flags carried along with the baggage. See FLAG.

FANKI, in *Geography*, a town of China, of the third ranks, in Chan si; 17 miles N. E. of Tai.

FANNA, a town of Italy, in Friuli; seven miles N.N.E. of Aviano.

FANNISSIMA, a town of Japan, in the isle of Nippon; 100 miles N. W. of Jeddo.

FANO, a town of Naples, in Abruzzo Ultra; nine miles S. S. W. of Teramo.

FANO, a sea-port town of the duchy of Urbino, on the Adriatic, the see of a bishop; surrounded with a lofty wall of brick and ditches, with towers at small distances, and bastions towards the sea. It has several monasteries, and some beautiful churches. It was anciently called "Fanum Fortune," from a temple built by the Romans to the goddess Fortune, after the defeat of Asdrubal, on the banks of the Metaurus. Here are the remains of a triumphal arch, erected in honour of Augustus, who sent hither a colony, called "Julia Fanetrus." It was destroyed by Totila, and rebuilt by Belisarius; 16 miles E. N. E. of Urbino. N. lat. 43° 52'. E. long. 12° 56'.

FANOE, or FOENOE, a small island of Denmark, in the Little Belt, situated about two miles S. from Middlefabrt, in the island of Funen. N. lat. 55° 30'. E. long. 9° 43'.—Also, a small island of Denmark, near the coast of Sleswick, in the German ocean, about 15 miles in circumference, chiefly inhabited by fishermen. N. lat. 55° 25'. E. long. 8° 43'.

FANPOTEN, a town on the E. coast of Madagascar. N. lat. 15° 45'. E. long. 50° 40'.

FANSHAW, CAPE, a cape on the W. coast of North America, and N. side of Frederick's Sound. N. lat. 57° 11'. E. long. 226° 44'.

FANSHAWE, Sir RICHARD, in *Biography*, was born at Ware-Park, Herts, in the year 1608. He studied at Jesus college, Cambridge, and from thence he removed to the Inner Temple. Having travelled into France and Spain, he was appointed secretary to the embassy at Madrid, under lord Alton. In the civil wars he adhered to the royal party, and attended the court at Oxford. He was secretary of war to prince Charles, and afterwards treasurer of the navy under prince Rupert. He was created baronet in 1650, and sent to Madrid to seek a loan for his master. He next acted as secretary of state for Scotland, and accompanied Charles II. on his expedition to England, and was taken prisoner at the battle of Worcester. He was soon admitted to bail, and went to the seat of lord Strafford in Yorkshire, where he amused his leisure by translating the "Lusiad." The year before the restoration he repaired to the king at Breda, by whom he was knighted, and, after his return, appointed master of requests and Latin secretary. In 1661, he was elected one of the representatives in parliament for the university of Cambridge, and soon after was sworn a privy councillor for Ireland. He was next appointed envoy-extraordinary to Portugal, and then ambassador to that court, for the purpose of negotiating the king's marriage with the infant Catharine. He acted in other important diplomatic missions, but was at length recalled by the king, who was displeas'd on his signing a treaty with Spain. As he was preparing to return, he was seized with a fever, which carried him off at Madrid in the

year 1666. Sir Richard sustained an amiable character, and his talents for general state affairs was univerfally acknowledged. He is likewise known as a literary character, chiefly by his poetical translations. That of "Guarini's Pastor Fido," first published in 1646, obtained for him the reputation of an elegant and easy versifier. He likewise translated the Lusiad, and some parts of Virgil and Horace, with other things. Biog. Brit.

FANSHIRE, in *Geography*, a river of Madagascar, which runs into the sea, 15 miles S. W. of Fort Dauphin.

FANTASIA, *Ital.* FANTASIE *Fr.* an instrumental composition in *Musick*, executed at the same time that it is conceived. There is this difference between a capriccio and a fantasia, that the capriccio is a string of singular and unconnected ideas, produced by a heated imagination, and which may, however, be composed at leisure; whereas the fantasia may be a very regular production, which differs from written music no otherwise than by being played immediately from the heart, and that it no longer exists after performance. So that the capriccio depends on the assortment and choice of ideas, and the fantasia on the promptitude with which it presents itself. It follows that a capriccio may be written down, a fantasia never; for as soon as it is written or repeated it is no longer a fantasia, it is a common piece of music. These were the ideas of Rousseau 40 years ago, and are now the general ideas of all who bestow a thought on the subject. But in the 17th century, when instrumental music first began to be cultivated, the acceptation of the word fantasia or fancy was very different from the present, which on the organ is termed a voluntary; on the harp or piano forte a toccata, toccatina, or prelude to something else. But of what were termed fantasia, previous to the invention of sonatas, quartets, or concertos becoming general, the following is the history. The reign of our James the First is a very early period in the cultivation of music, merely instrumental. The words concerto and sonata seem at this time not to have been invented even in Italy; as the Crusca dictionary gives no instance of so early a use of them in music-books. Concerto and suono implied nearly the same things in the days of Boccaccio, as concerto and sonata since; but concertare and concertanti were at first applied to the union of instruments with voices, in motets and madrigals, by doubling the voice-parts. It was not till late in the seventeenth century that instrumental pieces, of many parts, began to be called concertos, and of few, sonatas.

The earliest compositions we have found in Italy, for three or more instruments of the same species, are ricercari and fantasia. But of these, none seem to have been printed when the elder Doni published the second edition of his *Libreria*, 1557; as all the instrumental music that appears in his catalogue of musical compositions, which had then been published in Italy, are "Intabolature da organi, et da luto, d'Anton da Bologna, di Giulio da Modena, di Francesco di Milano, di Jaches Buas, piu di dieci volumi, e la continua."

About the beginning of the seventeenth century madrigals, which were almost the only compositions, in parts, for the chamber, then cultivated, seem to have been suddenly supplanted in the favour of lovers of music by a passion for fantasias of three, four, five, and six parts, wholly composed for viols and other instruments, without vocal assistance. And this passion seems to have arisen from the calling in these instruments to reinforce the voice-parts, with which they played in unison, in the performance of motets and madrigals, thence termed concertati. At length, the instrumental performers discovered, that both the poetry

and finging of the times might be spared without any great loss or injury to musical effects; as the words, if good, were rendered unintelligible by fugue, imitation, and multiplicity of parts; and the finging, being often coarse and out of tune, could be better supplied by their own performance. Thus vocal music not only lost its independence, but was almost totally driven out of society; as the ancient Britons, calling in the Saxons to assist them in their conflicts with the Picts, were themselves subdued and forced from their possessions, by too powerful auxiliaries.

We are the better enabled to speak of the instrumental music of this period, by being fortunately in possession of several considerable manuscript collections of fancies; particularly one in six parts, folio, which had been made for the P.E. strange family, in Norfolk, by the celebrated composer of Charles the First's reign, Mr. John Jenkins, and collated with other copies, and corrected not only by himself, but by six or eight other eminent masters of the times.

These pieces, which consist more of motets, madrigals, and innomines, originally designed for voices, than fantasia made expressly for instruments, were the productions of William Bird, Alfonso Ferabosco, sen. and jun. William White, John Ward, Thomas Ravenscroft, William Cranford, Thomas Lupo, Giovanni Coperario, and others. The style would appear now very dry and fanciless, in spite of the general title of these pieces. Indeed, it would be difficult to select one of them that would afford any other amusement to our readers, than that of discovering how ingenious and well disposed the lovers of music, during the former part of the last century, must have been, to extract pleasure from such productions.

Notwithstanding the infinite pains that have been taken in collecting and collating these books, they only prove that however insipid and despicable we may think their contents, our forefathers were of a different opinion; and that, contemptible as they now seem, they were the best which the first musicians of the age could then produce.

There is an infancy in every human production that is perfectable. The instruments to which these fantasies were adapted were viols of different sizes. (See *BASE VIOL*.) The passages, however, given to these several instruments at this time discover no kind of knowledge of the expressive power of the bow; and even Orl. Gibbons, who composed so well for voices in the church, seems very little superior to his cotemporaries in his productions for instruments. Indeed, his madrigals of five parts, as well as those of many others, are said in the title-page to be apt for viols and voices: a proof that with us, as well as the ancient Greeks, and other nations, there was at first no music expressly composed for instruments; consequently, the powers of these instruments must have been circumscribed; and when this music was merely played, without the assistance of the human voice and of poetry, capable of no great effects. The subjects of Orlando Gibbons's madrigals are so simple and unmarked, that if they were now to be executed by instruments alone, they would afford very little pleasure to the greatest friends of his productions, and those of the same period. At the time they were published, however, there was nothing better with which to compare them, and the best music which good ears can obtain, is always delightful, till better is produced. Air, accent, grace, and expression, were now equally unknown to the composer, performer, and hearer; and whatever notes of one instrument were in harmony with another, were welcome to the player, provided he found himself honoured from time to time with a share of the subject, or principal melody; which happening more frequently in canons, and fugues, than in any

other species of composition, contributed to keep them so long in favour with performers of limited powers, however tiresome they may have been to the hearers when constructed on dull and barren themes.

Music is so much a work of art, study, exercise, and experience, that every style must be best treated, even by men of the greatest genius, in proportion to the attention and labour they bestow on that particular species of composition. Orlando Gibbons, who appears to such advantage as a church composer, is utterly contemptible in his productions for instruments, of whose powers he was ignorant. Indeed, all instrumental music, but that of the organ, seems to have been in a very rude state at this time throughout Europe; and, if we except the fugues of Frescobaldi, all the music, even for keyed-instruments, is dry, difficult, unaccented, and insipid.

FANTASTICAL COLOURS, are the same with those called emphatical colours.

FANTIN, in *Geography*, a country of Africa, on the Gold Coast, extending about thirty miles along the coast of the Atlantic. It is bounded by Sabu on the west, the Iron mount, half a mile below Mawri, being its extremity. From the foot of this hill Fantin extends about ten miles eastward along the coast, having on the north side Arti Agua, and Tongua; Akron on the east; and the sea on the south. The soil is fertile, producing fruits, maize, and palm wine. The European natives have long traded here for gold and slaves. But the natives trade freely with interlopers, frequently shut up all the passages to the inland countries, and prevent all trade between the Europeans and the merchants of the interior kingdoms in gold and slaves; and they have sometimes starved the Dutch in their forts, till their demands have been complied with. The inhabitants are bold, cunning, and deceitful. Their government is aristocratical; the brasso, as their chief magistrate is called, leads their armies into the field, and possesses the chief power, though it is greatly restrained by the old men, who form a national council, the votes and acts of which are entirely independent of the brasso. Every town and sub-division of the county has also its chief, who frequently assumes independence, and enters on a war with his sovereign and the council of elders. Their intestine divisions are the chief security of their neighbours, as they are able to assemble an army of 10,000 men. They reckon about 4000 fishermen on the coast, and their small towns are very numerous. The capital, of the same name with that of the province, is about twelve miles up the country: and their other principal towns and villages are Anamaboa, where the English have a fort, Adja, or Aga, where the Dutch formerly had a fort, Little and Great Cormantin, Agua, Laguyo, Tantimquerè, and Manpran. N. lat. 5° 10'.

FANTOME CORN, in *Agriculture*, a term applied to such thin or light corn as has but little bulk or solidity. In this sort of grain there is but a small portion of the farinaceous matter.

FANTONI, JOHN, in *Biography*, a celebrated physician, was born at Turin in the year 1675. He studied philosophy and the belles lettres in the university of his native city, and evinced a superiority of talent in the rapid progress which he made. He then passed to the medical classes, in which he gave farther evidence of his abilities, and obtained his degree of doctor. He was enabled, through the liberality of his prince, to visit foreign seats of learning in pursuit of improvement in his art, and traverse France, Germany, and the Low Countries, every where making valuable additions to his knowledge. On his return to

Turin,

Turin, he commenced public teacher of anatomy, and afterwards was successively chosen to fill the chairs of theoretical and practical medicine. In the interim the king of Sardinia appointed him physician to the prince of Piedmont, his son. This office, however, did not interfere with his labours in the university, where he was still distinguished near the middle of the succeeding century, notwithstanding his advanced age.

The first publication of Fantoni was entitled "Dissertationes Anatomicae XI. Taurini, 1701." The second "Anatomia corporis humani ad usum Theatri Medici accommodata, ibid. 1711." This edition, which is, in fact, a part of the preceding work, relates to the anatomy of the abdomen and chest only. 3. "Dissertationes duae de structura et usu duræ matris et lymphaticorum vasorum, ad Antonium Pacchionum conscriptæ, Romæ, 1721." 4. "Dissertationes duae de Thermis Valderianis, Aquis Gratiensis, Maurianensibus, Genævæ," 1725, in 8vo. and 1738 in 4to. 5. "Opuscula Medica et Physiologica, Genævæ, 1738." This contains likewise some observations of his father. 6. "Dissertationes Anatomicae septem priores renovatæ, de Abdomine, Taurini, 1745." 7. "Commentariolum de Aquis Vindolienensibus, Augustanis, et Ansonensibus, ibid. 1747."

FANTONI, JOHN-BAPTIST, the father of the preceding, though less distinguished than his son, was also a teacher of anatomy and of the theory of medicine at Turin, as well as librarian, and first physician to Victor Amadeus II. duke of Savoy. He died prematurely in 1692, (having only attained the age of forty,) in the vicinity of Embrun, where the duke, his patron, was encamped, during the siege of Chorges. He left several unfinished manuscripts, which John Fantoni revised, and of which he published a collection of the best parts, under the title of "Observationes Anatomicae medicæ selectiores," at Turin, in 1699, and at Venice in 1713. This work contains some useful observations relative to the diseases of the heart. Eloy. Dict. Hist. or.

FANU, in *Geography*, a small island in the Mediterranean; 10 miles N.W. of Corfu.

FANUM, among the Romans, a temple or place consecrated to some deity. The deified men and women among the heathens had likewise their fana; even the great philosopher Cicero erected one to his daughter Tullia. Mem. Acad. Inscript. vol. i. p. 488, seq.

FANUM *Diænæ*, in *Ancient Geography*, was built, according to Ptolemy, on the banks of the Rhine. Some authors have supposed that the castle of Batenstein, now Vianen, was erected upon the foundation of this ancient temple.

FANUM *Fortunæ*, a town of Italy, in Umbria. See FANO.

FANUM *Jovis*, a temple of Jupiter, situated in Asia Minor, near the Thracian Bosphorus and the Syriac promontory.

FANUM *Martis*, the denomination of several places in Gaul. Hence sprung, according to the Notitia Imperii, the name of "Pagus Fanomartensis," given to a great part of Hainaut. This is probably the place now called *Famars*; which see.—Also, another place of Gaul, mentioned in the Itinerary of Antonine, on the route from Alauna to Condate Redonum, between Cosedia and Fines, at the limits of the Abrincatui. It is placed by M. D'Anville a little to the south of Constantia, on the sea coast, at a place now called "Mont Martin."—Also, another place of Gaul, pointed out in the Pentingerian table, between Condate Redonum to the south-east, and Reginea to the north-west, upon the sea-coast, the principal place of the Curiosolites.—Also, a place of Italy, in Etruria. Cluvius.

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FANUM *Minervæ*, a town of Gaul, marked in the Itinerary of Antonine, and placed by M. D'Anville to the south-east of Durocortorum or Rheims.

FANUM *Veneris*. See PORTUS *Veneris*.

FANUM *Volturnæ*, a small place of Italy, in Etruria, N.W. of Falerii.

FAN-YUAN, in *Geography*, a town of Corea; 23 miles E.S.E. of Koang-tcheo.

FANZARA, a town of Africa, in Fez; 15 miles S. of Salee.

FAON, LE, a town of France, in the department of Finisterre, and chief place of a canton, in the district of Chateaulin; 13 miles N. of Quimper. The place contains 682 and the canton 5,400 inhabitants, on a territory of 95 kilometres in 5 communes.

FAOUE', or FOUAH, a town of Egypt, situated on the west branch of the Nile, was formerly a sea-port, though it is now 20 miles from the sea. When the Nile was allowed to fill the canals with its waters, which once supported trade and diffused abundance; when boats laden with the commodities of Europe and Asia could navigate in tranquillity the coast of Alexandria, without being subject to the fury of the sea and of the "Boghiafs," Fouah, which was situated at the entrance of this canal, was a large and flourishing city, where the Europeans had their commercial establishments. The Venetians kept a consul here, and merchandize was brought hither by the canal of Alexandria. But the supineness of the tyrants of Egypt having suffered the mud to collect in the bed of the canals, so as to obstruct navigation, commerce was compelled to abandon the shore of Fouah, and carry its means and its riches to the harbour of Rosetta, where a variety of dangers render its progress uncertain. Fouah has, therefore, very considerably declined from its former splendour. Belon, who travelled in Egypt in 1530, says, that Rosetta was much smaller than Fouah; but the reverse has since taken place. Its contracted limits, the ruined state of its ancient edifices, and those yet standing, undermined by want and wretchedness, announce the rapid approach of a general decay. The fields, however, that surround Fouah display a rich and smiling fertility; while its delightful gardens produce fruits, which, on account of their superior excellence, are held in high estimation. Many have supposed that this city is the ancient Metelis, but Sonnini has placed this town near Rosetta, conceiving that Fouah was Naucratis, built by the Milesians, as it is imagined, in the reign of Psammeticus, and the country of Athenæus, a celebrated grammarian, who remarks that, in his time, there were fabricated in this town earthen vases, the covers of which had the appearance of silver. In front of Fouah the Nile forms, in the middle of its course, an island called "Geziret-el-Dahab," or golden island. Fouah is distant 16 miles S.E. from Rosetta, and 70 N.N.W. from Cairo. N. lat. 31° 10'. E. long. 31°.

FAOUE', a town of France, in the department of Morbihan, and chief place of a canton, in the district of Pontivy, 18 miles N. of L'Orient. The place contains 2,591 and the canton 12,069 inhabitants, in a territory of 257½ kilometres and 7 communes. N. lat. 48° 2'. W. long. 3° 24'.

FAPESMO, in *Logic*, one of the moods of syllogisms.

A syllogism in fapesmo has its first proposition an universal affirmative, the second an universal negative, and the third a particular negative.

FAQUIER, in *Geography*, a county of America, in Virginia, bounded N. by Loudon, and E. by Prince William; about 55 miles long and 20 broad, containing 12,575 free inhabitants, and 8751 slaves. It has a post-house; 51 miles from Washington.

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FAQUIR.

FAQUIR. See FARIR.

FAR, in *Horsemanship*, an appellation given to any horse's right side: thus the far foot, the far shoulder, &c. is the same with the right foot, right shoulder, &c.

FARA, or FARAY, in *Geography*, one of the Orkney islands, two miles long and one broad, and two miles W. of Eday. In ordinary years its soil and surface are more than sufficient to raise grain for the supply of its inhabitants. N. lat. 59° 4'. W. long. 2° 43'.

FARA, or Faray, one of the smaller Orkney islands, noted chiefly for its excellent sheep-pastures; near Rissay and the east coast of Waes, which at low ebbs forms one island with Hoy. N. lat. 58° 43'. W. long. 3° 1'.

FARA. See FAIR *isle*.

FARA, a town of Arabia Felix; 230 miles W. of Ca-them.

FARAB. See OTRAR.

FARABAT, a Persian port on the Caspian sea. This port, and Madhetifar, are situated on the southern coast, in the province of Masanderan; they are both small villages, of which Madhetifar is most commercial from its vicinity to Balfrusch, capital of the province, where the Russians and Armenians carry their merchandize. See BALFRUSCH.

FARADEESE, a town of Africa, near the east coast of Tunis, the inhabitants of which more than a century ago were the greatest cruisers and most experienced mariners of the country, though near four miles from the sea, their port being a small creek in the gulf of Hamam-et; but the superior conveniencies for navigation at Hamam-et, and the increase of trade, have, of late years, drawn thither all the inhabitants; 11 miles W. of Hamam-et, and 30 S. of Tunis. Shaw's Travels, p. 91.

FARAGENOUS MOUNTAINS, in *Geology*, according to Mr. Kirwan (by others called tertiary), are such as have resulted from the ruins of other mountains or strata, of different species jumbled together, according to the theories of these authors.

FARAH, in *Geography*, a town of Arabia, on the S. coast of the Persian gulf; 200 miles E.S.E. of El Catif. N. lat. 25° 7'. E. long. 51° 30'.

FARAM, one of the smaller Shetland islands. N. lat. 60° 4'. W. long. 1° 26'.

FARAMA, a ruined town of Egypt, originally founded by the Arabs, and situated a little to the eastward of Pehusim. This town did not long subsist, for it was destroyed in the 13th century. It had a mausoleum, which some have erroneously supposed to be the tomb of Galen, but which in reality was that of Pompey, placed by Pliny at some distance from mount Cefius, in the vicinity of which are the ruins of Farama.

FARAMEA, in *Botany*, Aubl. Guian. v. 1. 101. t. 47. Juss. 209. A genus, consisting of two species in Aublet, whose fruit is not sufficiently determined. It appears nearly related to the *Cephaelis* of Swartz and Willdenow, *Callicocca* of Schreber, but wants the involucreum. The flowers are tetrandrous and four-cleft. Nat. Ord. *Rubiaceae*, Juss. See *CALLICOCCA*.

FARAN, in *Geography*, a valley of Arabia, which extends from the Red sea to mount Sinai.

FARANAGUR, a town of Hindoostan, in Dowlatabad; 36 miles S. of Amednagur.

FARAND-MAN, in our *Old Writers*, a traveller or merchant-stranger, to whom by the law of Scotland justice ought to be done with all expedition, that his business or journey be not hindered.

FARANI, in *Geography*, a town of Africa, in the kingdom of Ludamar; 30 miles N.W. of Benown.

FARANSK, a town of Russia, and one of the 13 districts in the government of Viatka, situated on a rivulet falling into the Viatka.

FARAONI, a town of European Turkey, in Moldavia; 16 miles S. of Baken.

FARAT, a river of Nubia, which runs into the Red sea, N. lat. 21° 40', with good depth of water at its mouth.

FARCE was originally a droll, petty show, or entertainment, exhibited by charletans, or quacks, and their buffoons, in the open street, to gather the crowd together.

The word is French, and signifies literally *force-meat* or *stuffing*. It was applied on this occasion, without doubt, on account of the variety of jests, jibes, tricks, &c. wherewith the entertainment was interlarded. Some authors derive farce from the Latin *facetia*; others from the Celtic *farce*, *mockery*; others from the Latin *farrere*, *to stuff*.

At present, farce possesses a little more dignity. It is removed from the street to the theatre; and instead of being performed by merry-andrews to amuse the rabble, is now acted by our comedians, and become the entertainment of the politest audiences.

The poets have reformed the wildness of the primitive farces, and brought them to the taste and manner of comedy. The difference between the two on our stage is, that the latter keeps to nature and probability; and, in order to that, is confined to certain laws, unities, &c. prescribed by the ancient critics.

The former disallows of all laws, or rather sets them all aside on occasion. Its end is purely to please, or to make merry; and it sticks at nothing which may contribute to this end, however wild and extravagant. Hence the dialogue is usually low, the persons of inferior rank, and the fable or action trivial or ridiculous; and nature and truth are every where heightened and exaggerated, to afford the more palpable ridicule.

FARCILITE, in *Minerology*, is a substance composed of masses of stone, cemented together by a stony cement. See Kirwan's Geol. Ess. p. 133, 225, and 338.

FARCIMALIS TUNICA, the same with allantois.

FARCIN, FARCY, or *Fashions*, a disease in horses, and sometimes in oxen, &c. somewhat of the nature of a scabies or mange.

Gesner derives the word from *varices*, by changing the *v* into a digamma or *f*.

The farcin is infectious, and spreads like a true plague. Vegetius calls it *morbus farcinifcus*. It consists in a corruption of the blood, which shews itself in eruptions of hard pustules, knots, or buds (as they are commonly called) along the veins. Hence they are erroneously supposed to consist in a swelling of those vessels. These tumours generally burst, discharging a thin watery matter, and degenerating into foul spreading ulcers. The contiguous glands are usually inflamed and swollen from an absorption of the poison that occasions the disease. This disease sometimes makes its appearance in diffused swellings of the hind legs, or other parts of the body. The most common cause of farcy seems to be contagion, either from a glandered or farcied horse; for, according to Mr. White (*Treat on Veterinary Medicine*, vol. i.), there can be no doubt that these diseases will reciprocally produce each other. Whence we may conclude, that they both originate from the same poison, producing different effects, according to the parts on which its noxious influence is exerted. Its effects, however, are partial; the internal parts of the nose are more particularly liable to be affected by it: the skin is likewise very susceptible of its action; and when the disorder has continued long, so that the poison has produced its full effect,

FARCIN.

the lungs do not escape the contagion. The farcy, says Mr. White, may be either constitutional or local. If glanderous matter, or the matter taken from a farcy-ulcer, be applied to the skin, when the cuticle has been abraded, a chancre or foul ulcer is produced, which is distinguishable from all others by its peculiarly foul appearance, the edges becoming thick, and the discharge consisting of a thin and rather glutinous matter. It generally spreads rapidly, and never looks red or healthy. The absorbents or lymphatics about the ulcer become inflamed and swollen from an absorption of its poisonous matter. These swellings are commonly mistaken for veins, and hence it has been inferred that the blood-vessels are the seat of the disease; the glands likewise, to which these lymphatics lead, become inflamed and enlarged; at length small tumours or buds appear in the course of these absorbents, which are small abscesses arising from the inflammation of these vessels. Thus far, says Mr. White, the disease is *local*, and the constitution untainted: at length, however, the poison, which has been arrested by the glands, insinuates itself into the circulation, and infects the whole mass. The internal parts of the nose are generally first attacked; the next part that is affected is usually the skin, on various parts of which "farcy-buds" appear, and degenerate into foul spreading ulcers; at length the bones of the nose become carious or rotten; and, finally, the poison falls upon the lungs, and soon terminates the animal's sufferings. Sometimes the progress of the disease is very rapid, and in a short time destroys the horse; at other times it is remarkably slow, and continues for a long time, without sensibly affecting either the appetite or strength.

In the first stage of the farcy, while it is local, a cure may be easily accomplished, and topical applications will be sufficient to remove it. If the actual cautery be freely applied at this time, so as to destroy all the poisoned parts, the disease will be completely eradicated, and the chancre converted into a common sore, which will assume a red healthy appearance, and the cure may soon be completed by the application of digestive ointment. But if the disease has been neglected, or not perceived at its first commencement; if the lymphatics be enlarged or *corded* (as it is termed by the farriers); and if the neighbouring glands should be swollen, the cure is much less certain. Some of the poison may, in this case, have got into the circulation, though its effects have not been visible. In this stage, however, the chancre may be completely cured by the actual cautery, or other strong caustics; and if the poison should not have passed the glands, the cure will be radical; but if, on the contrary, the smallest portion of the poison should have insinuated itself into the blood, the whole mass will be poisoned, and the symptoms will be such as have been already described. When the first appearance of the farcy has been neglected, it will be advisable to give a ball, formed of muriate of quicksilver 1 sc., powdered aniseeds $\frac{1}{2}$ oz., and any syrup, once, twice, or three times a day, if the horse's strength will admit of it, restraining its effect upon the bowels or kidneys by means of opium; at the same time it will be necessary to keep up the horse's strength by a liberal allowance of corn. Malt has been found useful on these occasions. During this course of medicine the horse must be warmly clothed, have regular exercise, and never be suffered to drink cold water. Some have recommended verdigris in this disease; but Mr. White has had no opportunity of observing its effect. The balls above-mentioned have proved so efficacious, that he has had seldom any occasion for trying other remedies; but they should be continued for

two or three weeks after every symptom has disappeared, or else the cure will seldom be permanent.

It is not improbable that the farcy, as well as the glanders, may sometimes occur spontaneously; or at least, in many cases, it may not be traced to any assignable cause; and yet it might have arisen from contact with poisonous matter, though the mode of communicating it has not been ascertained. With respect to that kind of farcy which appears in the form of diffused swellings of the limbs or other parts, Mr. White is of opinion that it seldom originates from infection, and does not often depend on the action of the glanderous matter, being merely common œdematous swellings, such as accompany the grease. Hence we may account for the efficacy that has been sometimes attributed to purgatives and diuretics, as remedies for the farcy. When large abscesses are formed in consequence of farcy, they do not require any particular treatment, but the horse's strength should be supported in such cases by means of corn and malt. Some have supposed that the farcy depends altogether upon debility; and hence medicines of the tonic or strengthening kind have been recommended for its removal. When the distemper becomes inveterate, Gibson recommends the following mixture, *viz.* half a pint of linseed oil; oil of turpentine and nitre, of each three ounces; tincture of euphorbium and hellebore, of each two drams; the soldier's ointment, or oil of bays, two ounces; oil of origanum, half an ounce; double aqua fortis, half an ounce; when the ebullition is over, add two ounces of Barbadoes tar. With this mixture rub the tumours and corded veins once in two or three days, opening a passage to the matter issuing from the ulcers, if they are choaked up, with a small hot iron, and destroying with vitriol the proud flesh, which may be kept down by touching with oil of vitriol, aqua fortis, or butter of antimony. Dr. Braeken recommends the mercurial ointment for rubbing the cords and tumours before they break, in order to disperse them: and when they are broke, to dress the sores with equal parts of Venice turpentine and quicksilver. Mercurials have been likewise given internally in various ways; two ounces of quicksilver divided with an ounce of turpentine, and made up into four balls with diapente and gum guaiacum, of each two ounces, and sufficient quantity of honey, have been successfully given in the quantity of one ball twice a week; but when mercurials are administered either internally or externally, gentle purgatives should be interposed to prevent a salivation.

The water-farcy, which is a kind of dropsy, proceeds from a horse's feeding on low watry grounds, and in pits or holes where the grass grows above the water; for the horse in picking out the grass licks up the water, which occasions him to swell under the belly or chaps.

The water-farcy is of two kinds; one produced by a feverish disposition, terminating on the skin; and the other a true dropsy, in which the water is not confined to the belly and limbs, but it is found in different parts of the body, where a great number of soft swellings appear, which yield to the pressure of the finger. The first species may be relieved by slight scarifications in the inside of the leg and thigh with a sharp penknife; but in the other species the water must be discharged, and the crasis of the blood recovered by a purge given every week or ten days, and immediately after the first the following balls: take of nitre, two ounces; squills powdered, three drams, or half an ounce; camphor, one dram, and a sufficient quantity of honey to bring them of a due consistence for balls. This ball should be given once a day, and washed down with a

horn or two of the following drink : take of black hellebore, fresh gathered, two pounds : wash, bruise, and boil it in six quarts of water, till it is reduced to four : strain off the liquor, and pour on the remaining hellebore two quarts of white-wine ; place it in a gentle heat, and let it infuse forty-eight hours ; strain it off, and mix both together, and give the horse a pint of it night and morning. When the horse begins to recover, complete the cure by giving him half a pint of the following infusion every night and morning for a fortnight, and let him fast two hours after it : take gentian-root and zedoary, of each four ounces ; chamomile-flowers, and the tops of centaury, of each two handfuls ; of Jesuit's bark, powdered, two ounces ; of juniper-berries, four ounces ; of filings of iron, half a pound ; infuse the whole in two gallons of ale for a week, shaking the vessel often.

We have in the *Philosophical Transactions* an account of a horse being cured of this disease by hemlock. The discovery was accidental ; the master of the horse, riding near a place where hemlock grew abundantly, suffered his horse to eat greedily of it, and he became better from that time, and in a few days was wholly cured. We generally esteem hemlock a poison ; but besides this proof of its salutary effect, it is well known that its seeds are eaten by some birds, particularly by the bustards, in very great quantities, without any harm.

FARDAN, in *Geography*, a town of Persia, in the province of Segellan ; 155 miles S.W. of Zareng.

FARDEL of Land, in *Rural Economy*, is a term which, according to some, signifies a fourth, but which Noy asserts to be only the eighth part of a yard-land. See YARD-LAND.

FARDING-BAG, a term sometimes used to signify the first stomach of a cow or any other ruminant animal. It is chiefly employed by farriers.

FARDING-Deal, or *Farding-Land*, in our *Ancient Customs*, signifies the fourth part of an acre, now called a *rood*. In the register of writs we have also *denariata*, *obolata*, *solidata*, and *librata terra*, which must probably rise in proportion of quantity from the farding-deal, as an half-penny, penny, shilling, and pound, rise in value ; on which footing *obolata* must be half an acre ; *denariata*, an acre ; *solidata*, twelve acres ; and *librata*, twelve-score acres.

Yet we find *viginti libratas terræ, vel redditus* ; Reg. fol. 94. a, and 284. b. where *librata terra* should seem to be as much as yields xx s. *per annum* ; and *centum solidatas terrarum, tenementorum, et reddituum*, fol. 249. a. Others hold *obolata* to be but half a perch, and *denariata* a perch.

FARDINGDEL, was the fourth part of a yard-land, or of a plough-land, according to Spelman. See FARDEL.

FARE, a voyage or passage, or the money paid for passing by water, &c.

For the fares of hackney coachmen, watermen, &c. see *Hackney-COACHES*.

FARE of Pigs, in *Rural Economy*, a provincial mode of expressing the number of pigs which a sow brings forth at one time. See FARROW.

FAREHAM, in *Geography*, a market town in the hundred of that name, and division of Portsdown, in Hampshire, England, is situated at the north-western extremity of Portsmouth harbour ; and owes its chief importance to its vicinity to that naval establishment, its principal trade and manufactures being those of packing and ropes for shipping, of which it supplies great quantities to the dock. The town is well built ; has a parish-church and two meeting-houses. The civil government is vested in a bailiff, two constables, and two ale-conners, who regulate all matters relative to

weights, measures, trade, &c. Vessels of large burthen are built at the quay. During the summer season this town is much frequented for the purpose of sea-bathing ; and a commodious bathing-house has been lately erected. Fareham is 72 miles distant from London : has a good market on Wednesdays, and an annual fair well supplied with corn, cheese, hops, &c. The population report made to parliament in the year 1801 was 555 houses and 3030 inhabitants.

FAREL, WILLIAM, in *Biography*, the son of a gentleman in Dauphine, in France, was born in the year 1489. He distinguished himself at the university of Paris for rapid proficiency in the ancient languages, and though brought up with the Papists we find him preaching the principles of the reformed religion at Meaux, in the year 1521. Two years afterwards a persecution was commenced by the Franciscans against those whom they chose to single out as heretics ; among these was Farel, who, to provide for his own safety, fled from France. He retired to Strasburg, where he was acknowledged as a brother by Bucer and Capito, as he was by Haller, Œcolampadius, and other eminent reformers in Switzerland. At Bern he publicly defended his opinions, in set theses, against the doctrines and practices of the Catholics, till he excited so much opposition as obliged him to quit the place. He now undertook the reformation of Montbeliard, and was very successful in the attempt, but his zeal was too nearly allied to intemperance to produce all the effect that his talents were capable of commanding. On a procession day, he tore from the hands of the priest the image of St. Anthony, and threw it into the river ; which had well-nigh cost him his life, and which, among other acts of violence, led Erasmus to think and to speak slightly of him. His friend Œcolampadius was the means of moderating his temper, by seriously expostulating with him on the subject in an epistolary correspondence. " Men," said he, in one of his letters, " may be led, but will not be driven by force. Give me leave to say you do not seem in every respect to remember your duty, you were sent to preach, not to rail. Pour on wine and oil in due season, and demean yourself as an evangelist, and not as a tyrannical legislator." Farel travelled from place to place in the character of a reformer ; and from many of the scenes of his exertions and labours he was driven by the bigotry and fanaticism of the times. At Neuchâtel and Geneva he exercised the office of pastor ; and at Metz he planted a church, and obtained numerous proselytes, but he and his followers were obliged to fly from that city, and take refuge in the abbey of Gorze, where the count of Furlenberg took them under his protection. Their enemies were, however, more powerful than their friends ; they besieged them in their asylum, and obliged them to surrender upon a capitulation. Farel escaped and returned to Neuchâtel, where he resumed his labours with much assiduity. In 1553 he was obliged to appear at Geneva, to answer a charge brought against him that would, if true, have affected his life, but, according to Calvin, it was an infamous fabrication, in return for his zeal in reproving public vice. At this time Farel, with utter inconsistency of character, and to his own eternal disgrace, assailed in the persecution and murder of Servetus. In 1558 he married ; and in 1565, as he was on a journey, he was taken ill and died, being about 76 years of age. He was distinguished for an undaunted spirit ; for a commanding voice, and for a powerful eloquence. His writings are neither numerous nor important. They consist of theses : disputations, and some practical treatises. Bayle.

FARELAINS, in *Geography*, a town of Portugal, in the

the province of Entre Duero e Minho; six miles N.E. of Villa de Condé.

FARELLA, a small island in the East Indian sea. S. lat. $0^{\circ} 48'$. E. long. $104^{\circ} 27'$.

FARELLON SUCIO, a small island in the Spanish Main, near the coast of Darien. N. lat. $9^{\circ} 43'$. W. long. $79^{\circ} 40'$.

FAREN, in *Ichthyology*, a name given by the Swedes to a fish peculiar to their country. It is of the genus of the cyprini, and is distinguished by Artedi by the name of the yellow-eyed cyprinus, with thirty-seven bones in the pinna ani. See *CYPRINUS*.

FARESKUR, in *Geography*, a town of Egypt, on the east branch of the Nile; seven miles S. of Damietta.

FAREWELL, CAPE, a cape on the S.W. coast of East Greenland. N. lat. $59^{\circ} 38'$. W. long. $42^{\circ} 45'$.—Also, a cape on the N.W. coast of Tavai-Poenamoo, the southern island of New Zealand. S. lat. $40^{\circ} 33'$. W. long. 186° .

FARFANA, a town of Spain, in Catalonia; five miles W. of Balaguer.

FARFARA, a name given by some of the ancient *Botanists* to the plant we call colt's foot, from the river Farfarus, a river of Italy, mentioned by Ovid as remarkable for its shady banks, which afforded a very large quantity of this plant. Pliny mentions this plant with much confusion, calling it also farfaius and farfugio, and forgetting that he had before described it under the name of tussilago or belchion. See *TUSSILAGO*.

FARFRUGUM, a name by which some authors have called the caltha palustris, or marsh-marygold.

FARGEAU, *St.* in *Geography*, a town of France, in the department of the Yonne, and chief place of a canton in the district of Joigny; 25 miles S.W. of Joigny. The place contains 2093, and the canton 6632 inhabitants, on a territory of $257\frac{1}{2}$ kilometres, and in seven communes. N. lat. $47^{\circ} 38'$. E. long. $3^{\circ} 10'$.

FARIAH, a town and province of the country of Balk, on the borders of Persia; 90 miles W. of Balk. N. lat. $36^{\circ} 18'$. E. long. $63^{\circ} 40'$.

FARJAN, a town of Persia, in the province of Irak; 75 miles S.W. of Hamadan.

FARIBE, a town of Africa, in the country of the Foulahs, on the Senegal. N. lat. $16^{\circ} 45'$. W. long. $14^{\circ} 34'$.

FARIDABAD, a town of Hindoostan, in the soubah of Delhi; 18 miles S. of Delhi.

FARIGLIANI, a small island near the east coast of Sicily. N. lat. $37^{\circ} 35'$. E. long. $15^{\circ} 15'$.

FARILA, a town of Sweden, in Hellingland; 39 miles N. of Hudwickswall.

FARILHOENS, two small islands in the Atlantic, near the coast of Benguela. S. lat. $12^{\circ} 35'$.

FARIM, a town of Africa, and capital of a province or kingdom of the same name, belonging to the Papels, on the river St. Domingo. N. lat. $12^{\circ} 10'$. W. long. $14^{\circ} 30'$.

FARIMA, or BANSJU, a province of Japan, on the S. coast of the island of Nippon, abounding in manufactures of silk, cloth, paper, &c.

FARINA, in *Agriculture*, a term frequently used to signify the fine mealy substance afforded by pounding or grinding different sorts of grain. It is very prevalent in wheat, constituting, in a great measure, the flour from which bread is made. It is found to partake somewhat of the nature of gum, but has considerably more taste, is more fermentable, and greatly more nutritious. It is likewise abundant in many vegetables, being mostly de-

posited in certain parts of them, apparently for the purpose of being more beneficially accommodated to their nourishment and support. Many of the bulbous and other roots, as well as those of the potatoe, briony, &c. and such as afford different preparations, as salsp, cassava, &c. contain a large portion of white feculæ, which greatly resembles, and in reality possesses, the properties of farina. The leguminous class of plants, as peas, beans, &c. are also found to abound in this sort of matter. The largest quantity of this material is, however, met with in grains, as wheat, barley, rye, and oats, which are in consequence of it denominated farinaceous grains. It likewise abounds in rice, and other plants of the same kind.

When only slightly examined it seems to be a substance of a homogeneous nature; but from actual experiment it is found to be a compound, constituted of three different parts, which are easily separable. Where it is taken from wheat, this is easily shewn by simply forming a palle with a quantity of it and cold water, and then suspending it in a bag of muslin, or other similar cloth; afterwards letting fall on it a stream of cold water from a height, the containing bag being occasionally squeezed in a gentle manner: the water in its descent conveys away with it a very fine white powder, which may be received with the water in a vessel placed below, underneath the bag. This process is continued until no more of the white powder comes off, which is shewn by the water that passes through the bag, ceasing to have a milky colour. The operation being completed, the farina is found to be separated into three distinct substances: the glutinous, or *vegeto-animal* part remains in the bag; the *amylum*, or starch, is deposited at the bottom of the water, which has been received in the vessel placed below the bag; and the mucous matter is held dissolved in the water from which the starch has been deposited, and is capable of being brought to the consistence of treacle, by evaporating the water in which it is held in the state of solution.

It is likewise found, that these several different parts vary greatly in their sensible and chemical properties. The *vegeto-animal* part has a whitish grey colour, being a tenacious, ductile, elastic matter, partly possessing the texture of animal substances. When distilled in a retort it yields, like all animal matters, a true volatile alkali; and its coal affords no fixed alkali. It is not only insoluble, but even indiffusible in water; both which are shewn from its remaining in the bag after long continued lotions or washings. Like gums, it is soluble in alcohol, in oils, and in ether; but is insoluble in water, and yields on distillation products very different from those afforded by gums. It is consequently of an animal nature, and would seem to approach nearer to the coagulable lymph of animals than to any other substance. The fixed alkali, by means of heat, dissolves the *vegeto-animal* gluten; but when it is precipitated from this solution by means of acids, it is found to have lost its elasticity. The mineral acids, and especially the nitrous, are likewise capable of dissolving the *vegeto-animal* part of farina. The amylaceous, or starchy matter, forms the principal part of the farina. As already noticed, it is that fine powder which is deposited from the water which has pervaded the entire farina: it is of a greyish white colour, but is capable of being rendered much whiter by making it undergo a certain degree of fermentation. Starch is incapable of solution in cold water, but in hot water it forms a transparent glue; hence the necessity of employing cold water in separating it from the *vegeto-animal* part. When distilled in a retort, it affords an acid phlegm; and its coal yields, like other vegetables, a fixed alkaline salt. As starch constitutes the greatest part of the farina, it is probably the
chief

chief nutritious constituent principle in bread. The mucous, or rather mucoso-saccharine matter, is only in a very small proportion in bread. Upon undergoing distillation it is found to present the same phenomena as sugar. The use of this matter seems to be that of producing the vinous fermentation; and it is not improbable but that the making of good bread may depend on a proper proportion of the three different parts that have been already shewn; the vinous fermentation being promoted by the mucoso-saccharine part, the acetous by the starch, and the putrid by the gluten vegetable; consequently, that from the different degrees or states of these several stages of fermentation the qualities or properties of good bread may in a great measure be derived. See BREAD.

Besides this, it is found from actual experiment, as well as long experience, that those substances which abound most in farina, are the most expeditious in fattening different sorts of animals, as hogs, poultry, &c. and at the same time afford that sort of fat which is the most firm and solid in its nature; hence it is found necessary in most cases to feed out animals of these kinds with some material that contains it in a pretty large proportion.

FARINA *Fecundans*, in *Botany*. See FECUNDATION of *Plants*.

FARINA, *Cape*, in *Geography*, a cape on the north coast of Tunis. N. lat. 37° 42'. E. long. 10° 3'.

FARINAGIUM, in *Rural Economy*, a term which was formerly employed to signify the toll of meal or flour.

FARINELLI, CARLO BROSCHI, DETTO, an Italian opera-singer, whose voice and abilities seem to have surpassed the limits of all anterior vocal excellence, was born at Andria, in the kingdom of Naples, in 1705. He learned the first rudiments of music of his father, according to his own account, and singing of Porpora, who generally accompanied him wherever he went. In 1722, at the age of 17, he went from Naples to Rome, with his master, then engaged to compose an opera for the Aliberti theatre, in that city; where, during the run of an opera, there was a struggle every night between him and a famous player on the trumpet, in a song accompanied by that instrument: this, at first, seemed amicable, and merely sportive, till the audience began to interest themselves in the contest, and to take different sides. After severally swelling out a note, in which each manifested the power of his lungs, and tried to rival the other in brilliancy and force, they laid both a swell and a shake together, by thirds, which was continued so long, while the audience eagerly waited the event, that both seemed to be exhausted; and, in fact, the trumpeter, wholly spent, gave it up, thinking, however, his antagonist as much tired as himself, and that it would be a drawn battle; when Farinelli, with a smile on his countenance, shewing he had only been sporting with him all this time, broke out all at once in the same breath, with fresh vigour, and not only swelled and shook the note, but ran the most rapid and difficult divisions, and was at last silenced only by the acclamations of the audience. From this period may be dated that superiority which he ever maintained over all his cotemporaries. Here he continued with Porpora till 1724, when he first went to Vienna. In 1725, he performed at Venice in Metastasio's first opera of "Didone Abbandonata," set by Albinoni. After this he returned to Naples, where he performed with the celebrated female singer Tesi, in a serenata composed by Hasse. In the early part of his life he was distinguished throughout Italy by the name of "the boy." In 1726 he sung at Milan, in "Ciro," an opera set by the elder Ciampi. In 1727, he performed at Bologna, with Bernacchi, in an opera set by

Orlandini. In 1728, he went to Vienna a second time; and afterwards returning to Venice in autumn, he sung with Faustina, just returned from England, in Metastasio's "Ezio," set by Porpora. Here he continued two years, performing, in 1729, with Gizzi and Nicolini, in "Semiramide Riconosciuta," set likewise by Porpora, and in "Cato," by Leo: and in 1730, with Nicolini and Cuzzoni in Hasse's celebrated opera of "Artaserse," in which he first appeared in England; and in "Idaspe," set by his brother Riccardo Broschi. Wherever he went his powers were regarded as miraculous; but he told the author of this article, that at Vienna, where he was three different times, and where he received great honours from the emperor Charles VI. an admonition from that prince was of more service to him than all the precepts of his masters, or examples of his competitors for fame: his imperial majesty com-manded to tell him one day, with great mildness and affability, that in his singing he neither *moved* nor *stood still* like any other mortal; all was supernatural. "Those gigantic strides, said he; those never-ending notes and passages (ces notes qui ne finissent jamais) only surprise, and it is now time for you to please; you are too lavish of the gifts with which nature has endowed you; if you wish to reach the heart, you must take a more plain and simple road." These few words brought about an entire change in his manner of singing: from this time he mixed the pathetic with the spirited, the simple with the sublime, and, by these means, delighted as well as astonished every hearer. In the year 1734, he came into England, where every one knows who heard, or has heard of him, what an effect his surprising talents had upon the audience; it was extacy! rapture! enchantment!

In the famous air "Son qual Nave," which was composed by his brother, the first note he sung was taken with such delicacy, swelled by minute degrees to such an amazing volume, and afterwards diminished in the same manner, that it was applauded for full five minutes. He afterwards set off with such brilliancy and rapidity of execution, that it was difficult for the violins of those days to keep pace with him. In short, he was to all other singers as superior as the famous horse Childers was to all other running-horses; but it was not only in speed, he had now every excellence of every great singer united. In his voice, strength, sweetness, and compass; in his style, the tender, the graceful, and the rapid. He possessed such powers as never met before, or since, in any one human being; powers that were irresistible, and which must subdue every hearer; the learned and the ignorant, the friend and the foe.

As general and indiscriminate praise would convey to the mind of a musical reader no distinct ideas of the powers of this extraordinary singer, it will be necessary to discriminate the specific excellencies of which he seems to have been possessed.

No vocal performer of the last century has been more unanimously allowed by professional critics, as well as general celebrity, to have been gifted with a voice of such uncommon power, sweetness, extent, and agility. Nicolini, Senesino, and Carestini, gratified the eye as much by the dignity, grace, and propriety of their action and deportment, as the ear, by the judicious use of a few notes within the limits of a small compass of voice; but Farinelli, without the assistance of significant gestures or graceful attitudes, enchanted and astonished his hearers by the force, extent and melodious tones of the mere organ, when he had nothing to execute, articulate, or express. But though during the time of his singing he was as motionless as a statue, his voice was so active, that no intervals were too close, too wide, or too rapid for his execution. It seems as if the composers

FARINELLI.

composers of these times were unable to invent passages sufficiently difficult to display his powers, or the orchestras to accompany him in many of those which had been composed for his peculiar talent. And yet, so great were his forbearance and delicacy, that he was never known, while he was in England, to exclaim, or manifest discontent at the inability of the band, or mistakes of individuals by whom he was accompanied. He was so judicious in proportioning the force of his voice to the space through which it was to pass to the ears of his audience, that in a small theatre at Venice, though it was then most powerful, one of the managers of the opera complained that he did not sufficiently exert himself—"let me then," says Farinelli, "have a larger theatre, or I shall lose my reputation without your being a gainer by it."

On his arrival here, at the first private rehearsal at Cuzzoni's apartments, lord Cooper, then the principal manager of the opera under Porpora, observing that the band did not follow him, but were all gaping with wonder, as if thunder-struck, desired them to be attentive; when they all confessed that they were unable to keep pace with him: having not only been disabled by astonishment, but overpowered by his talents. This band was small, consisting only of Carbonelli, Mich. Christ. Festing, Valentine Snow, afterwards serjeant-trumpet, and Mr. Vezan, a dancing-master, who was likewise a steady and excellent concert player on the violin, and constantly employed whenever Carbonelli or Festing was the leader. It was from this worthy man that we had this anecdote.

There was not one of all Farinelli's excellencies by which he so far surpassed all other singers, and astonished the public, as his *mezza di voce*, or swell; which, by the natural formation of his lungs, and artificial economy of breath, he was able to protract to such a length, as to excite incredulity even in those who heard him; who, though unable to detect the artifice, imagined him to have had the latent help of some instrument by which the tone was continued, while he renewed his powers by respiration.

With these talents he went into Spain in the year 1737, with a full design to return into England, having entered into articles with the nobility, who had then the management of the opera, to perform the ensuing season. In his way thither he sung to the king of France at Paris, where, according to Riccoboni, he enchanted even the French themselves, who at that time universally abhorred Italian music; but the first day he performed before the king and queen of Spain, it was determined that he should be taken into the service of the court, to which he was ever after wholly appropriated, not being once suffered to sing again in public. A pension of near 3000*l.* a-year was settled on him for life.

He said, that for the first ten years of his residence at the court of Spain, during the life of Philip V. he sung every night to that monarch the same four airs, two of which were composed by Haffé, "*Palido il sole*," "*Per questo dolce Ampleffo*," and "*Ah, non lasciami no, bell idol mio*," by Vinci: we forget the other, but it was a minuet which he used to vary at his pleasure. He was honoured with the order of St. Jago by his first royal master. Of the manner in which he spent his time some idea may be gathered from what we have already related: the lovers of anecdotes might, indeed, be gratified with innumerable particulars concerning the effects of his amazing talents, if anecdotes were not below the dignity of lexicography; one or two, however, that do honour to his heart and natural

disposition, we hope our graver and more critical readers will excuse.

It has been often related, and generally believed, that Philip V. king of Spain, being seized with a total dejection of spirits, which made him refuse to be shaved, and rendered him incapable of attending council, or transacting affairs of state, the queen, who had in vain tried every common expedient that was likely to contribute to his recovery, determined that an experiment should be made of the effects of music upon the king her husband, who was extremely sensible to its charms. Upon the arrival of Farinelli, of whose extraordinary performance an account had been transmitted to Madrid from several parts of Europe, but particularly from Paris, her majesty contrived that there should be a concert in a room adjoining to the king's apartment, in which this singer performed one of his most captivating songs. Philip appeared at first surprised, then moved; and at the end of the second air made the virtuoso enter the royal apartment, loading him with compliments and caresses; asked him how he could sufficiently reward such talents; assuring him that he could refuse him nothing. Farinelli, previously instructed, only begged that his majesty would permit his attendants to shave and dress him, and that he would endeavour to appear in council as usual. From this time the king's disease gave way to medicine: and the singer had all the honour of the cure. By singing to his majesty every evening, his favour increased to such a degree, that he was regarded as first minister; but what is still more extraordinary, instead of being intoxicated or giddy with his elevation, Farinelli, never forgetting that he was a musician, behaved to the Spanish nobles about the court with such humility and propriety, that instead of envying his favour, they honoured him with their esteem and confidence. One day in going to the king's closet, to which he had at all times access, he heard an officer of the guard curse him, and say to another that was in waiting "honours can be heaped on such scoundrels as these, while a poor soldier, like myself, after thirty years' service, is unnoticed." Farinelli, without seeming to hear this reproach, complained to the king that he had neglected an old servant, and procured a regiment for the person who had spoken so harshly of him in the anti-chamber; and in quitting his majesty he gave the commission to the officer, telling him that he had heard him complain of having served thirty years, but added, "you did wrong to accuse the king of neglecting to reward your zeal."

The following story, which is less serious, was frequently told and believed at Madrid, during the first year of Farinelli's residence in Spain. This singer, having ordered a superb suit of clothes for a gala at court, when the taylor brought it home, he asked him for his bill. "I have made no bill, sir, says the taylor, nor ever shall make one. Instead of money," continues he, "I have a favour to beg. I know that what I want is inestimable, and only fit for monarchs; but since I have had the honour to work for a person of whom every one speaks with rapture, all the payment I shall ever require will be a song." Farinelli tried in vain to prevail on the taylor to take his money. At length, after a long debate, giving way to the humble intreaties of the trembling tradesman, and flattered perhaps more by the singularity of the adventure than by all the applause he had hitherto received, he took him to his music-room, and sung to him some of his most brilliant airs, taking pleasure in the attentiveness of his ravished hearer; and the more he seemed surprised and affected, the more Farinelli exerted himself in every species of excellence. When he had done, the taylor, overcome with ecstasy, thanked him in the most rapturous

rapturous and grateful manner, and prepared to retire. "No," says Farinelli, "I am a little proud; and it is perhaps from that circumstance that I have acquired some small degree of superiority over other singers; I have given way to your weakness, it is but fair, that, in your turn, you should indulge me in mine." And taking out his purse, he insisted on his receiving a sum amounting to nearly double the worth of the suit of clothes.

After the death of Philip V. his favour continued under his successor Ferdinand VI., by whom he was dignified with the order of Calatrava in 1750; but then his duty became less constant and fatiguing, as he persuaded this prince to have operas, which were a great relief to him: he was appointed sole director of those spectacles; and had from Italy the best composers and singers of the time, and Metastasio to write. He shewed me in his house four of the principal scenes in *Didone* and *Netette*, painted by Amiconi, who accompanied him first into England, and then into Spain, where he died.

When the late king of Spain ascended the throne, he was obliged to quit that kingdom, but his pension was still continued, and he was allowed to bring away all his effects. The furniture of his house was very rich, as it was almost entirely composed of the presents which he had received from great personages. He seemed very much to regret the being obliged to seek a new habitation, after having lived twenty-four years in Spain, where he had formed many friendships and connections that were dear to him; and it was a great proof of the prudence and moderation of his character, that in a country and court, where jealousy and pride are so predominant, he continued so long to be the king's chief favourite, a distinction odious to every people, without the least quarrel or difference with any of the Spaniards.

When he returned into Italy in 1761, all his old friends, relations, and acquaintances, were either dead, or removed from the places where he had left them: so that he had a second life to begin, without the charms of youth to attach new friends, or his former talents to gain new protectors.

He said that Metastasio and he were twins of public favour. Their first acquaintance began at Naples, where Farinelli performed in Metastasio's first dramas, in "*Angelica*," 1723, and in "*Didone*," 1724; in "*Siroe*," at Venice, 1725, and 1726. They seem not to have met again till Metastasio was settled at Vienna, where Farinelli was engaged three several times, and where they saw each other for the last time in 1733, from which period their affection continued with undiminished ardour to the end of their lives. The letters of Metastasio to this vocal phenomenon and worthy character are all preserved from the year 1747, to the last use which the poet made of a pen, in 1782. Nothing need be added here to his public professional character; but in the letters of Metastasio, published in the memoirs of his life, the numerous and impressive eulogies of that excellent and refined moralist, and judge of the human heart, exalt his private virtues and conduct through life to an uncommon pitch of excellence. During his residence in Spain, we were curious to obtain information concerning the life of this portentous performer: we had accounts from the highest authority of his modesty, humility, and benevolent propensities, during his splendid residence at Madrid, while in the meridian of royal favour, invested with wealth, honours, and influence, sufficient to excite every species of envy, hatred, and malice, in all the orders of society. Yet so found were his intellects, so sage and judicious his conduct, that he cannot so properly be said to have escaped the shafts of envy, as to have prevented their being shot at him. Of

almost all other great singers, we hear of their intoxication by praise and prosperity, and of their caprice, insolence, and absurdities, at some time or other; but of Farinelli, superior to them all in talents, fame, and fortune, the records of folly among the spoiled children of Apollo furnish not one disgraceful anecdote. In one of Metastasio's letters to his Caro Gemello, (his dear twin,) as he always called Farinelli, he says, "the Spanish minister plenipotentiary, don Antonio di Azlor from your court is arrived, and pleases extremely here; not only my august patrons, but the nobility and the whole corps diplomatique. He has an agreeable seriousness in his aspect, an openness in speaking, and so noble, courteous, and judicious an address, that we hope he will worthily and usefully sustain the character with which he is honoured. He is interrogated by every one concerning yourself, as all are solicitous about what is most dear to them; and all are extremely pleased with his answers. He assures them that your prosperity has not in the least altered the sweetness and moderation of your character. A rock, according to ancient and modern examples, extremely difficult to avoid; and much more amidst the favours, than the persecutions of fortune. He has assured them that though elevated to such an enviable situation, you have not an enemy. To obtain forgiveness, (Metastasio adds,) for such prosperity, I can easily conceive how wise, how disinterested, and how beneficent must be your conduct. I congratulate you on these inestimable characteristics, which are your own, and not the gifts of fortune; and I congratulate myself for having known and loved you, before you had given such illustrious proofs of your estimable and amiable qualities."

In one of the poet's letters to Farinelli in 1752, when at the zenith of his favour and fortune, he says, "I have seen, for a short time, count Esterhazy, after his return from Madrid, and have found him full of you. He regards you as a hero, and has desired me to tell you so; which will oblige me likewise to love you more than ever. At this last assertion I cannot help laughing; but I own, that to hear you thus praised, affords me the same pleasure as if it was myself: so much does our old, true, and reciprocal friendship seem to have united us together, and consolidated our interests. God preserve you, our dear Gemello, and inspire others to think as you do."

"What I speak and write to you, my dear friend, is what I think, not what I say; and I do not write all, lest I should be thought by those who are not acquainted with me one of the common worshippers of your fortune: which I only love in you, as an instrument by means of which you discover the good qualities of your heart: among which I must, for my own sake, enumerate the admirable constancy of your friendship."

Again, in 1756, he says, "at length our noble and worthy Monsignor Migazzi, arch-bishop of Vienna, is arrived here from Madrid. I have put his patience to extraordinary trials, with my numerous and minute questions concerning your health, way of life, friendship for me, and the public approbation which you have so well contrived to merit. He went so far as to tell me, that, conscious of your heroic conduct in circumstances so seducing, he might venture to canonize you without the fear of opposition. Figure to yourself, if you can, how sweet such music must be to the ears of your most faithful and affectionate Gemello."

These are instances of the strength of his head during prosperity; we shall give two or three examples of his fortitude, when "fallen from his high estate." In 1758, he lost his great patroness and judge of his worth and talents, the queen of Spain: and, in 1759, her consort Ferdinand

VI. who being succeeded by Charles III. his brother, the late king of Spain, who hated music, and would not suffer the found of a voice or an instrument to be heard in his palace, ordered him to quit Madrid, and return to Italy; but not to his own country, Naples, whither it was his wish to retire; but from some caprice, never clearly explained, though his pension was continued, he ordered him to spend the remainder of his days at Bologna. Upon his first loss, Metastasio in condolence says: "The death of so admirable a queen, and her royal consort oppressed with grief for so irreparable a loss, are objects for a disinterested servant, obliged, honoured, and full of affection and gratitude like yourself, that must inevitably plunge your mind in an abyss of desolation. I know not what to say to you, my dear friend, equal to what I feel for you. Yet I have no doubt but that you, who have seen the world how capable you are of resisting the flattering smiles of fortune, will know how to support adversity; and that your prudence will not wait for the assistance of necessity, to manifest wisdom and Christian resignation." And on the death of his royal patron Ferdinand, in 1759, he begins his second letter of condolence in the following manner: "Yesterday was delivered to me your letter of the second of August, from Villaviziosa: and though tinged with the gloomy colour reflected from your painful situation, it was great consolation to me to find, that, with your feeble state of health, you have had sufficient vigour to resist so tremendous a shock. The fatal news of your beneficent king having been delivered from his sufferings, arrived at Vienna four days before your letter. It is to be hoped that the melaucoly state in which he long remained without the least chance of recovery diminished the violence of a blow which must have been expected, and which delivered a poor prince from the painful existence in which he languished. And yet, with all these solid reasons, I judge, my dear Gemello, by the emotions of my own heart, what your's must be; but I promise myself much more from your virtue than mine; because the examples of moderation with which you have so long furnished the world in the midst of the most intoxicating smiles of fortune, give us assurances of your meeting her frowns with equal fortitude. Be of comfort, my dear Gemello: inconstancy in human affairs is the universal condition on which we live, as every mortal knows by woeful experience. No misfortune, however, can rob you of the praise of not suffering yourself to be seduced or dazzled by the blaze with which you were so long surrounded."

The death of his partial patrons not only deprived him of his importance at that court, but seems to have bereaved him of all comfort during the rest of his days. In a letter of Metastasio to him in 1763, we find the following testimony of his resignation to his fate. "I now begin to discover that my beloved Carluccio is as superior to the frowns, as he has hitherto been to the smiles, of fortune. I promised myself this heroism from you: and was certain that your greatest difficulty was knowing how to set bounds to the tender excesses of your good heart, and gratitude. Now time and reflection have rendered you master of yourself, it is fit, my dear friend, that you should enjoy that sweet tranquillity, which is so justly due to your toils and conduct."

In 1764, "his guide, philosopher, and friend," says, "your last letter of the 5th inst. really consoled me. From the serenity and pleasantry with which it is coloured from the beginning to the end, I conceive that you are at length arrived at the secret of wiping from your mind that cursed foot with which it has so long been discoloured. I congratulate you on your success, in an enterprise which borders on a species of heroism of which so few

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are capable. We have an infinite number of great men, who are venerated as models of knowledge and prudence, who have sunk under catastrophes much less violent than yours. Happiness, therefore, attend my dear Gemello! who has proved himself as much superior in adversity as prosperity, and who knows how to estimate human felicity better than those who call themselves philosophers; and is in no want of scholastic jargon to enable him to stand firm and motionless in every gust of wind. Heaven bless and keep you in this wise and placid state for at least half a century."

In 1772, in a letter to a Bolognese lady who had boasted of her acquaintance with Farinelli, he says: "your partiality, madam, for my dear Gemello, the cavalier Broschi, is a new motive for the increase of that esteem which I have always had for you: as his excellent discernment assures me of the merit of those persons with whom he is in habits of intimacy. And I envy you both that mutual enjoyment of each other's company, at which I can never aspire." And in 1779, in a letter to the same lady, the venerable bard says "you have obliged me extremely my dear signora Giacinta, by honouring me with the continuance of your correspondence, and assuring me of the affectionate remembrance which my dear and respected friend sig. Carlo Broschi retains for me, which I return with a mutual and most constant reciprocation. I love and esteem him as much as it is possible for a man to be loved and esteemed, who has so far surpassed all his peers, not only by his excellence in the charming art which he professed, but by the uncommon virtuous qualities of his mind, which have rendered him amiable, and admirable, in every situation into which fortune has thrown him.

We have dwelt with more pleasure on the virtues of this extraordinary vocal performer; as we fear they are more rarely found in musicians than great talents. Possessed of irresistible powers of pleasing, they must be regarded as spoiled children of nature and of the public; who in their vital voyage, "are not only ignorant how to sail before the wind, but how to tack, without losing their steerage." However, if such splendid fortune as Farinelli's has happened to but very few mortals, there have not been wanting instances of great vocal powers being united with sound intellects, prudence, and good conduct, of all which we may safely venture to say that Pachierotti was eminently possessed.

FARINOLA, in *Geography*, a town of Naples, in Abruzzo Ultra; 11 miles S. S. E. of Teramo.

FARIO, in *Zoology*, a term for salmon when about half grown, after it is past the state in which it is called a salar, and before it is of the full growth.

FARIS, in *Geography*, a town of Persia, in the province of Comis; 30 miles S. E. of Bitam.

FARLEE, a town of Bengal; 8 miles N. of Rangamatty.

FARLES, a river of North Wales, which runs into the Irish sea; 4 miles W. of Crickath.

FARLEU, in *Rural Economy*, is a term used formerly, in the west of England, to signify the money paid by tenants in lieu of heriot. It is frequently understood in some manors of Devonshire to be the best goods, as heriot is the best beast, payable on the death of a tenant.

FARLOF, in *Geography*, a town of Sweden, in the province of Schonon; 6 miles N. of Christiaustadt.

FARM, in *Agriculture*, a term which formerly signified a small messuage or district in the country, comprising a house, land, and other conveniences, which was hired or taken by lease, either in word or writing, under a certain

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yearly

yearly rent or charge; but which at present may be defined a certain portion of ground cultivated by the proprietor or tenant in different methods, according to the nature of the land, for the purpose of deriving profit from it. These leases were differently denominated in different districts or places; hence, in the more northern parts of the kingdom they were frequently termed *tacks* and *fermebails*; while in some parts of the south they had the title of *wikes*.

The word *firma*, ferm, or farm, in corrupt Latin, signified a place which was inclosed or shut in; whence it has been asserted by Menage, that in some districts or provinces they term *closerie*, or *closure*, what in others is called *ferm*, or *farm*.

By Skinner and Spelman the word *farm* is, however, derived from the Saxon term *fearme*, or *feornic*, which signifies *victuals*, food or provision, as the tenants and country people anciently paid their rents in victuals, and other necessaries of life, but which was afterwards converted into the payment of certain sums of money. Hence a *ferm* was originally a place which furnished or supplied its owner or lord with provisions. The Normans likewise distinguished between *farms* which paid in kind, as in provisions, and those which paid in money, denominating the former simply *fermè*, or farm, while the latter were called *blanche ferme*, or *white farm*. The latter of the above writers has likewise shewn that the word *firma* anciently signified, not only what is now called a *farm*, but also a feast or entertainment which was given by the farmer to the owner, proprietor, or landlord, for a certain number of days, and at a certain rate, in consideration of the lands, &c. which he held of him. Thus in the laws of king Canute, the term *fearm* is by Lombard rendered *victus*; and we have likewise *reddere firmam unius noctis*, as well as *reddebat unam diem de firma*, which evidently denote provision for a night and day, the rents about the time of the conquest being all reserved in provisions. This custom is asserted to have been first altered under the reign of the first Henry.

There is a statute, the 21 Hen. VIII. cap. 18. in which it is enacted that no parson or spiritual person shall take *farms* or leases of land, on pain of forfeiting ten pounds per month, &c.

And by the 25 Hen. VIII. cap. 13, and the 32 Hen. VIII. cap. 28. no person whatsoever shall take above two *farms* together, in the same parish, under the forfeiture of three shillings and four-pence a week.

In considering the nature of farms, it is evident that there must be different sorts, from the different methods in which they are cultivated or employed. Where the principal part of the land is under the plough they are termed arable farms; but where the fattening of cattle or other sorts of live stock is more immediately the object, they are distinguished by the title of grazing farms; where the chief intention is the obtaining different sorts of animal products, such as milk, butter, and cheese, they are denominated milk, cheese, and butter, or dairy farms; and where the two systems of arable and grass management can be combined, they are called mixed, or convertible farms. As manure must be had in order to render farms of any kind productive, the last sort may probably, in general, be considered as the most advantageous. And in addition to these, where hay is the principal object, there are grass or hay farms; and where live stock is chiefly reared, cattle or breeding farms.

Most of the ancient writers on husbandry, who lived in warm climates, or countries where the heat and moisture of the air had sensible, and frequently very dangerous effects on the health of the inhabitants, were very

particular in their directions for the choice of farms or estates, and of the spots whereon houses should be built, so as to avoid the inconveniences arising from the climate, or from the quality or situation of the ground. But though the temperate air which we enjoy in this island renders such directions less necessary, yet, as several places in it are sickly, and as, even in the most healthy situations, many houses and villages are built upon the least healthy spots, it must be of considerable advantage to those who can make their choice to know what soils and places ought to be avoided; and of such as are already fixed to be acquainted with the means of correcting those inconveniences which cannot be totally remedied. The Romans had generally pleasure as well as profit in view, when they bought or stocked a farm, and therefore they laid it down as a rule, that no degree of fertility should tempt a man to purchase in an unhealthy country, nor the pleasantest situations in a barren one. "Buy not too hastily," said the wise Cato, "but view again and again the purchase you intend to make; for if it be a good one, the oftener you see it the better it will please you. Examine how the neighbouring inhabitants fare; let the country it lies in be a good one, the ways to and from it good, and the air temperate; let your land, if you can choose your situation, be at the foot of a hill, facing the south, in a healthy place, where a sufficiency of labourers, of cattle, and of water, may be had; let it be near a flourishing town, the sea, or a navigable river, or bordering upon a good and well-frequented road; let the buildings upon your ground be strong and substantial; do not rashly condemn the methods of others." It is best to purchase from a good husbandman, and a good improver, where it can be done.

But, besides the healthfulness of the situation, three other things should be particularly attended to in the choice of a farm or estate; these are, the air, the water, and the soil. The air should be pure and temperate, the water wholesome and easily come at, and the soil rich and fertile. The knowledge of the healthiness of the air is, as lord Bacon observes, discoverable rather by experiment, than by reason or conjecture. To examine the moisture of the air before a house is built, wool, or a sponge, may be hung up in the place and afterwards compared with some of the same, exposed in the same manner, and at the same time in another place. According as they gain more or less in weight, the air is more or less humid. The air is liable to greater alterations from heat and cold in some places than in others; and as that inequality in the air is an enemy to health, the most equal should be chosen. This is easily determined by the thermometer, and by viewing the situation of the place; for the intermixture of hills and valleys, though pleasing to the eye, may be held suspected as to the lengthening of life, because of the variations of heat and cold.

It may be added, that the ancients were likewise particularly attentive to the quality of their water, and to the ease of coming at it. They advised bringing into the farm-houses the water of such springs as never dried up; or, if there was no such spring within the farm, to bring running water as near to it as may be; or to dig for well-water, not of a bitter or brackish taste. If neither of these was to be found, they directed large cisterns to be provided for men, and ponds for collecting and retaining rain-water for cattle. They esteemed that running water to be the best for drinking which had its source in a hill; spring or well-water from a rising ground was deemed the next best; well-water in the bottom of a valley was held to be suspicious; and marshy or fenny water, which creeps slowly on, was by them rightly looked upon as the worst of all.

That

That water is known to be wholesome which has no mineral in it, is perfectly clear, has no taste or smell, deposits no slimy sediment, leaves no spots or incrustation when boiled in copper or brass vessels, and which boils pulse in a very little time. As spring and well-water pass through beds of sand, gravel, or small stones, these clear it of all impurities, unless there be mixed with them substances which are soluble in water. If any mineral is mixed with the water, it is unfit for the farmer's use. If it be hard, it is thereby rendered unfit for washing, and some other culinary uses. This is the kind of water which gives flesh boiled in it a red colour. But even the hardest water may be easily rendered perfectly soft, and fit for any use by mixing with it a small portion of pot-ash, or fixed alkali, or, for want of these, the ashes of any burnt fresh vegetables, such as the boughs of the ash-tree, fern, &c.

And in respect to the goodness of the soil, it should be judged of from a minute examination and comparison of different circumstances, such as the appearances of the trees, hedges, crops, and different plants that are produced upon it, as well as from its particular nature and colours.

On the Proper Size of Farms.—In regard to the consideration of the proper size of farms, it may be remarked that it is not proposed to decide as to the precise number of acres which constitute what is generally denominated a proper sized farm. The person who attempts to do so will, it is supposed by a late writer, be involved in difficulties from which he will find it impossible to extricate himself; while his hypothesis must be liable to so many objections, as to evince, in the clearest manner, that without considering the subject in various points of view, it is impossible to form even a general conclusion. This subject, which, though apparently simple, involves a great variety of particulars, may probably be best elucidated, by explaining how far large and small farms are advantageous or otherwise to the proprietors, the occupiers, and the nation in general. There is probably no point within the range of husbandry which has, however, caused more serious alterations and disputes with theoretical agriculturists and speculative political economists, than that of the size of farms. By some it has been strenuously contended that they should be altogether small; while others have maintained, with equal pertinacity, that they should be large, and others again have supposed that they should be of various sizes, restricting the largest to a certain number of acres. But all such plans are obviously of an impracticable nature. In a country where the capital and means are so various, it must evidently be of great advantage to have farms of very different sizes, both in respect to extent of land, and that of rent, or annual value; as, by this means, the honest and industrious labourer in husbandry may be properly accommodated, and by degrees become wealthy and independent; while at the same time the expert, ingenious, and improving cultivator, who possesses extensive capital and information, may not be disappointed in embarking in such undertakings of this kind, as may amply repay his superior skill, capital, and industry. The nature of the management of a district, as well as that of the soil, should likewise, in some measure, regulate the size of the farms. Thus, where sheep-walks prevail, or the grazing system is extensively pursued, they should be large; but where the plantation or orchard practices are followed, they should be small. Both in the stiff, wet, and hard dry clayey soils, the farms should be large, that the farmers may have sufficient strength to work them at the proper seasons, which is very seldom the case when they are small. But the free, deep, medium soils, which are wrought with much less difficulty, may answer well in small farms.

Large Farms.—It has been suggested by a late writer that if the introduction of improvements in cultivation, and the breeds of the different species of live stock, are objects of importance to the proprietors of the kingdom as individuals, large farms must be considered by them as beneficial. As individuals, also, they must experience other advantages from large farms. The extent of capital employed in stocking and cultivating these farms insures a regular and prompt payment of the rents. Building and repairing farm-houses on such farms, although considerable at first, is not so heavy an annual charge as on small farms; while the expence of inclosing and sub-dividing does not amount to one-tenth part. It was fortunate, the writer thinks, for British farmers, as well as for British husbandry, that proprietors adopted the resolution of letting part of their estates in large farms. By that means men, possessing every requisite for constituting them good farmers, turned their attention to the cultivation of the soil, and the introduction of every improvement connected therewith; and, in very many instances, have not only been so successful as to maintain and educate their families in ease and comfort, but also to acquire such fortunes, as to render them independent proprietors; a circumstance that must give sincere satisfaction to every liberal mind; and from the service they have done in promoting the interests of agriculture, they are well entitled to enjoy the fruits of their industry. In regard to the community large farms, the writer says, must be considered as favourable in several respects. On what farms, he asks, in Norfolk, have turnips been cultivated, and used to the greatest advantage? On what farms in the Carse of Gowrie in Scotland has the cultivation of grain been most successfully carried on? In Leicestershire, where have the greatest improvements in the different breeds of live stock been effected? In the counties of Northumberland and Berwick, where have improved breeds of stock been most generally united with skilful culture? Every person who has travelled through these districts, with a view of procuring agricultural information, must, he thinks, answer, On large farms.

It is from large farms also that the towns are principally supplied with the great articles of grain, fat cattle, and sheep of the best quality. And as farms of this size are kept in the highest state of cultivation, of which the lands are susceptible, and managed with the fewest number of hands; the greatest quantity of produce that can be spared from the like extent of land necessarily goes to market. To the occupiers of large farms it is also chiefly owing that the supply of the towns in these indispensable articles is so regularly kept up. If these farmers could not afford to keep their grain and fat stock on hand, till those of the poorer tenants were disposed of and consumed, the markets would either be over-stocked at particular seasons, and entirely empty in others; or, what is equally bad, the articles would get into the hands of a few dealers, who, by mutual consent, might raise the price to any extent they pleased, notwithstanding any acts of parliament against forestalling, that could possibly be framed.

There is one particular description of farms which ought to be taken notice of here; these are in some places called *Led-farms*, in others, *Grass-farms*. Many farmers rent one or more large farms in different parts of the country, which are managed by an overseer. These are, the writer conceives, for the interest of the proprietor, because he generally receives a higher rent than could be afforded, were the farmer's family to be maintained from the profits of any of them alone; a great proportion being also allowed to remain in grass, the lands must be in an improving state. The farmer, after paying the extra rent, and the wages of

an overseer, still retains that proportion of profits which renders the renting of such farms an object to him; but, when it is considered that the farmer's close attention to minute particulars in the management of a farm is absolutely necessary to make it to the highest degree profitable, it is by no means clear, that the greatest produce which such farms are capable of yielding goes to market. The great, and indeed the only solid objection against large farms is, in his opinion, the consequent depopulation of the country. This, it will be generally acknowledged, is a most serious evil, and ought to be guarded against as much as possible. The remedy, however, in Scotland, it is conceived, is easy, and in many places adopted; namely, by building cottages on the outskirts of the farms, and hiring ploughmen who are married, and have families. These men are allowed grass for a cow, and a small quantity of ground for cultivating grain, potatoes, and garden-stuff, in part of their wages. Were this plan generally introduced in both kingdoms, the grand objection against large farms would, the writer conceives, be in a great measure removed; the description of inhabitants would, no doubt, be changed, but the population would suffer no material decrease, and, at the same time, nearly an equal quantity of free produce would find its way to market, as in any other case.

The intelligent author of the corrected Report of the County of Chester likewise contends for the superior advantage of large farms on the following grounds. "Twenty or thirty acres of land cannot, says he, in the nature of things, furnish full employment to a farmer; nor is the profit which they afford by any means adequate to the comfortable subsistence of a family: a man, therefore, who enters upon a farm of this description, must either have some other occupation, to which he directs a great share of his attention; or must unavoidably be subjected to poverty, and all its concomitant distresses. In either of these cases, the disposition of the land cannot but be regarded as unfavourable to the general interests of agriculture; in the former, farming being made an object of secondary consideration, and frequently being very imperfectly understood, the cultivation of the land is seldom carried to its practicable length, and, consequently, a certain proportion of produce is virtually lost to the community; in the latter case, the evils resulting from a farm of this description are still more decided in their nature; since it will be generally admitted that no species of occupation can be beneficial in its consequences to the country at large, which is not so to the individual immediately concerned in it. The same reasoning will apply equally to farms of forty or fifty acres: wherever the extent of land is not sufficient to furnish full employment to the farmer, and a comfortable subsistence to his family, a certain portion of personal exertion must necessarily be lost, and the consequences must be unfavourable, whether considered individually, or in a national point of view.

"Another serious objection to small farms may be grounded on the difficulties they oppose to general improvements in agriculture. A farmer, entering upon thirty or forty acres, very frequently with a high rent, and little or no capital, cannot be expected to make any material improvement on his land, or to attempt experiments in cultivation, which are probably, expensive in the first instance, and uncertain in the results they may afford. All that he can do is to pursue the old-beaten track; to force out of the ground the payment of his rent, and a bare subsistence for his family, and fortunate may he esteem himself if he succeeds so far as to do this. On the other hand, the man who farms a considerable extent of land can pursue with vigour any

new modes of agriculture that appear likely to be attended with beneficial effects; the possession of a competent capital enables him to undertake, and put into execution, any improvements of which his farm is susceptible, till by these means his lands are brought to the highest state of fertility. The opportunity which is afforded him, of making one department of his farming economy subservient to another, is an additional advantage which the farmer on a small scale cannot carry into effect to any great extent. The latter too must necessarily expend on his land a quantity of capital greater in proportion than is required in a farm of more considerable size; he must have his cart and horses, his plough and his harrow, and every other agricultural implement, as well as his neighbour, though he has only thirty acres, and his neighbour eighty or a hundred. Reverting then to the well-established, and, indeed, self-evident axiom in political economy, that capital is most advantageously employed, when, with a given quantity, the largest proportion of produce is the result; it seems scarcely to admit of a doubt, that large farms are, in this point of view, greatly more beneficial to the nation at large, than those of small extent only.

"The principal objections to large farms are, he says, founded on the tendency, which, as already noticed, it is asserted, they have to diminish the population of the country, and to increase the price of provisions. It is obvious, however, he thinks, that both these objections cannot stand their ground at the same time. If the population of the country be diminished, while the produce of the ground is increased, or even while it remains the same in point of quantity, it is clear, that no increase in the price of provisions can take place; on the contrary, it would be natural to expect a very considerable reduction in this respect. As these objections against large farms may, however, be urged individually, it is proper that a distinct answer should be given to each of them. With respect to its influence on population, it cannot be denied that the consolidation of several small farms into one of larger extent might have the immediate effect of throwing a number of individuals out of employ; many of whom, from the inadequate demand for labour of other kinds in the country, would be necessitated to have recourse to emigration. But this effect could be of only temporary duration. If, in consequence of the diminished number and increased size of farms the improvements in agriculture became more extended, and its general state more flourishing, it can scarcely be doubted but that the ultimate effect in this change in the disposition of the land must be favourable to the population as well as to the prosperity of the country. The immediate effects of the adoption of improved modes of cultivation, and of the increased quantity of produce from a given proportion of capital, must be a diminution in the price of provisions. As a necessary consequence of this the price of labour must likewise be diminished; or, to speak in more general terms, an increased value would be given to the circulating medium; a circumstance highly favourable to a country, as it regards its commercial and manufacturing connections with other nations. The equalizing nature of commerce would, indeed, in process of time, restore this value to its accustomed level; but the impulse which had been given, meanwhile, to industry of every kind, could not fail to insure internal prosperity, and, consequently, an increase of population to the country. If this reasoning be accurate, there appears, says the writer, no grounds for doubting that the enlargement of farms, to a certain extent, at least, would be productive of essential benefit to the real interests of the nation; a trifling diminution in population might, perhaps, indeed be the immediate

result of the measure in question; but that the ultimate consequences of its operations would be injurious in this respect does not appear probable.

“The objection which has been urged against large farms, as tending to enhance the prices of provision, seems equally void of validity. The grounds of this objection are, that, by the enlargement of farms, the competition which exists between small farmers would be in a great measure lost, and a spirit of monopoly introduced in its stead. In answer to this, it may be sufficient to ask the simple question, why may not this competition, esteemed so advantageous to the country, take place among farmers who hold two, three, or four hundred acres of land, as well as among those who hold thirty or forty? That this is contrary to experience the writer can by no means allow. Wherever monopoly has been the immediate cause of an unusual high price of corn, or other necessaries of life, it must, he conceives, have been practised on a much larger scale than could be done by any combination of farmers in the country. In fact, a very slight consideration must prove the futility of any objections to large farms vested on these grounds. Supposing, for the sake of argument, that the farmers in one county or district should combine to keep their stocks out of the market, and thus to raise the price of provisions; is it at all consistent with probability to suppose that the farmers, in the neighbouring districts, would favour this scheme, by retaining their individual stocks; on the contrary, is it not more likely that they would immediately come forward to supply the deficiency in the market, and thus counteract the designs of their more avaricious neighbours? Indeed it appears a point so clear, that the same competition of interests must exist among large as well as among small farmers, that the writer apprehends no conclusion can be deduced from this circumstance which will not apply with equal force to both cases. If then this competition renders provisions cheaper where the farms are small, will it not have precisely the same effect where they are of large extent? And does it not appear highly probable, that a very considerable diminution of the price of provisions would be the consequence of the general enlargements of farms in the kingdom? This, as was stated before, must, in the natural course of things, be the immediate effect of improved modes of cultivation, and of an increased quantity of produce from a certain given expence of capital.” The able writer does not here by any means contend for an indefinite extension of the size of farms; but merely suggests that those of three or four hundred acres are superior, in point of advantage, to individuals and the country, to those of from thirty to sixty acres.

Small Farms.—It is contended by the first of the above writers that these are, no doubt, advantageous to the proprietors, in so far as the greatest number of British farmers are possessed only of slender capitals; and therefore, when small farms fall out of lease, several candidates immediately appear. The operations on the farm being for the most part conducted by the farmer's own family, the expence of hired servants is saved, and he is thereby enabled to give a higher rent than could otherwise be done, without changing the imperfect systems of agriculture, too commonly practised on farms of this description. The advantages in favour of the proprietors are, however, probably fully counterbalanced by the imperfect modes of cultivation above alluded to: the additional expence to which they are subjected by upholding farm-houses on an estate let in small farms; to which may be added, the very great extra charge which must unavoidably be incurred in inclosing and sub-dividing an extensive tract of land into small fields. It is, no doubt, for the

interest of such tenants, that there should be a great number of small farms. The limited extent of their funds, and their knowledge and influence in the scale of society, would put it totally out of their power to embark in large undertakings of this nature; and if all proprietors were to adopt the resolution of letting no farms under a certain size, then people, as often happens, would be forced to turn their attention to some other employment, by which they could maintain their families. In a national point of view, small farms are, the writer thinks, undoubtedly advantageous. Large cities and towns are confessedly inimical to the increase of population, and would, in time, be in a great measure without inhabitants, but for the constant and regular supply which the country furnishes. Small farms are not only in favour of population, but of the most valuable sort of population; as, in consequence of the share of education which many of them obtain, the children of such farmers become valuable acquisitions to the artist and manufactures. If, says the writer, small farms were entirely abolished, a great part of the occupiers must retire to towns, and engage in some branch of manufactures. At the commencement of every war our manufactures receive a shock, from numbers of hands being called off to serve their country in our fleets and armies. Were this supply to be drawn chiefly from the towns, which in this case would certainly happen, what then would be the state of our manufactures, that great prop of national prosperity? In a word, it is owing, in no small degree, to the distribution of so large a share of the country into small farms, that the proper equilibrium of population between the towns and the country so necessary to be preserved, is maintained. It is true, that owing to the number of persons of which the families of this class of farmers are generally composed, and the imperfect manner in which the lands are too frequently cultivated, a very small proportion of the great article of bread corn goes to market. But the no less necessary articles of milk, poultry, eggs, and, in many cases, fuel, are furnished to the inhabitants of the towns and villages in much greater quantities from half a dozen of small farms, than from one of six times the extent. To this list may also, the writer thinks, be added butter and cheese, with a few exceptions only, where dairy-husbandry is practised on a large scale. It would, the writer conceives, be extremely difficult to determine which of the sizes of farms before mentioned are in every point of view most beneficial. There is, however, as has been already noticed, no occasion to hesitate in deciding, that a variety in the size of farms is not only for the interest of all concerned, but absolutely necessary for the prosperity of the state. Were the farms all small, the population of the country would exceed the due proportion of the towns, and the quantity of provisions which it would be necessary to import would be immense. If the country was wholly divided into large farms, and unmarried ploughmen principally employed, as is the case at present, the towns would be overstocked with people; and unless the prices of cheese, butter, milk, eggs, poultry, fuel, &c. were advanced, so as to make it an object to that description of farmers to send them to market, a very scanty supply would be furnished. The diversity in the size of farms in the island is, says the writer, no doubt in favour of, and must be agreeable to, the farmers; for, as they differ in knowledge and enterprise as much as in the extent of their capitals, they will naturally consider that farm as of the most proper size which is upon the whole best suited to their particular circumstances and situations. Farms of the largest extent, the management of which a farmer is able himself minutely to superintend, must necessarily prove the most profitable; therefore, were

the knowledge, enterprise, and capitals of farmers all alike, large farms would be considered by them as of the most proper size. There is, however, no view of the subject, by which it will be found that any one size of farms would be generally advantageous. On the contrary, it is clear, the writer thinks, that the greater variety there is in the extent of farms, provided that variety is general over every district in Great Britain, the more extensively will the general interests of the nation at large be promoted and brought forward.

In considering the controversy respecting large and small farms, Mr. Marshall remarks, that those who are in favour of the first are chiefly men of public spirit, who have turned their attention to agriculture; and having found, or perceived, that farms of magnitude, conducted by men of judgment, spirit, and capital, abound in corn and cattle of the highest qualities, have concluded, he thinks, without any further examination, that all farms should be large. Those supporting the latter position, with equal pretensions for the public good, consist, he supposes, of minor gentlemen, the clergy and other professional men, tradesmen, and others in middle life, who live in towns; and who, finding the prices of poultry, eggs, and other good things, greatly enhanced of late years, imagine that the modern enlargement of farms must be the cause, consequently call out loudly for a division of large farms; in order, it may be inferred, that articles of luxury may become plentiful; not regarding, or perhaps not knowing, what an expenditure of poor men's food is occasioned by the rearing and fattening of poultry. The same barley, or other grain, which has been used in rearing and fattening a fowl, to supply one dish of an epicure's dinner, would have furnished a labourer's cupboard with bread for several days. But admitting what is obvious, that farms of magnitude, cultivated by wealthy and skilful men, furnish the markets with a greater proportion of the common necessaries of life, than small ones in the hands of poverty and ignorance, it is but common prudence to examine into the effects which would follow a general enlargement of farms, to be managed by wealthy men; and to conceive how the markets would be supplied, under such a regulation, before it be carried into effect. If at present (1801), when the country contains farms of all magnitudes, and cultivators of all descriptions, there is a general cry against farmers, for keeping back their corn from market, what evil and outrage might not be expected were all the lands of the kingdom in the hands of the wealthy? If the prices of grain after harvest should not meet their expectations, they would, in consequence, defer to thresh out more than for their own uses. And although they might have cause of repentance the ensuing summer, this would not relieve the distressed of the famished poor in the mean time; while, on the contrary, were all the farm lands of the country in the hands of the needy, the reverse would be the consequence. Presently after harvest, the produce would be hurried to market too fast for the consumption, and the surplus would necessarily fall into the hands of dealers, who, besides reserving on all occasions an allowable profit, would have it in their power to fix their own prices during the summer months. Of course either of these extremes would be productive of serious evil. What the community require, with respect to farm produce, is to have the markets regularly supplied by the growers, the immediate producers, whether of vegetable or of animal food; without its passing through the hands of middle men unnecessarily. Hence it is evident, that to obtain a regular supply of the corn market by the growers themselves throughout the year, cultivators of different descriptions are requisite; needy men,

who want an immediate supply of money, after harvest, to pay servants' wages and Michaelmas rents; men without affluence, who thresh out their corn in the winter months; and opulent, purse-proud, speculative men, to supply the markets during summer and early autumn. And this most desirable order of things the country happily enjoys at present in a considerable degree. Nay, even admitting that the higher classes, who reside in towns, are entitled to the indulgence of luxuries out of the produce of lands, we still perceive the propriety of a gradation of farms; inasmuch as it furnishes large farms to feed the poor, and small ones to pamper the rich. Though, in a general view of the country in this point, no great alterations are requisite; yet, when examined in detail, it admits of some improvement. There are districts which abound too much in small farms, others in large ones, and some in farms much too large for accurate management in any way. And if the subject be viewed in the light of good government, and the permanent welfare of the country, a similar gradation in the sizes of farms appears to conform with right reason. The tenantry of a country may be said to occupy the wide space in society which intervenes between labourers and men of landed property; and surely they ought to form a regular chain between them. But make the farms of the country either uniformly large, or uniformly small, and a number of links would be wanting. In the former case, particularly, a wide breach or chasm would be formed, a void space between a numerous peasantry and their petty lords; a state of civilized society this, which has no foundation either in reason or sound politics, which require a regular gradation from the peasant to the prince, and from the highest to the lowest in society; such a one as we fortunately find in this country at this time. And viewing the subject in a moral light, the present order of things appears to be nearly right. If farms were either uniformly large, or uniformly small, industry, frugality, and emulation (the sinews and nerves of society,) would, among the lower classes in agriculture, lose their stimulus. If a farm servant or a labourer saved a few pounds, or had fifty or a hundred pounds left him, he could not employ them in his own line of life. He would either dissipate them, live on them as an idler, or carry them into some other line of business. Whereas at present, at least in districts in which farms of the smaller sizes still abound, there are many instances of servants of the lowest order rising to affluence, merely by the help of their own industry, frugality, and a natural spirit of emulation, cherished and led on by the gradation of farms.

But as *large* and *small* are merely comparative terms, "the extent of largeness, or greatest size, is the chief consideration; and this depends, in some measure, on the nature of the lands to be occupied, and the particular plan of management to which they are subjected. For it may be safely assumed, that no man ought to occupy more land than he can personally superintend. But in a district applied to sheep-walks farms of size are required; especially in a bleak or open country, where they require a constant attendance. A shepherd will take care of two or three hundred sheep as well as of a smaller flock. And an active sheep farmer, who knows his business, may well superintend several shepherds. Hence, in a passage of country applied wholly or principally to sheep-farming, individual holdings of more than five hundred pounds a-year (estimated according to the present value of money) appear to be politically admissible. Also in marsh land districts, applied to grazing, farms of magnitude may be admitted. The occupier in this, as in the former case, has only one object; and like a manufacturer of a particular article, or a man conducting one particular branch

of trade, he may extend his business to almost any limits. But, that in districts and situations in which the arable and grass-land management mix, or ought to intermix, the case is very different. For here not only markets, and the management of stock of various kinds require attention, but the seasons, or even a shower, may frustrate the best laid plan, and render the master's presence necessary to accurate management. Here servants, and workmen of various employments, working animals, and implements, call for hourly attendance in the field; while the different departments of the home-stall demand almost constant superintendance, equally to guard against negligence and dishonesty; in the winter season more especially; to see that every grain of corn, and every handful of fodder, is applied to its proper use; and that no waste, even of manure, is suffered to take place. During the spring and summer months the corn farmer's time and attention are more required in the field; to see that every perch of ground he occupies is applied to some profitable purpose, or is put under a course of preparation for future crops; as well as to defend existing crops from enemies, whether animal or vegetable; to protect them equally from domestic stock, vermin, and weeds. In harvest his constant and active exertions are called for; not only to preserve his ripened crops, as much as in him lies, from injury by the weather, but from spoil and waste, by the carelessness of work-people in the various operations which they must necessarily undergo. And in autumn his most serious thoughts are wanted to look forward to the general management of the ensuing year. All these attentions, and innumerable others, the public have a right to expect from the occupiers of lands, in a country whose appropriated lands have been found by many years experience to be insufficient, under the present imperfect state of agriculture, to supply its inhabitants with the common necessaries of life. Thus, seeing the weight of care and forethought which every sufficient husbandman has to sustain, we may venture to conclude that there are few men who have attention and activity enough to manage politically more than five hundred acres of land, in a state of mixed cultivation, and worth, according to the present rental value of lands, five hundred pounds a-year; even though they lie compactly round one central farmery. It is not here meant that there are few men who are able to manage more than 500*l.* a-year with profit to themselves. Many a man gets rich with three times the property under his care; and lying perhaps in three distinct farms. But no wonder, for he may be said to be receiving three men's incomes, with only one family to maintain. If, through the inaccuracies and inattentions of management, he lose even half what two other occupiers would have gained, still he is doubling his own income, by holding three instead of one farm. He gets two profits, and the community lose the third."

It is further supposed that a farm of 500*l.* a-year, which is composed of inferior lands, as those which are worth ten shillings an acre, is too large for one man to manage politically. A thousand acres lie too wide for one set of farm offices. The great length of carriage of crops and manure, and the travelling of plough-teams and workmen of every description to distant grounds, occasion a waste of labour, beside the waste of ground by lengthened roads and drift ways, and the injury done to stock by a length of drift. And no man can superintend two home-steads with political accuracy. But to excite emulation, and to encourage men of capital, education, and spirit, to enter into, and persevere in the profession; to study its higher departments, and take the lead in practical improvements, a small proportion of corn farms of five hundred pounds a-year may be politically

eligible. It may be added that the lower extremity terminates in the cottage and its cow ground; which may be set down at five pounds a-year. This, however, is a sort of farm which, like that of five hundred pounds a-year, ought to be kept within bounds as to number, this being of the two the least political; unless as the lowest step of the ladder of emulation. Thus, in a public light, it appears that the sizes of farms on lands of good quality, and adapted to mixed cultivation, ought to extend from those of five pounds to those of five hundred pounds rental value. But that the proportional number towards each extremity ought to be small. For to the writer's mind it appears evidently, that it is from farms of the middle sizes, as those of one to three hundred pounds a-year, the community receive the greatest proportion of the common necessaries of life. It is chiefly among the cultivators of farms of these sizes that we find the three principal requisites of good husbandry, namely, capital, skill, and industry. On farms below these sizes, the first, and frequently the second, is wanting; and on those of higher magnitude the last is apt to be deficient.

On Laying out Farms.—In this business there is considerably more difficulty than is generally supposed. But it has been stated by a late able writer on landed property, that much depends on the natural and acquired circumstances of the different lands or estates. The situation, the soils, the present state of occupation or system of management, and the present size of the farms, require to be maturely studied, and duly weighed, before any effective steps can be safely taken. It is an arduous task to alter the arrangement or general economy of an estate with profit and credit to its proprietor; even when the whole is rented at will, or from year to year. Where leases exist, difficulties are increased; and the day of improvement is placed at a greater or less distance. Nevertheless, a man who has at his heart the permanent good of the estate which he possesses will look forward, and concert plans for its future improvement and welfare. And as an estate which is judiciously laid out into compact farms, of suitable sizes, is worth considerably more by the year than one of the same intrinsic value, whose lands lie scattered and intermixed in farms of improper sizes, he will not fail to set on foot a plan of reform, which requires nothing but attention and perseverance to be accomplished. The first attention required is to study its natural characters, to view it as in a state of nature, and without inhabitants; marking the elevation and turn of its surface, whether it consists of mountain, upland, vale, or water-formed lands, and ascertaining at the same time its soils, sub-strata with regard to their absorbency or retentiveness; thus determining to what uses its several parts are adapted, whether to sheep-walk, or grazing grounds, meadow lands, or mixed cultivation. Having surveyed the sheep-walk and grazing ground, he should trace the natural and fortuitous lines of the culturable lands; as the feet of steep hills, the ridges of uplands, large rivers, public roads, &c. &c. these being data which cannot well be disregarded. Where a blank is given, such as an extent of newly appropriated lands, to lay them out into what may be termed natural farms, of such sizes as will bring the most permanent rent at the least expence of buildings, yards, private roads, drift ways, and fences. And to this end the most natural, or eligible sites for farm-steads, are to be sought for with attention; laying to those which are the most eligible such lands as by natural situation, and natural quality, belong to them. Thus laying out the lands to the best advantage; and producing farms of different sizes; thereby inviting good farmers, with different capitals, to settle upon the estate. The principal requisites of a home-stall, for a farm in mixed cultivation, are shelter and water, for domestic purposes as well

well as for the use of yard stock ; with some permanent grass ground below the yards, to receive the overflowings of the dung basons, that nothing of manure may escape or be lost from the premises. Where lands lie in a shelving situation, it is generally desirable to have the home-stead near the mid-way of the slope. Thus gaining a central situation, and having lands above as well as below the yards ; so that neither the whole of the crops, nor the whole of the dung, may require to be drawn against the hill at a busy season. A dip or shallow valley, with a natural stream falling down it, and with lands in the lower part of it, which are capable of being converted into watered mowing ground, is in general a desirable site for a home-stead.

However, when an estate is already inhabited, and laid out into farms, with the farm-steads fixed, and the buildings substantial, it requires much thought and some time to make great alterations, either with credit or profit to its proprietor. Where the lands of different farms lie scattered and intermixed with each other, as they too frequently do, either through circumstances that were unavoidable perhaps at the time they took place, or through improper indulgencies to favourite tenants ; or through the ignorance or negligence of managers ; or the less pardonable design of those who have had an interest in the dissensions which the intermixture of lands seldom fails to create ; something may generally be done towards lessening or remedying the evil ; even where parts of an estate are under the temporary alienation of leases ; through the means of amicable exchanges between tenants. This is a species of improvement which ought to be sedulously attended to by the managers of estates, as lands which lie compact and convenient to the home-stead are worth considerably more to an occupier than those of the same intrinsic value, which are scattered at a distance, so that by this sort of exchange a two-fold advantage comes home (or will come at the expiration of the lease or leases) a clear income to the proprietor ; beside rendering the management of the estate more easy and pleasurable. And in cases where the entire estate is rented from year to year, the consolidation of farms may be effected with less difficulty, and the two-fold advantage be immediately enjoyed.

It is advised, in order to conduct the business of a general arrangement, regulation, or reform of an estate which is already laid out into farms, with full effect, to study it as a blank, in the manner as if it were in a wild or unappropriated state ; to ascertain its natural or most eligible home-steads, and the lands which, by situation, belong to them ; then to examine the existing farm-steads, buildings, roads, drift ways, and inclosures, and by duly considering the aggregate of facts thus adduced, to endeavour to make out such a plan of improvement as will secure the greatest clear and permanent rent, at the least expence, without driving from the estate the deserving part of the existing tenantry. And a plan of reform being fixed, let the intended farms be outlined and coloured on a general map of the estate ; and this done, let each be separately delineated on a small map suited to the pocket, that the proposed arrangement may be continually under the manager's eye, whether in the business-room or upon the estate. This method of conducting a plan of reform, which has been repeatedly experienced, is equally applicable to an estate which is wholly at will, and to one which is partly under lease ; every favourable opportunity being taken as the leases fall in, to carry the plan into execution, always keeping it in view from the time it is formed ; and, in consequence, letting down buildings, or repairing them in a temporary way, where they will not be wanted, and keeping

them up, in a substantial manner, where they will be eventually required. And where the farms are too large, or the farm-steads very improperly placed, but where the existing buildings are yet in a substantial state, it requires to be calculated whether the increase of rent by the proposed alteration will pay six per cent. for the money required to be laid out in making it, taking, however, into the account, the superiority of new buildings. The erecting of an entire range of farm-buildings, with the requisite appendages, is an undertaking which, in private economics, demands mature consideration. There are cases, however, in which it may be effected with profit, and many in which it may be done with credit and respectability to those employed.

Where the farms are too small, suitable aggregations should be made, and each of these be coloured on the maps as one farm, the alterations being afterwards made as circumstances may direct ; preference being ever given to the most deserving managers, and every fair opportunity taken to dismiss the undeserving. By this easy means, giving the most impressive lesson on good management to the tenantry of the estate, the best effects are produced in this way.

But it is to be further remarked, on the subject of laying out farm-lands into suitable tenements, that although compactness of form and centrality of home-stead are always desirable, they are not the only objects to be attended to. The specific qualities of the lands of the estate are another subject of consideration. If the lands of an estate are naturally adapted to different purposes, as cool strong lands, fit for perennial mowing-grounds, especially if they can be profitably watered, and dry uplands that are suitable for mixed cultivation only ; a portion of each ought, according to long-established ideas, to be included in every farm : a principle this, however, which is generally destructive of the compactness of form. And a more modern opinion is, that perennial grass-lands are not at all necessary to profitable farming, cultivated herbage and roots being equal to all the wants of modern husbandry. Nevertheless, where a suit of meadow and pasture grounds can be properly united with arable lands, it will generally be for their mutual benefit to unite them. This, however, is to be done by a general arrangement, not by making up disjointed farms with lands lying in distinct and perhaps distant parts of a parish, as we not unfrequently see. For the extra carriage of crops and manure, or the unnecessary and injurious drift of stock, and the waste of manure thereby incurred, together with the mischiefs arising from stock being left at a distance from the eye, and the time lost in passing, on every occasion, between distinct parts of a scattered farm, eventually fall on the proprietor. In fact, where an estate consists of arable lands of different sub-strata, so that some parts are retentive of moisture and others not, it ought to be the aim of the planner to include portions of each in every farm, in order that each occupier may have a regular succession of employment for his teams in a moist season, and in order that, whether the summer proves wet or dry, he may not be destitute either of grass or herbage. And in districts of a mixed nature or strata, where a variety of lands are found, this, by due attention, may not unfrequently be done, without much deranging the compactness of the farms, or the central situation of the home-steads.

In laying out the particular fields of a farm, it must depend greatly on the situation, soils, and the system of husbandry to which they are the most suited. There are, however, certain points or principles that deserve attention in the business. The great benefit of having a water-meadow below the farm-stead has been already seen. But where a sufficient breadth of land cannot be commanded in that situ-

ation,

ation, to become an object as a mowing-ground, to be watered superficially, the yard liquor may be expended with profit on a smaller plot, converted to a farm garden ground, to be watered by means of parallel trenches, formed across the slope or descent of the ground to receive it, in the manner described below, thus conveying the nutritious particles which have escaped from the dung-yards immediately to the fibrils of the plants while growing, or to the base of the soil into which they are required to strike. And on every farm in which there is not a sufficiency of watered garden ground, a garden field of some acres for the culture of green herbage and roots with the plough, for horses, cattle, and swine, as well as for culinary purposes, ought to be laid out near the farm-yard. A pasturing paddock or two near the house is likewise a requisite appendage to a home-stead; as a fiddle-horse pasture, and as a hospital ground for sick or ailing stock.

And dairy-grounds, where the dairy is a principal object, ought, in like manner, to be laid out near the house, and open into the lobby, green, or milking-yard. But the meadows or perennial mowing grounds may be laid out at a distance with better effect, as it is always convenient to stack hay in the field of its growth; and if not wanted near the spot, it may generally be brought home, with less inconvenience and expence, at almost any other time than amid the bustle and hazard of hay-harvest.

Arable lands, on the contrary, cannot lie at a distance with propriety; as, in this case, not only the crops and manure require a length of draught, but the time taken up by the plough-teams in passing to and fro, is a further inconvenience. Nor should the pasture grounds for working stock, whether oxen or horses (where these are pastured), be far from the home-stall. But those for store cattle and sheep may lie at a distance with less impropriety. Woodlands, such as coppice-grounds, may also lie at a distance. The writer thinks it clear, from this sort of distribution requiring much of the land contiguous to the farm-stead, that there is an impropriety in very large farms, and an advantage in farmeries being centrally situated.

In the business of laying out arable lands, the number of fields must constantly be regulated by the plan of management proper to be pursued, and by the size as well as the nature of the lands of the farm to be laid out. Where, as just noticed, lands of opposite qualities, as those which are retentive of moisture, and those that are absorbent and open, are contained within it in sufficient quantity, two sets of arable fields should be laid out, that the works of tillage and sowing may not be liable to be interrupted by a shower, and that the stock of the farm, be the season wet or dry, may not be distressed for pasturage. Likewise on a large farm, the lands of which are uniformly absorbent, and consequently adapted to the turnip husbandry, it is proper to have more than one set of arable fields, in order that a sufficient choice of contiguous or near fields may be had, over which to distribute the turnip crop (where this mode of husbandry is practised) and thereby prevent an unnecessary length of carriage. But on rich retentive lands, in situations where an ample supply of extraneous manure can be procured, or where such lands are united with marsh and meadow grounds, to furnish a sufficiency of hay and pasturage, without the assistance of the arable lands, one set of arable fields may be sufficient; four or five fields or divisions being all that are necessary, at least on a small farm. But that on the generality of English farms, on which a number of manure-making stock are necessary to be supported by the arable lands, a greater diversity of fields is required; as in this case it is necessary that the lands should lie some

years in a state of cultivated herbage, between each course of arable crops, according to its nature, and the time it will lie profitably in a state of grass, as two, three, four, or five years. Consequently, if the arable rotation occupy the land four years (taking three crops of corn with a fallow-crop, or fallow intervening), the number of arable fields required for one set will be six, seven, eight, or nine. However, much depends in all cases not only on the nature of the land, but on the calcareous and other extraneous manure, which may be procured, in greater or less quantity, in almost every situation of a farm.

It may be observed, that the sizes of arable fields may seem to be given in the number. But on a large farm, in a bleak situation, and on which it is proper to keep a numerous flock, it may often be found requisite to sub-divide the arable divisions, not only for the sake of shelter, while the lands lie in the state of herbage, but for the convenience of separating and shifting stock. Hence it is incumbent on the planner of a farm to weigh well the various circumstances that belong to it, as on these only the true size and number of arable fields can be calculated. Even the shape of an arable field is not a thing of arbitrary choice. It ought to be regulated by the shape of the farm, and by the roads and water-courses running through it, as well as by the nature of its lands, the turn of its surface, and its aspect or exposure. A perfect square, or long square, is a desirable shape, where circumstances will admit of it. Crooked lines and irregular figures are inconvenient in the operations of tillage, and should of course be avoided. Two sides at least ought to run parallel to each other. And it is equally, or more desirable, that each field should have a uniformity of soil and sub-soil, as on these depend the uses to which it is applicable; and it is at once unpleasant and unprofitable to have different parts of the same field under separate courses of management. Yet where the natural line of division is very irregular, it is improper to follow implicitly all its windings. The planner ought rather to draw a judicious line between the two, and the cultivator to alter the qualities of the lands, which happen to be unnaturally severed, by draining, manuring, and other necessary means.

And the direction of the fields should be the same as that in which the land ought to be ploughed for a crop, provided it be compatible with the given lines of the farm. On a level surface, or on one which is gently inclining, the direction of the beds of retentive lands that require to be laid up in round ridges ought to be nearly north and south; in order that the crops on either side of them may receive equal sun, and ripen evenly. Consequently, in this case, the fences which form the two longer sides of the quadrangle should take that direction. But where the surface is steep, this principle of direction must give way to another of greater utility. If the land is retentive, and the soil requires to be laid up into round beds, across the slope, the direction of the ridges must be guided by the face of the slope; and the fences, on the general principle, ought to take the same direction; observing, in this case, where circumstances will admit, to let the fences wind to the right of a person standing on the brink of the slope, and facing towards it; as the beds ought to take that direction for the greater ease in ploughing them. And where the face of a hill is steep, and the land absorbent, the soil requires to be turned downwards of the slope with turnwrest or Kentish plough; and the fences to be directed by the natural lines of the hill as much as possible.

In laying out cow grounds, grazing grounds, or other perennial pasture grounds, regard should be particularly had to water. And wherever good water is naturally found, or

can be conveniently brought by art, to that point, a pasture ground ought to tend, in order to enjoy the necessary supply as much as possible.

And in laying out water-meadows, where they are situated on sloping grounds, or the higher sides of which adjoin to upper lands, the main conductor (where a proper fall from the source of the water will admit of it) ought to define the outline of the meadow on that side; and the fence which separates the meadow lands from the dry grounds ought to run immediately along the upper side of the water-course; the two thus becoming natural guards to each other. But within an extended flat, or an extent of gently shelving meadow-grounds belonging to different proprietors, and where deep ditches are required to be sunk on the upper sides of the fences, to drain the lands that lie above them, the plan here recommended would be improper. But in the situations described above it is perfectly eligible, and ought not, in ordinary cases, to be departed from. And in concluding his observations on this interesting branch of rural economy, the intelligent writer suggests, that in regard to drift ways and private roads, where a public road runs through a farm, the more distant fields ought, under ordinary circumstances, to run into it, to prevent the interior of the farm from being cut up unnecessarily by carriages, or poached by stock, or laid waste by unnecessary private roads and drift ways, which increase the number of fences, and are made and kept up at considerable expence. And where public roads do not present themselves, private lanes are highly requisite, especially within large farms. It is obvious that all these circumstances require to be carefully considered by those employed in this sort of business. And it is suggested by the writer, that whether in laying out an estate or a farm, it is prudent to go repeatedly over the ground, with a map of unalterable data in one hand, and a list of desiderata in the other; and with the leading principles of the art in the mind, but without any pre-conceived general plan in view; ever letting the particular circumstances of the lands to be laid out determine the true points to be fixed, and the proper lines to be drawn; acquiring correct ideas of outline by enlarged surveys; and by more minute examinations, adjusting particular points. In this way farm lands may be laid out in the most easy and convenient methods for the purposes of their occupiers.

The nature of the fences, which may be most advantageously had recourse to under particular circumstances, will be more fully considered and explained in speaking of fences and inclosing. See FENCE, and INCLOSING of Land.

On hiring and stocking Farms.—Whatever the nature of the farm may be, there are a variety of circumstances which require to be particularly weighed and considered before it be finally engaged by a tenant. The author of "Modern Husbandry" has remarked, that when a farmer has occasion to hire a farm, he should be equally careful to examine, on the one hand, all the advantages which it enjoys, and on the other, all the disadvantages to which it is subjected. By making a just estimate of both, and by comparing the result with the rent demanded, can he only be able to form a correct opinion respecting the equity of that demand. In making this estimate, he should discard equally from his mind that over-cautious prudence which is disposed to doubt of every probable advantage that may insure success, and that too adventurous temerity which is apt to overlook, or at least to lessen, real disadvantages, such as no future exertion of his can possibly overcome. The value of land, says he, depends no less on its fertility, whether occupied in tillage or pasture, than on its situation in regard to markets.

For this reason, an arable farm, in the vicinity of a large town, is worth a higher rent than one of an equal size and quality in a remote part of the country. For the same reason, namely, a superior advantage in regard to markets, a sheep or store-farm in the north of England yields a higher rent to the proprietor than one (but for the difference of situation) of similar value in the north-west of Scotland. In renting a farm, one general rule ought, he thinks, always to be attended to, namely, fixing on good lands. Over the kingdom at large, the rents paid for farms of this description are in general reasonable, when compared with what is commonly paid for those of more indifferent soils: The author of the "New Farmer's Calendar," however, well remarks, that it can obviously very seldom happen that a tenant, in want of a farm, can have the opportunity of choosing precisely that kind of soil and situation which may be deemed the most advantageous; in general, he must content himself with such as chance to be unoccupied; and these chances, in fruitful parts of the country, have never been of late years, and since the vast enhancement in price of all the fruits of the earth, very numerous. But the superior advantages of natural fertility and facility of cultivation are too plain to admit of question or argument: and nothing is more clear than the preference which ought to be given to good land at the advanced price, since the culture of barren land is infinitely more expensive, and the risk of crop nearly double: and what is of great force, from the influence of custom and local circumstances, the price of land in the most fruitful counties is frequently as low as of that in districts of far inferior fertility. An attentive observer, although not very conversant in the principles or practice of husbandry, can scarcely, he thinks, be deceived as to the general nature and degree of goodness of soil upon a farm; a comparison with the neighbouring farms, and their average products, will be a sufficient guide. Wherever, says he, is found considerable depth of mixed soil, even if natural fertility be deficient, art and culture will remedy the defect, and fully reward the labours of the husbandman. On the other hand, the most shallow and stony lands, from a natural richness in their light moulds, may be wonderfully productive. The luxuriance and deep verdure of the grass, the spontaneous growth of white clover, the tallness and fruitfulness of the hedge-wood, particularly hazel, the large size of the timber, and the height and substance of the straw, are all common indications of a strong and fertile soil: plenty of weeds, particularly thistles, although a popular, he fears, is but an equivocal sign, since the most barren land will also produce spontaneously abundant crops of those. It is much more prudent for a farmer, he thinks, to wait and look forward, than to engage himself upon a miserable barren tract, where the certainty or promise can be of nothing but everlasting labour and expence: such must be the case upon soils which are naturally poor; at the same time of insufficient depth, and abounding with flint or shingles upon sandy wastes, parched gravels, cold, acid, iron clays, boggy or poachy lands, to or from which there is scarcely access or passage during the winter months. Some such tracts we have in England; and of those held in hand an opulent and well-skilled proprietor can make a far greater annual profit than can be drawn from the labour of a needy and miserable tenant. The most profitable purposes to which these estates can be devoted are, he conceives, the growth of wood and of live-stock. A farmer who aims at obtaining his profits with the least possible trouble and risk, and without the burden of much live stock, must procure a rich light land-farm, with a sandy loam; on such a situation, without a moderate capital, and the example of

his neighbours before his eyes, he may, he thinks, set himself down in contented indolence, and yet grow rich. The case is widely different with him who engages with a strong clay, or, in the improvement of an exhausted or infertile soil; this will find an ample field for the most strenuous exertions, directed by a fair portion of agricultural skill, and ought to entertain no hope of very considerable success without the aid of a full flock of cattle. These observations are, he says, by no means intended to damp the ardour of aspiring husbandmen, who aim at raising a fortune and a name by the improvements of low priced land; for although, from the irregularity of rate *per acre* above hinted, the rent of land is seldom the prime cause of good or ill success, yet cheapness is a material consideration, when money is to be expended in gradual improvement. A farm at four or five shillings *per acre*, possessing within itself, or its vicinity, the permanent means of amelioration, will turn out a mine of wealth in the hands of an able cultivator, who, in the course of half his lease, will bring it to a level of fertility with the high-priced kinds of land.

There is, the same writer remarks, another point which merits attention, which is, the manner in which the farm was formerly cultivated. If it has been exhausted and run out by over-cropping, and requires fencing, draining, repairs of houses, lime, marle, &c. all which are to be effected at the tenant's expence, the rent payable to the landlord in such a case ought, he justly observes, to be very moderate, in comparison to what the tenant could, with equal propriety, afford to give, were he to enter on the lease when the farm was in a high state of cultivation and improvement. The difference here is, he says, much more considerable than the generality of proprietors or farmers are disposed to allow. For instance, a farmer who enters to the possession of a farm in a high state of cultivation, enters immediately to the greatest returns which that farm is capable of producing; while he who enters to a farm which had been previously exhausted by improper management, finds himself under the necessity of expending large sums on the improvement of it; when, at the same time, his returns for the first few years are probably inadequate to the expence incurred in carrying on even the ordinary operations. In the one case, the farmer enters, from the beginning of his lease, on the receipt of his annual profits, moderate as they may be; and in the other, he is sinking a large share of his capital, for which his returns must at best be slow. If this loss of capital and interest, the additional expence of cultivation, and the inferiority of crops for the first seven or eight years are fairly calculated, it will, he thinks, be found that the farmer who, under these circumstances, pays twenty shillings the acre for a lease of nineteen years, has as high a rent upon the farm, during the whole lease, as the other who pays nearly double the sum.

One other particular of great importance ought, he says, to be mentioned, namely, the impropriety of renting a larger farm than the capital which the farmer possesses will properly stock and improve. When this happens, the tenant puts it out of his power to adopt the proper plans by which he could turn the farm to the greatest possible account. He becomes cramped in carrying on the ordinary course of business, and is frequently obliged to dispose of his crops at an under value for ready money; and therefore cannot purchase lime, marles, or other means of improvement, which are not to be had without the expenditure of considerable sums. Although it will not hold in every case, yet it may be asserted as a good general rule that, in the improved parts of the kingdom, four pounds *per statute acre* is a moderate sum for stocking a farm, without including the expence

of buildings, repairs, fences, drains, &c. If, therefore, a farmer should be so imprudent as to rent a farm of one hundred acres when his capital does not exceed 2000*l.* he must be fortunate indeed in times and seasons if he has not occasion to repent of his temerity.

And by the same author it is observed, that it is doubtless a sound general maxim for a man to hire no more land than his capital is amply sufficient to stock; the disadvantages and dangers of a want of money, in all concerns, are too common and well known to be for a moment insisted on; the farmer had indeed better be somewhat short than burdened with too large a tract of land; for in the latter case, if he be judicious and master of his profession, he may well employ his surplus capital in a superior and garden-style of cultivation, and as a dealer in live-stock. But it is yet a grating thing to an industrious man to refuse a promising bargain, particularly of the low-rated kind, on account of its extent, the very consideration which must animate his hopes; and when such a one has made the leap, instead of the common method of aiming at the culture of the whole in a slovenly, insufficient, and unprofitable manner, it would probably be much the safest plan to crop only such a portion of the farm as his means would compass with good effect, seeking but to pay the rent and live, and, by dint of frugal and persevering industry, to make an annual addition, until, in process of time, the whole farm should be in a flourishing state of cultivation.

The writer cannot forbear, he says, in this place, copying an important remark from Mr. Young, which, in truth, he has repeatedly seen verified. Farmers frequently adopt no other rule respecting the rent they will give than mere custom, nor attend to any other criterion of estimating the worth and qualities of land, than that of the good or ill success of the last occupant; than which there can scarce be a more fallacious method of forming a judgment. He has known many farms, on which fortunes might have been obviously, and afterwards were really made, lie untenanted, and taken afterwards with the utmost apprehension, purely because an ignorant, wretched, and needy tenant had failed therein. Many fine farms may now be pointed out, on which the old tenants starved, and brought their families to the work-house, at seven shillings an acre; whilst their successors (times still the same, or worse) made their fortunes by being rented at eighteen. It is a cruel disgrace, or rather a very laughable piece of burlesque, for a man, pretending to common discernment, to regulate his judgment and his conduct from motives like these. If fair land be offered at a fair rent, it is well; if an additional rent be demanded, and a man, after the nicest scrutiny, both actual and probable, can discover money's-worth in the terms, he must be unwise to forego the occasion. Some landlords, from a magnanimous and princely spirit, have supposed it beneath their dignity to raise their rents; and certain tenants, mistaking the nature of this bounty and the question in general, are extremely averse to the very idea of any advance, not considering that it is a question of property, and that landlords, as well as tenants, have all possible right and reason to make a fair advantage of the growing prosperity of the times. Those men who are averse to a distant removal, by which they might obtain a far superior situation, from the single consideration of present loss in the disposal of their stock, do not, the author thinks, well understand their own interest. A present trifling loss, which the farmer's circumstances can well bear, ought not to weigh against a permanent and growing profit; this motive, however, confines many a farmer to a poor and barren spot: men are,

absolutely afraid of fair calculation, as they often are of their best friends.

In the examination of a bargain, he observes, the objections may be of a two-fold nature; such as may be held insuperable; or such as may admit of compensation, either in proportional abatement of price, or in the goodness of the prospect. As to the first, on perceiving them, a man instantly turns his back on the business. In his ideas, tithes taken in kind; a number of common carriage-ways, or paths, and the lands intersected by other property; far distant markets, and roads impassable in winter, are objections of that class; and granting pecuniary compensations can be made, there can be none found adequate to the anxiety of mind which must be inevitably suffered in such a situation. Of these defects, with which a person is content to put up, he ought to have a very correct estimate, that he may really know when an offer is made deserving of his acceptance; an important point, where many contracting parties fail. Every practical man knows that in bargaining, as in angling, there is a critical moment, a time to strike, which may never return. The heads already enumerated will furnish matter for an estimate in writing, taken on the actual survey. Thence will appear the sums necessary to be expended, and the deduction of rent, or other recompence, such expenditure will fairly warrant. In this estimate, the state or nature of the fences should be well considered, and also the injuries done by game in some instances in particular situations.

It is on the whole concluded, that the farmer who intends to hire a farm, should consider whether the land be rich and fertile, and the climate favourable; as well as whether the farm be well situated in regard to markets; properly accommodated as to houses; has easy access to lime, marle, and other manures; and whether the price of provisions be fully on a par with the rate of labour.

Having adverted to these different circumstances, and fully pointed out the advantages of a perfect examination of the soils, so as to ascertain their natures and qualities, as to stiffness, moisture, exposure, levelness, slope, stonyness; what draining, manuring, fencing, &c. may be wanted; and likewise the roads, distance of markets, prices of commodities, labour, the state of tithes, and poor rates; Mr. Young advises that one general rule in hiring a farm should not be overlooked by the farmer, which is, to fix on good land, and he can scarcely give too much for it; but that, for poor soils, the least rent is sometimes too high to be consistent with profit. By poor soils, however, are not to be understood such as have a command of lasting manures, that work great improvements; nor waste-lands, which, under that false denomination, are often found the most profitable of all. It is supposed that the found, mellow, rich, putrid, crumbling, sandy loams, are of all soils the most profitable; such as will admit tillage soon after rain, and do not bake on hot gleams of sun coming after heavy rains, when finely harrowed; such land is better worth forty shillings an acre, than many soils deserve five.

Next the stiff loam, which is nearest allied to brick earth; this, till drained, is in general an unkindly soil, without plenty of manure.

It is known in winter by being very adhesive upon walking over it; is long in drying, even where little or no water is seen upon it; for which reason it is generally late in the spring before it can be ploughed. When quite dry, it breaks up neither so hard and cloddy as mere clay, nor near so crumbly and mellow as good loam. If it be in stubble, it is apt to be covered with a minute green moss. There are many varieties of this soil, but all agree in most of these circumstances, and in being what the farmers call poor,

cold, hungry land. When hollow-ditched, and greatly manured, it yields any thing; but those who hire it should forget neither of these expences.

The gravelly soils are numerous in their kinds, and very difficult in their natures. Warm, dry, found gravelly loams, are easily distinguished in winter. They admit ploughing all winter through, except in very wet times; always break up in a crumbly state of running moulds; and if in a stubble, will dig, on trial by the spade, in the same manner. If under turnips, it may be perceived by walking through them, that it will bear their being fed off. But the wet cold spongy gravel is a very bad soil; it is known in winter by the wetness of it; and in spring, by its binding with lathy showers. It rarely breaks up in a crumbly state, or shews a mellowness under the spade. Very expensive drains greatly correct its ill qualities; but it requires a prodigious quantity of manure to fertilize it. And other gravels are so sharp and burning, that they produce nothing except in wet summers; but such are known at any season of the year.

And the sand-soils are as various as the gravels, and are all easily discoverable in their natures. The rich red sand, is, it is believed, as profitable a soil as any in the world. It has at all seasons a dry foundness, and at the same time a moisture without wetness, which secures crops even in dry summers. The spade is sufficient to try it at any season of the year. The light sandy loam is likewise an admirable soil; it will bear ploughing like the preceding, all winter long, and appears quite found and mellow when tried with the spade. If it lie under a winter fallow, the best way of judging of its richness is to remark the state of the furrows, and the degree of adhesion in the soil. Stiff land, being dry and crumbly, is a great perfection; and sand, being adhesive, is an equally good sign. Consequently when the farmer views a light sandy loam, whose found dryness is acknowledged, he may presume the soil is rich, in proportion to its adhesion. Where it falls flat in powder, and has no adhesion, it is a mere sand. The white chalky *marm* is often cold and wet, will not bear ploughing in winter, unless the weather be very dry or frosty; runs excessively to mortar, with a heavy shower when in a pulverized state. It is a cold soil of little profit, is supposed, except with peculiar management. It is believed to answer best when laid down in a dry state to saintfoin. The farmer is advised to lay it down as a maxim, that strong, harsh, tenacious clay, though it will yield great crops of wheat, is yet managed at so heavy an expence, that it is usually let for more than it is worth. Much money is not often made on such land. The very contrary soil, a light, poor, dry sand, is very often indeed in the occupation of men who have made fortunes. Some permanent manure is usually below the surface, which answers well to carry on; and sheep, the common stock of such soils, is the most profitable sort he can depend on.

All the stiff sorts of soils are viewed to most advantage in winter; the general fault of them is wetness, which is in the greatest excess at that season of the year. If the fields be level, and the water stands in the land, notwithstanding the furrows are well ploughed and open, it is a sign that the clay is very stiff, and of so adhesive a nature, as to contain the water like a dish. It is likewise probable, that draining may prove insufficient to cure the natural evil of such land. This kind of soil likewise shews itself in the breaking up of stubbles for a fallow; a very strong draught of cattle is then necessary to work it. It breaks up in vast pieces, almost as hard as iron. When it is worked fine, it will run like mortar, with a heavy spring or summer

flower. These soils will yield very great crops of beans and wheat, &c. They must, like others, be cultivated by somebody; but it is advised to have nothing to do with them, where it can be avoided, nor ever to be captivated with seeing large crops upon the land, for the farmer does not see at the same time the expences at which they are raised. Peat, bog, moor, and fen, in many variations, are very profitable; but the expences of improvement demand a calculating head. The vicinity of lime or marl is here of great importance.

In grass lands the marks for judgment are different. They are, in the writer's opinion, best examined by attending, first, to the circumstances in which they are most deficient; and then to such as are in their favour. The more seasons grass-fields are viewed in the better, though any one is sufficient for a tolerable judgment. One great evil attending these lands is, that of being too wet; the signs of which can never be mistaken or overlooked in any season of the year. In winter it is at once perceived by walking on them; at all times of the year by the herbage which generally abounds on them, such as rushes, flags, and a great quantity of moss; and also by the colour of the grass, which is mostly blue at the points; sometimes of a dirty yellow hue, and always coarse. If the soil be the first described, stiff clay, and the surface level, the evil will be very difficult of cure; if of the other sort of clay, or stiff loams, draining will have great effects in improving it.

Grass fields on gravelly soils are, if the gravel be sharp, very apt to burn in dry summers; but they give great and sweet crops in wet ones, provided that the land be a gravelly loam. An *absolute* gravel should never be under grass. A farmer should not, however, regret having a pasture or two of this sort in his farm, as they are of excellent use in winter for feeding sheep and lambs on with turnips or other food of the same kind.

With regard to the low meadow lands, whatever the soil may be on the banks of the rivers and brooks, they are in general good, but often subject to the misfortune of being overflowed in summer, which not only ruins crops of hay before they are cut, but carries them away, perhaps when just made. And many grass-fields on all soils consist of so bad an herbage, as to be of little value. Made up of weeds, and the worst and coarsest of grasses, if a landlord will not allow such to be ploughed, the farmer should minute down the rent accordingly. This fault is visible at all seasons, and cannot be easily mistaken. But a river that does not overflow, running through a farm, is a very favourable circumstance, as it indicates a probability of all the grass-fields being well supplied with water for cattle, and other animals.

Besides the circumstance of well proportioning the size of the farm to the extent of capital as already noticed, there are several others which should be well considered in fixing upon farms, such as their being compact and convenient in the fields, which are too often overlooked by farmers who are about to rent land. If they attended to it as much as their profit required, we should, the writer thinks, see landlords reforming their estates, in this particular, more than many do at present. There is not, it is supposed, a more expensive, perplexing circumstance in a farm, than that of the fields being in a straggling, disconnected situation. The disadvantages are obviously numerous and striking.

The covenants of leases should likewise be well attended to, as landlords are very often tenacious of those which they have usually inserted in them; so that a farmer, when

he approves of a farm, and agrees to the rent, may not find the conditions of tenure proposed to him, such as are compatible with his interest, his designs, and with good husbandry. The merit or reasonableness of covenants must always be considered in comparison with the nature of the farm. It is for want of this consideration that unreasonable covenants are ever proposed. And these prohibitions are often foolish, but sometimes admissible: they must depend on local circumstances, which should be well weighed by the farmer before he makes his decision.

The ascertainment of rent is a highly important part of the business of hiring a farm, though the circumstances already noticed precede it, as the rent must in a great measure depend on them. The chief point necessary to be here considered is the combination of rent, tithe, and rates in one sum. It is advised that the farmer, knowing the capital intended to be invested, should estimate the interest of it at not less than 10 *per cent.* and then calculate the expences and produce; the former, being deducted from the latter, will leave that sum which he can afford to pay in these three sorts of rent. And further, deducting the tithes and rates, the remainder will be what he can afford to pay to the landlord. Where rent is calculated in any other way, it must be erroneous and deceitful, and not by any means to be depended on.

On the business of stocking farms, the same able writer has likewise suggested many useful hints and directions. He considers the advantage to be derived from the occupation of land to depend so much on the farmer commanding the requisite capital, that it is extremely necessary for the young beginner to be well advised on so essential a point. If he be fixed in business by some experienced relation, he will not, of course, want the proper instruction; but as many adventurers, as they may be called, are every day making efforts to try their fortune in the culture of the earth, and many gentlemen taking farms into their hands, sometimes without sufficient consideration of the necessary expences, it may not be improper to consider a few points concerning this business. Thirty years ago, the sum which was usually appropriated to the stocking of a farm, varied from three to five pounds the acre; and it was a general idea, that the latter sum was sufficient for any farm, part arable, and part grass, of no uncommon fertility. Rich marshes were, of course, excluded in the calculation, and light stock farms were often stocked for three pounds the acre. But these matters are now greatly changed: rents are much increased; tithes are compounded at a higher rate of payment; poor rates are enormously risen; all sorts of implements comprehended in the article wear and tear are thirty or forty *per cent.* dearer; labour is in many districts doubled; the prices of cattle and sheep, as well as all other sorts of live stock, are greatly advanced; so that at present, the same farm which at that period would have been very well stocked, and the first year's expences provided for, at the rate of five pounds the acre, would now demand nearly from seven to eight pounds the acre. But it is to be remembered, that in all such estimates it is necessary to suppose that every tool bought in is new, and that the live stock be good of the sort, as well as that the first year's expences be provided for, though a portion of the crop may come in before the whole payment is made. It is stated that a man cannot be at his ease if he do not provide in this manner; nor will he be able to make that profit by his business with a small capital, which will attend the employment of a larger. By profit the writer would be understood to mean a *per centage* on his capital, which is the only satisfactory way of estimating it. If, by stocking a farm with five pounds the acre,

acre, he makes seven or eight *per cent.* profit; and by stocking in the proportion of eight pounds the acre, he makes ten *per cent.* (and this difference will, it is believed, often be found); it must be sufficiently apparent that the loss by the smaller stock is a very serious evil. It will depend much, it is supposed, on situation and local circumstances: the benefit of procuring manures, or litter, to make dung, may, in some places, be very great, in others much less; but not to be able to profit by every favourable opportunity that may attend the spot on which a farmer is fixed, must be highly disadvantageous to him. To irrigate land is an expensive operation; but to omit or postpone it for want of money for the undertaking, is to lose, perhaps, the capital advantage of a farm. Cases of this sort might be greatly multiplied; and there is not one that does not call on the farmer for an ample capital to obtain the greatest possible benefit.

It is hinted, that of all the different sorts of farms those of the warren kinds are hired and stocked with the smallest capitals; but there are marsh lands in different districts, and especially in Lincolnshire, which are stocked at the vast rate of more than thirty pounds the acre. And the general annual expence of many hop plantations rises to thirty pounds, and the capital to more than sixty pounds the acre.

In general, for stocking, according to the modern principles of husbandry, not less than from eight to ten, or fifteen, pounds the acre can be necessary; and in some cases, where improvements are to be made, considerable more will be required.

It is suggested, that if the farmer is not capable of making ten *per cent.* on his capital, he must either have an indifferent farm, there must be bad management, or the times must be greatly against him. It is justly supposed that he should make from twelve to fifteen *per cent.*, and that some farmers make more, even when the price of corn is not in any way extravagant.

These directions should be well weighed and considered by those farmers who have had but little experience, before they enter upon the serious business of hiring and stocking farms.

It has been remarked, in respect to the advantages of different sorts of farms, by the author of the "New Farmer's Calendar," that were it demanded of him generally, what is the most advantageous application of land? he should be inclined to answer, that of dairying, or feeding a large number of cows for the produce of butter; but with the reserve, that the business be conducted with great variation from the common modes. The dairy-man must himself be a perfect judge of the live stock which he entertains, and they be of the improved species: no bad milkers must be kept, nor indeed any kept too long; the profit of grazing must come into the account, and of pig-feeding to a much larger than the usual extent. The winter provisions for the cows, both green and dry, must be so ample as to equalize the produce of butter, in money, at least, with that of the summer, and it will be clearly advisable to have a considerable breadth of land under the plough. If this, however, be the most profitable, it is, no doubt, he says, the most troublesome scheme of husbandry. The next in point of profit is, he thinks, two-thirds arable, and one-third grass; the most advantageous winter feed provided, and cattle enough of the best kinds kept to furnish annually from twelve to fifteen loads *per acre* of rich compost. This may prove more profitable than if all the land were grazed, since it is to divide the risk of markets between corn and cattle; and large crops of the former may of right be ex-

pected where the quantity of manure shall have been so liberal. A family which cultivates a parcel of land, with the prudent view of increasing its income and domestic comforts, should keep, he says, a small dairy, with two or three breeding fows, a small flock of sheep, some tame rabbits, and a few hives of bees. It should not be forgotten to stock a fish-pond or two, if there be such convenience. The plan will also, he thinks, admit of the fattening a few bullocks annually.

Hay-farms and grazing-farms are obviously, he says, attended with the least trouble. Hay-farming is, however, by no means the most profitable branch of husbandry, as it lies under the constant disadvantage of incapacity to feed live stock to any good purpose; hence much after-grass is annually wasted. Granting a hay farmer has fattened a lot of beasts, they must, he observes, be late in the season, when beef is usually cheap, and he cannot keep them until after Christmas, for fear of injuring his future crop of hay, which is his grand dependence. As to grazing, however profitable or void of trouble it may be, he would advise every person to be cautious how he enters into it to any great extent, unless he shall have previously acquired a considerable knowledge of live stock. Most bailiffs know much worse than nothing at all of the matter. In the common advice given on the head of breeding animals, aptitude of situation and room have always been very properly insisted on; but the consideration, the most important, perhaps, of all others, hath hitherto been neglected, which is, aptitude in the breeder himself for the undertaking, without which, we will venture to affirm, no adequate success ought to be expected. A man ought to be possessed of much sensibility for the brute creation, with a considerable spice of the mania of improvement, who sets up for a breeder. In his daily or weekly bible-excursions, he must be sure never to forget the book of Job. He must enter fully into the spirit of a thousand little niceties, both of judgment and practice, which it would take a good volume to describe. He must find a pleasure in never-ending care and solicitude, and keep a perpetual watch. On such conditions a breeder, he thinks, will acquire wealth and fame. The generality of cultivators, whatever may be their situation, had, perhaps, better purchase their live stock ready made. With respect to fattening animals for market, the greatest difficulty, in his opinion, occurs with pigs, as is sufficiently manifest from the accounts of our numerous experiments. The English of the matter is, he thinks, that the business requires a correct judgment both of that species of stock and of the markets.

But whatever be the nature of the farm, it is obvious that it can never be cultivated to the greatest possible advantage without having the security of a fair equitable lease. See LEASE.

And on the conducting or management of farms, it is observed by the same author, that it has always been the fashion to lay much stress on the difference between the gentleman and the labouring farmer, and to allow a decided superiority to the latter, nay, even to deny all possibility of the former deriving profit from the practice of husbandry. The matter has, he thinks, been improperly stated. Nothing can be more true than that the man, whether gentleman or farmer, who determines to remain ignorant of his business, and who indolently suffers himself to be cheated through the nose, will have a fair chance to be everlastingly unsuccessful. But grant the gentleman a moderate portion of the science of agriculture, and a decent competency of activity and resolution, and he conceives the balance will preponderate even heavily on his side, whatever
may

may be the quantity of lands, from a cabbage-garden to a farm of a thousand acres. The personal labour and superintendance of the mere common farmer, in the old beaten track, can never, he thinks, stand in competition with the advantages of the new husbandry, of the most productive kinds of live stock, of an ample portion of manure, and of the garden cleanness of the hoe-culture. Agriculture, viewed in a trading light, perhaps makes as ample a return for the use of money as any domestic concern whatever; and although such be not the general custom, it is easy enough of proof, that very great capitals, to the amount of twenty, thirty, or forty thousand pounds, and upwards, might be safely and prosperously employed upon an extensive farm. The cultivator of two thousand acres, who should fully stock according to the principles of the new husbandry, breed and fatten his own cattle, consuming all his spring-corn at home, bacon his hogs, and meal his own wheat, would find occasion, he says, for sums of very high account. His articles being all those of the first necessity, and being without the obligation of allowing credit, the profits would be more certain, and the risk less, than in any mercantile concern. In what, he asks, consists the new husbandry, so often quoted by agricultural writers without a definition? In allotting certain portions of an arable farm to the purpose of summer and winter feeding a stock of cattle, sufficient, with their dung, to manure and fertilize the whole of the land; in eradicating, as far as possible, all useless vegetation with the hoe; in the use of the various improved or newly-invented implements, for the purpose of expediting or abridging labour; and in the judicious selection of domestic animals. The usage of the old husbandry (too generally prevalent indeed, he says, at this hour) is to place very little dependance on the profit of live stock, to feed very few, excepting those animals absolutely necessary for labour, to reject the hoe-culture, perhaps altogether, to foul the land by repeated corn-crops, and to clean it partially and insufficiently by summer-fallows, or seed in its foul state for a temporary ley.

There is, says the same writer, a false pride amongst farmers of inferior property, which demands examination, if not correction. A man will make any shift, even to the neglect of the important advantage of purchasing cattle in the autumn, rather than sell his oats during harvest, or his wheat at Michaelmas. His importance is much diminished, unless he can make a capital display of stacks: but fair and impartial calculation alone must be his guide in this case, who pursues his real interest.

FARM Buildings, in *Rural Economy*, are such buildings and offices as are necessary for carrying on with convenience the various concerns and purposes of a farm. It is evident that the nature and extent of such erections, as well as their peculiarity of construction, must be very different, according to the difference of farm management which is required to be carried on with them. However, in general, a much greater extent of such buildings will be necessary where the farms are of the arable or corn kind, than where they are simply of the dairy, grazing, and hay or grass kind. Though the extent of buildings, even for those of the first of these sorts, may be greatly retrenched by having recourse to the threshing-machine, and the beneficial practice of stacking the grain in proper yards, with suitable staddles for the purpose, and at the same time the expence of such erections be considerably reduced by having simply shed-buildings instead of those of a more finished kind, which are mostly in use, while the convenience to the farmer will be nearly the same. There is, however, one circumstance to be here particularly regarded, which is, that whatever the description of the

farm may be, the extent of the buildings should constantly be amply sufficient for the various uses of it.

The most usual descriptions of buildings which are wanted on farms, are those of *farm houses, barns, stables, granaries, cow-houses, cattle-sheds, calf-pens, dairy-houses, bog-flies, root-houses, straw-sheds, chaff-houses and bins, cart-lodges, harness-rooms, tool-houses, work-shops, poultry-houses, pigeon-houses, and bee-stands*. See these several heads.

There has been considerable diversity of opinion amongst writers on rural economy concerning the most proper distribution of buildings of this sort, and the point is yet far from being decided. It is, however, obvious that it must be different in some degree, according to the peculiar nature of the farm, and the way in which the business of it is to be managed.

In *arable farms*, or those which are chiefly under the plough, the principal things wanted, in regard to distribution, are that the farmstead and buildings should have a central situation, in respect to the ground, being a little elevated if possible, and near the principal market-road. If contiguous to a brook or small river, it may be an advantage in the supplying of water, as well as turning different sorts of machinery.

On *pasture farms*, especially those of the sheep kind, but very few buildings are requisite; nor where they are of the dairying, grazing, or breeding sorts, is there any necessity for their being numerous. In their distribution the convenience of roads and water should be particularly attended to.

In *mixed farms*, or those which are partly of the arable and partly of the grass kinds, the distribution of the buildings should be pretty much the same as on those of the perfectly arable sort, only perhaps somewhat fewer in number.

On *family, or residence farms*, which are another kind of mixed farms, calculated for the convenience of personal residence, uniting the pasture for breeding, rearing, and occasionally fattening animals, as well as the keeping of milch cows, and growing meadow-hay, with the arable land for the supplying of artificial fodder, grain, roots, different kinds of vegetables, green-food for soiling, &c. The variety of buildings should here be considerable, so as to suit the different purposes of the farm, having the principal of them, or what may be called the farmery, conveniently contiguous to the family offices, but at the same time effectually screened from the residence, being likewise well connected with all the different parts of the farm, and, if possible, placed so as to have the advantages of wind and water. This sort of farm has been well designed by Mr. Loudon in his "Treatise on Country Residences."

The subject of the proper distribution of farm-buildings is fully entered into in an able paper in the first volume of *Agricultural Communications* to the Board. The writer there considers the construction, arrangement, and situation of these buildings as so important to the practical farmer, as to merit the fullest attention of the rural economist. It is stated, that on a judicious combination of these points the convenience and facility of carrying on his different operations in a great measure depend. Yet the examples of farm-offices being erected either on a commodious plan or with any thing of judgment in the situation, are extremely rare. Indeed, says the writer, whether we view this subject as relating to the landlord, the tenant, or the public at large, it appears highly interesting. To the landlord it is a matter of considerable moment, a part of his rents very often depending upon it; for it is natural to suppose that a tenant, especially on a long lease, would give more for a farm if the

house and offices were commodious, than if they are so miserably deficient as most farm-offices are. He would even be the more readily induced to take a farm on that very account; and thus the landlord may often lose a good tenant, merely by not having proper accommodation for him. He has heard farmers declare, that they would willingly agree to pay five *per cent.* or more on the expences laid out on commodious buildings, over and above the rent of the farm, rather than occupy for nothing those they at present possess, and that they would, besides, undertake to be at the expence of every ordinary repair during the continuance of their lease. How then, says he, can a landlord lay out a few hundred pounds to better purpose than to accommodate his tenants, if he gets not only five *per cent.* on the money thus laid out, (but provided his buildings are very complete) perhaps as much additional rent as will amount to five *per cent.* more. He is well convinced that the great expence of erecting new farm-buildings in the usual way is a very material obstacle to altering the present form; for there are few landlords, he supposes, who would choose to lay out five or six times the rent of a farm in new accommodations for that farm, if by propping and patching they can at a small expence make the old buildings answer. When, says he, we hear of 500*l.* being expended in building a barn on a small farm of about 100*l.* rent, as is the case in some parts of England, and 1000*l.* laid out on a farm-house, it is no wonder that landlords are cautious of engaging in such buildings, and it cannot be supposed that tenants would be mad enough to do so. Hence, perhaps, is the principal reason why the generality of farm-houses and offices are in so ruinous a condition. But when farmers can be persuaded that such enormous barns are unnecessary; that their corn can be kept much more secure and less liable to injury in a well-aired rick-yard, and that if they have just room enough in their buildings for all the common purposes of the farm, no more is requisite; also, that a neat, small commodious dwelling-house is fully more comfortable than a large dismal one; and then we shall find, he thinks, that landlords will more readily agree to accommodate their tenants; and that instead of those gloomy, preposterous, ruinous buildings, now a disgrace to almost every part of the kingdom, we shall behold neatness and uniformity combined with every necessary accommodation, which will afford not only pleasure and comfort to the occupiers, but a beauty and an ornament to the country at large. That this may be accomplished at a very moderate expence, he hopes to be able to prove. So far as any general rule can be given upon this subject, and allowing for circumstances and the variation of prices, he is fully persuaded by the observations he has made in different parts of the kingdom, that, in general, one year's rent of the farm, if not under 70*l.* (or at most two) is amply sufficient for building every accommodation necessary upon that farm, exclusive of the dwelling-house; and that one year's rent is enough to build a dwelling-house on all farms not exceeding 400*l.* a year (in many situations less may do); and, lastly, that 500*l.* are sufficient for a dwelling house, and 1000*l.* for offices on a farm of any extent. It is likewise observed, that in building new farm-houses and offices, a great saving of expence will accrue, by making use of all the serviceable materials in the old buildings, where such buildings are, and it will astonish many (provided they are fairly dealt with) who have been accustomed to those large, unnecessary, and expensive buildings commonly used, at how small an expence, comparatively speaking, a new set of offices, or house may be built, having the advantages of such materials near the spot. Workmen, in general, are much averse to using old materials, especially carpenters, who, rather than run the risk

of touching a rusty-nail with a hatchet or saw, will put their employer to the expence of some hundreds of such tools, by condemning the old, and advising him to purchase new timber.

To a tenant, the construction and arrangement of his farm-buildings is a matter, he says, perhaps of more importance than even to a landlord. After all his toils and labours, and the many anxious and sleepless hours he has passed before his crop has come to maturity, if his offices are insufficient, or improperly constructed, he still runs the risk of many inconveniences, and even real loss. The security of his grain, the labour, and the value of his horses, and other cattle, the safety and duration of his implements, are all dependent on the perfection or imperfection of his offices. By arranging them judiciously (a matter very little attended to), a great deal more labour may be obtained from his servants, and every operation on the farm will be carried on with more facility and dispatch; for, if a barn is set down here, a stable there, a cow-house or feeding-house in another place, all without rule or order, and as if chance had set them down, much unnecessary labour will be occasioned, and a great deal of time lost in carrying provender to the cattle, and in keeping them so clean and dry as is necessary towards their health and preservation.

Farm-buildings, as has been already remarked, should always, he says, be proportioned and constructed according to the size and produce of the farm; which, in settling their dimensions and arrangement must be particularly taken into consideration. If, for example, the farm is adapted entirely to grazing, very few buildings will be necessary, except some sheds, and these will be in use chiefly during the winter season, temporary ones being often erected in the fields for the summer. On farms where cattle are housed only in winter, or in such farms where more buildings are used in winter than in summer, a great expence in roofing may be saved in cattle-sheds by erecting walls only, or having pillars or posts placed and framed in such a manner as to support pease, hay-ricks, or any other sort of ricks that are not intended to be taken down till the spring or summer. This will not only answer the purpose of an excellent warm roof, but will be a very good situation for building such ricks. If, however, the farm is entirely for grazing, as before supposed, there may not be a sufficiency of ricks, unless the fodder for the cattle, to make such temporary roofs. In that case the sheds must of course have permanent ones, which may be of the cheapest construction. Or, if there should be a sufficient number of boards about the farm, as is sometimes the case, they may be laid loosely on, to serve as a roof to the sheds, till wanted for other purposes.

But a dairy farm will require a different sort of accommodation, being in general composed partly of the grazing and partly of the arable kind. The cow-houses must be proportioned to the number of cows usually kept, with every other accommodation for carrying on the dairy business, whether as a cheese or butter farm. Small stables, and a small barn, are sufficient for such a farm.

But in an arable or corn farm, which generally partakes of both the other sorts, the buildings must be more numerous, and suited, in some respect, to all these different purposes; the stables in proportion to the number of horses or cattle requisite for labouring the farm; the cow-houses, and feeding houses, according to the number of cows generally kept, and cattle fed; the barn and granary according to the extent of arable land, together with all the other usual accommodations for breeding young horses or cattle, for hogs, poultry, &c. all which must be particularly considered of, while planning the farm offices and buildings.

However,

However, since the invention of threshing-mills, a most material alteration may, he conceives, be made in the construction of farm-buildings, particularly in barns. The tedious and laborious operation of threshing with the flail made it necessary to have the barn large enough to hold a great quantity of corn in the straw, or at least to contain a whole stack at once; and, besides, to have it so lofty as to give sufficient height for raising the flail. This is by no means necessary where there is a threshing-mill, for as the mill, if properly constructed, will thresh the corn as fast as taken in, it is unnecessary to throw in the whole stack at once, or what remains of it in the rick-yard, if any, may be covered with a tarpawling, or painted canvas for that purpose, a thing that every farmer ought to have, being of essential use either in case of a sudden shower in harvest, when building a stack, or hay-rick, or of leaving one unfinished at night, or any other time. A threshing-mill not requiring so lofty a barn as a flail, a very convenient granary or store-room may be obtained above the mill, which, in the common way, could not have been had. In short, the advantages of a threshing-mill are so numerous, that no farm producing 1000 or 1200 bushels of grain annually should, he thinks, be without one of them. See GRANARY, and THRESHING-Machine.

It is further observed, that when the plans of any farm-buildings are finally determined on, there are many preliminary considerations necessary to be attended to, previous to the commencement of the work. Such are the situation with respect to the quality of the air, the water, materials for buildings, access and exposure, the soil for laying the foundations upon, the best method of conducting the drains, together with the expence of completing the whole of them.

In ancient history we are told, the writer says, that the Romans were so very attentive and careful in the choice of a good and healthy situation, that they would not even encamp upon a spot of ground till they tried various experiments to ascertain if it was sufficiently healthy. How much more necessary then is it, says the author, to ascertain the salubrity of a place destined for more permanent purposes. In general, where a choice of situation can be had, these four things should, he thinks, be particularly attended to; a pure and temperate air, the water wholesome, and easily come at, the soil dry, and the place central, and of easy access. No buildings whatever require these qualifications more than farm-buildings: yet, in general, it would appear that they had been totally disregarded. How often do we see farm-buildings and barn-yards placed in the very worst situation in a whole farm; in low, marshy, boggy spots, almost inaccessible to man or beast, and fit only for a resort for frogs and wild-ducks. Perhaps too, within a little distance, a fine dry wholesome situation might have been obtained; for there are few farms of any considerable extent in which a tolerably good situation for building may not be found somewhere. If dryness and purity in the air are so desirable and requisite for the site of a dwelling-house, how much more (if possible) are they necessary for farm-offices and barn-yards. If these are placed in a damp and humid spot, the farmer's whole crop runs the risk of being rendered useless and unsaleable, however dry and well conditioned he may have brought it from the field; for if the place to which he brings it is damp and unwholesome, his grain will soon acquire a softness, and perhaps mildness, very injurious to its value. On the other hand, if the situation is dry, his grain will not only improve and keep in better order, but in general it will be of a better quality, and consequently worth a better price at the market or other place of sale.

In the business of fixing the arrangement of a new set of

farm-buildings, the first thing to be taken into consideration, after choosing the situation, is the nature and produce of the farm. From these may be judged the different kinds of accommodation that will be necessary. For example, every farm must have, 1st, a dwelling-house; 2dly, a barn suitable to the extent of arable land on the farm, either with or without a threshing-mill, but always with one, if possible; and it should be endeavoured to place it so that it may go by water, if a supply can be had; 3dly, stables, the dimensions of which must be determined according to the number of horses necessary for the farm; 4thly, cow-houses, or feeding-houses, or both, according to the number of cows and cattle; and so on, till the whole accommodations necessary, and their dimensions, are fixed upon. Having ascertained these, and the situation for building on being also settled, the ground must be carefully and attentively viewed; and if not very even, the different levels must be observed, and the best way of conducting all the necessary drains, and carrying off all superfluous moisture. Also the best situation for dung and urine pits, or reservoirs, which will, in a great degree, ascertain at once where the cattle-houses and stables should be. These being fixed on, the barn should, he observes, be as near them as possible, for the convenience of carrying straw to the cattle; and the barn-yard should be contiguous to the barn. If a granary is resolved on, that should also be near the barn, or over it; as likewise the straw-house, which should be close to the barn. These main points being determined on, the others will easily be found; always observing this rule, to consider what is the nature of the work to be done about each office, and then the easiest and least laborious way to perform that work so far as it is connected with other offices. In case this should not be sufficiently explicit, he shall suppose, by way of illustration, the situation of a feeding-house is to be considered of. The nature of the work to be performed here is, bringing food and litter to the cattle, and taking away their dung. The place from whence the greatest part, perhaps, of their food and all their litter comes is the barn; therefore the feeding-house should be as near the barn as possible. If turnips, or other roots, or cabbages, make a part of their food, the most commodious way of giving these must be determined on; whether by having a root-house adjoining the cattle-house, and that filled occasionally, or by having a place to lay them down in, near the heads of the stall from whence they are thrown in at holes in the wall left for that purpose. The easiest method of clearing away the dung must also be considered, according to the different plans mentioned when describing cow-houses, cattle-sheds, &c. See *Cow-house*, and *CATTLE-shed*.

And the same general rule being observed in determining on the site of all the other offices or accommodations, together with a careful examination of the ground to be occupied (upon which the arrangement of the offices in a great measure should depend), any person conversant in rural affairs, who attends to these particulars, and can lay down his ideas in a drawing, may, he thinks, easily direct the planning and building of a very commodious set of offices. With respect to the site of the dwelling-house, in addition to what has already been said, it may be remarked, that, although a house, being situated in the middle of a regular front is, in some points of view, the most pleasing way, and in many situations perhaps the best, yet, unless the ground and other circumstances in every respect favour such a disposition, he would not invariably adhere to it; for it may often happen, he thinks, that a much better situation for the dwelling-house may be obtained at a little dis-

tance from the offices, and a pleasing uniformity enough be observed in them at the same time.

In some cases, and for some kinds of farms, it may be particularly necessary to have the house so placed in respect to the offices and farm-yard as to admit of their being constantly inspected, and the labour which is to be performed in them to be perfectly attended to and superintended.

A late writer on "Landed Property" has, however, well-remarked, that the particular requisites of a farm-stead are as various as the intentions of farms. A sheep-farm; a grazing-farm; a hay-farm; a dairy-farm, and a farm under mixed cultivation, may require different situations and different arrangements of yards and buildings. On a farm of the last species, which may be considered as the ordinary farm of this kingdom, the principal requisites are conceived to be shelter, water, an area or site sufficiently flat for yards and buildings, with meadow land below it, to receive the washings of the yards, as well as sound pasture grounds above it for a grafs yard and paddocks; with private roads, nearly on a level, to the principal arable lands; and with suitable out-lets to the nearest markets. Where the first of these is wanting in the desired situation, it may in time be supplied by plantations and mound fences. And where there is not a natural supply of water, a well, water cellar, or artificial rill may furnish it. And grafs lands are easily produced in almost any situation; and by the help of enriching water, or by manure and pasturage may in most be rendered perennial.

From what has been advanced it is conceived evident that no general plan can prevail, even on what may be emphatically called an *English farm*, composed of arable meadow, pasture, and wood lands. The plan of the farm-stead must ever be moulded to the main object of the farm, whether it be corn, the dairy, rearing cattle, fattening cattle or sheep; as well as to its size; for although the same or nearly the same species of conveniences are required on a small as on a large farm of the same intention, the number may be less; and the arrangement be made on a more frugal plan. But in this, as in every other matter of arrangement, the first thing to be done is to ascertain the particulars to be arranged, which for a farm of the mixed kind or under mixed husbandry may be thus enumerated; 1st, a set of farm buildings adapted to the intended plan of management, as a dwelling-house, barns, stables, cattle sheds, cart shed, &c.; 2dly, a spacious yard, common to the buildings, and containing a receptacle for stall manure, whether arising from stables, cattle-sheds, hog-sties, or other offices, together with separate folds or straw yards, furnished with appropriate sheds for particular stock, in places where such are required; 3dly, a reservoir or catch-pool, situated on the lower side of the buildings and yards, to receive their washings, and collect them in a body, for the purpose of irrigating the lands below them; 4thly, a corn yard, convenient to the barns; and a hay yard, contiguous to the cow or fattening sheds; 5thly, a garden, and fruit ground near the house; 6thly, a spacious grafs yard or green embracing the whole, or the principal part of the conveniences; as an occasional receptacle of stock of every kind; as a common pasture for swine, and a range for poultry; as a security to the fields from stock, in straying out of the inner yards, and as an anti-field, or lobby, out of which the hone-grounds and drift-ways may be conveniently entered, for different purposes.

With regard to the distribution and arrangement of these objects, in order to make it with good effect, great caution, study, and patience are required; that the most may be made of given circumstances. An accurate delineation of the

site which is fixed on requires to be drawn out on a scale; the planner studying the subject alternately upon the paper and on the ground to be laid out; continuing to sketch and correct his plan, until he has not a doubt left upon his mind; and then to mark out the whole upon the ground, in a conspicuous and permanent manner; before the foundation of any particular building be attempted to be laid. It may be easily conceived by a person who has not turned his attention to this subject, that there must be some simple, obvious, and fixed plan to proceed upon. But seeing the endless variety in the mere dwelling places of men, it is not to be wondered at, if a still greater variety of plans should take place where so many appurtenances are required; and these on sites so infinitely various; nor that men's opinions and practices should differ so much on the subject, that on a given site no two practical men, it is more than probable, would make the same arrangement. There are, however, certain principles which no artist ought to lose sight of in laying out buildings and conveniences of this description. The barns, the stables, and the granary, should be under the eye, should be readily seen from the dwelling house. And the prevailing idea at present is, that the several buildings should form a regular figure, and inclose an area or farm-yard; either as a fold for loose cattle, or where the stalling of animals is practised, as a receptacle for dung; and the most prevalent figure is the square. But this form Mr. Marshall supposes more defective than the oval or circle, the angles being too sharp, and the corners too deep. Besides, the road-way, necessary to be carried round a farm-yard, in order to have a free and easy passage between the different buildings, is inconveniently lengthened, or made at greater expence. The view of the whole yard and buildings, from the house on one side of it, is likewise more confined in some respects.

The able author of the work on "Landed Property" had formerly, he remarks, suggested the plan of a polygon, or many-sided figure, or an irregular semi-octagon, with the dwelling house and the stables on the largest side, having ranges of cattle-stalls opposite. But he has since formed one on the complete octagon, the dwelling-house being on one side, and the entrance, gateway, and granary opposite, the remaining six sides being occupied by stables and cattle-sheds, with a broad-way dipping gently from the buildings, and surrounding a wide, shallow dung-dish, which take up the rest of the area of the yard. This is offered as a hint to those engaged in laying out and directing buildings of this sort, which they may adapt to the particular nature of the site or situation of such as they are about to erect. But it is supposed not essentially necessary to follow any particular form or figure. The sides may have a greater or shorter length, according to the nature of the site, and the intention of the builder. The site should, if possible, be nearly, but not quite level; the principal yard being formed across the descent; having the barn on the higher, and the stables on the lower sides; as in this way the barn, stack-yard, straw-yards, cow-stalls, and dwelling-house will have a dry situation; while the road that leads into the yard, and to the carriage-sheds, will be on the level ground, which is the most suitable and proper.

In regard to the dwelling-house, the situation which is the most advantageous must in some measure be directed by the extent or size of the farm. Where it is small, for the purpose of the labouring farmer, it may be placed at the north end of the yard, facing into it, and be approached through it. As the kitchen is the chief room in which he resides when at home, and in which his wife performs most of her domestic business, the yard, the buildings, and the stock in

in the yard, will be constantly under the eye. But in an extensive farm, where a yard-man is kept to attend the flock in winter, and where the house-work is mostly done in the back-kitchen and dairy-room in the summer, and when the farmer is desirous of entertaining his friends with a more agreeable prospect than a farm-yard, the house may occupy the south end of it, facing into the garden, and have a separate approach in front. It is, however, suggested, that the first mode of distribution gives a desirable shelter to the yard, while the latter leaves it exposed to the north winds, which blow through the entrance and open carriage-sheds. In either case, it is screened from the east winds by the barn and cattle-sheds. It is also of advantage to have the house fronting to the south, in order to give coolness to the dairy buildings. But since the introduction of threshing machines, in the place of threshing floors, the barn is become quite different, requiring another form, arrangement, and situation. One end of it should, in these cases, be placed towards the farm-yard, instead of the side, which is proper in the contrary circumstances, the other end being towards the stack-yard, to which it should be connected, with a rail-way for removing the corn upon to it, having a lean-to-shed and straw-yard on the sides where they may be requisite. These barns should be large enough to contain a good quantity of grain at a time, for threshing out in wet weather, when little else can be done. See BARN, FARM Yard, and THRESHING Machine.

It is further suggested, that the small angular room-bleads between the ranges of sheds may be formed into convenient places for containing fodder, roots, &c. and for the keeping of calves, &c. &c. There should likewise be a receptacle for the stall manure, which should be properly formed and connected with the stalls by proper drains, and a reservoir for the reception of the yard liquor, where it cannot be turned upon the land below, which in many cases is of but little consequence to its improvement.

But the arrangement and connection of buildings of this sort, as relating to different descriptions of farms, may probably be better and more readily understood by an examination of the annexed plates.

In *Plate XIII. (Farm) on Agriculture*, is given a full representation of the necessary farm buildings for carrying on grazs and dairy husbandry on a middling scale. At *fig. 1.* is shewn the plan and elevation of a house where the grazs, hay, or other similar system of farming is pursued. *Fig. 2.* is the ground plan of the same; and *fig. 3.* displays the arrangement or distribution of the several out-buildings or offices.

The expence of completing a set of farm buildings on this plan would, at present, where materials are pretty much at hand, be from four to five hundred pounds.

At *fig. 4.* in the same plate, are exhibited the plan and elevation of a house of this nature, where the chief system pursued is dairying; *fig. 5.* explains the ground plan; and at *fig. 6.* the distribution of different necessary offices is displayed.

On this plan, as there are fewer out-buildings than in the former case, a set of proper farm-offices, with the house, would probably cost from three to four hundred pounds.

It must, however, be remarked, that the convenience or distance of materials, must render the difference of expence in the buildings very considerable in both these cases.

And in *Plate XIV. (Farm) on Agriculture*, we shew plans and elevations of farm-buildings, where the system of husbandry is of the corn, or of the mixed kind, and the farms of a middling extent.

Fig. 1. is the plan and elevation of the house; *fig. 2.* the ground-plan of the same; and *fig. 3.* the distribution of the various out-buildings.

This plan may, in most cases, be finished for the sum of from six to seven hundred pounds.

At *fig. 4.* are the plan and elevation of a farm-house and buildings of the latter kind.

Fig. 4. is the elevation of the house; *fig. 5.* the ground plan; and *fig. 6.* affords a view of the situation and arrangement of the several necessary offices.

If finished on this plan, the expence would be from seven to eight hundred pounds.

The materials, in constructing buildings of this nature, should always be of the best kind, as durability is a principal object. See FARM Yard.

FARM House, is that sort of building which is attached to, and constructed for, the purpose of carrying on the different operations, and general business of a farm. It should be so contrived as that the necessary work may be performed with the greatest ease and convenience. The writer of a paper in the first volume of "Agricultural Communications to the Board," has suggested, that houses of this sort should not only contain every conveniency for a family, but have a degree of neatness and uniformity, which, if properly managed, will cost no more than a dull, irregular building. It was long since remarked by Columella, that "a farm house should be somewhat elegant, to give pleasure to its possessor, and to allure the wife to take delight in it. It should be built on the most healthy spot of the farm, in a temperate air, such as the middle of a hill commonly enjoys, where it is neither stifling in the summer, nor exposed to the rage of winds and storms in the winter." At present other circumstances mostly regulate its situation. See FARM Buildings.

The size of a farm-house should be regulated by that of the farm, according to a late writer, although not so strictly so as the other buildings; a parlour and kitchen, with dairy, closets, and other conveniences below stairs, and the upper story divided into bed-chambers, are probably sufficient accommodation for any farmer's family. These may be constructed or enlarged according to circumstances, or to the inclination of the proprietor: but it is better to give a little more room than necessary, than not to give enough. None of the buildings about a farm, he says, admit a greater latitude of construction than the farm house; for sometimes a very small house may do for a very large farm: at other times it would require a pretty large house in a small farm, according to the size of the farmer's family, and, perhaps, to the situation in life he has been accustomed to; for there are many very respectable and worthy farmers whose manners and conversation entitle them to the best accommodation; and it sometimes happens that a landlord will consider this, and build a house for the farmer instead of the farm. There is something, he remarks, so pleasing in the appearance of neatness and cleanliness about a dwelling-house, that even a stranger, transiently passing by, cannot help being pre-possessed with a favourable opinion of these within. He passes along with the idea fixed in his mind of prosperity and happiness residing within the walls. How different, says he, the sensation felt on viewing a contrary scene; a house dismal and dirty, the doors and walls furrowed and bespattered with filth of all denominations, and fragments of broken dishes, and dirty dairy utensils scattered in all directions; a scene which must imprint on the mind the idea of misery and mismanagement, and a contempt for those flatterers who can suffer such beautiliness; for in such cases it is generally the female part of the

family who has the merit or demerit of domestic appearances. And how easy a matter is it to constitute the difference; a little care and attention is the whole secret. It adds greatly, the writer thinks, to the beauty and neatness of a dwelling-house, to have a little plot of garden-ground or shrubbery before it: this not only contributes to keep every thing neat and clean in front, but is often easier managed than a garden behind. After feeling the pleasure and satisfaction of keeping this plot in good order, every weed that appears visible from the windows will be considered as a nuisance, and pulled up accordingly. So great an antipathy to weeds may thus be raised in the farmer's breast, that his efforts for their destruction may even be extended to the fields; and by these simple means a slovenly farmer may, he conceives, be so completely reformed, as not to suffer a weed to be seen on his farm.

It is stated that large windows add greatly to the cheerfulness of a farm-house; the sashes being placed as near the outside of the wall as possible. The reverse of this is, he says, a glaring deformity in most houses in the northern parts of the kingdom. There the windows are so small, and the sashes placed so deep in the walls, that it gives the most disagreeable gloominess to the whole building. This is said to be done with an idea of preserving the sashes from the weather, a most egregious mistake. The sashes are, perhaps, more liable to injury by being deep in the walls, than by being placed near the outside, for they receive full as much wet, and are not so soon dried again.

It is, the writer says, a common practice, and, with many, a general rule, to build the farm-house adjoining to the offices. Where the situation will not admit of a better arrangement, or in a small farm, to save a few roods of building, this may be done; but in general it is better to build the dwelling-house, and any other buildings with chimnies in them, a little way detached from the farm offices, not only on account of the danger arising from fire, but of the disagreeableness (perhaps unwholesomeness) of living in a dung-hill, or in the midst of cattle and swine. If, says he, a farm-house, for the sake of uniformity, is to be built adjoining the farm-yard, there should be a considerable length of wall at each end of it to unite it to the offices. But it is certainly better to make the house at a little distance from the wall of the yard; and whether that distance is ten feet, or fifty feet, there can be little or no difference with respect to convenience. At the same time it is by no means adviseable that the farm-house should much exceed fifty or sixty yards from the offices, as there might unquestionably some inconvenience arise if beyond that distance. In the annexed plans of farm-houses four things are particularly attended to in their construction, simplicity, uniformity, convenience, and cheapness. In delineating such buildings, therefore, there is not, the writer thinks, that latitude given for a display of those architectural ornaments, which in a higher sphere of buildings are so pleasing to the eye, and so truly beautiful when disposed by the hand of a skilful architect. Such ornaments are unnecessary in farm buildings, and are therefore entirely omitted. At the same time a strict attention to uniformity is particularly observed; and although the windows are, in general, made something wider in proportion to their height than is permitted by the rules of architecture, in order to answer the purpose of giving as much light as possible, (the chief use of windows,) it is, however, hoped, that no very great or offensive deviations are made from these rules, even in that case. The accommodations are calculated to be as convenient as possible in the family way; and by making the ground-floors at least sixteen inches, or two steps, above the

level of the ground, and taking proper care to lay those floors, a great deal of that dampness, and consequently unwholesomeness, so often complained of, will, he conceives, be guarded against and prevented.

Many people, the writer says, prefer gable-ends, as in *fig. 4. Plate XV. (Farm) on Agriculture*. For his own part he is, however, of opinion, that hip-roofs, and the vents within the buildings, are generally preferable. The hip-roof requires no more materials; and the gable-ends not only occasion more expence of building, but an unnecessary addition of weight upon the end walls. Vents built within-side the house are less liable to smoke than when in an outside wall; besides, they contribute generally to keep the house warm, for they act as flues, and diffuse their heat, in some degree, all over the building. It must be observed, that the principal walls are all delineated, of the thickness of two feet, that being considered as the best thickness for rough stone walls. Where the stones are good, and of a proper form for building, or where bricks are used, the walls may, no doubt, be thinner; but, when too thin, the heat of the sun in summer, and the coldness of the external air in winter, have so disagreeable an effect, by penetrating through, that it is best to err on the safe side, and to make them of a good thickness. This is one of the greatest inconveniences, he observes, of brick buildings; for in general brick walls are so thin, that these effects are most sensibly felt both in the summer and winter seasons.

And by making the different apartments and other divisions and conveniences no larger than necessary, the least possible expence will, the writer says, be incurred. The dimensions of these should be proportioned according to the sum intended to be laid out. Very frequently a good plan is thrown aside merely on account of the expence of putting it in execution; whereas, it should be considered, that, by contracting the rooms, and the building in general, the same plan may be executed accordingly, whatever expence may be determined on. The plans given may therefore be varied in size, till of such dimensions as will cost no more than the sum allotted for that purpose. For these reasons, estimates of buildings, in a general view, are, the writer conceives, really of less importance than most people imagine, there being hardly two counties in the kingdom where the same plan can be executed at the same expence. Even in the same county, and in the same parish, the expence will often vary considerably, according to circumstances. The distance from materials, the quality and price of those materials, the goodness or badness of the roads, the nature of the soil to be built on, and, consequently, the expence of the foundations, the price of labour, the season of the year, and even the state of the weather, all tend to make a difference in the expence of building. It is, therefore, hardly possible to make a correct estimate, unless the spot intended for erecting the building is known and examined; and an incorrect estimate is much better to be omitted. Some people, the writer remarks, will pretend to make an estimate without even inquiring into those circumstances which must regulate the expence, knowing that when the sum they mention is expended, their employer will not stop the building on that account. It is best, therefore, to be cautious in dealing with some people, unless they will contract for the sum estimated.

But in some parts of the country, it is observed, a house built on the plan and of the dimensions shewn at *fig. 1. in Plate XV. (Farm) on Agriculture*, may be completed for about 70*l.* or 80*l.*; while in other parts it may cost 150*l.* or more; consequently, it would tend only to mislead, by stating either the one or the other as an estimate of such a building.

At *fig. 5.* in the same plate, is the plan of a farm-house also on a larger scale. Yet to commence a building, without knowing previously the expence it will cost, should at all events be avoided, as being almost a certain opening for imposition. The best way, therefore, to ascertain this, is to choose a plan: if the proposed building is not of that extent or importance to require the aid of an architect, employ any person conversant in those matters, whose fidelity can be relied on, to examine the ground, and to consult with different tradesmen concerning the expence at which they would undertake to execute their respective parts; a pretty correct estimate may, the writer says, thus be obtained. Or the plan may be laid before different intelligent tradesmen, and their estimates required, and afterwards examined into, not only as to the charge made, but the manner of executing the work; for it is not always the lowest estimate that is to be preferred. If in either case the sum should amount to more than is proposed to be laid out, the dimensions of the plan, and the manner of finishing some of the parts, may be altered, till it is found that it may be executed for about the sum proposed by the person who intends to build.

And it has been remarked by the author of "Modern Agriculture," that, in regard to the share of expence and trouble which proprietors and tenants in general ought to be subjected to, in erecting farm-houses, all leases should contain a clause, by which the proprietors become bound to be at the expence of materials and workmanship, to the extent of a stipulated sum, rather above than below two years' rent. The tenants should not only undertake the carriage of materials, without making any charge for so doing, but also become bound to keep the houses in good order, and to relinquish them equal in value at the expiration of the lease, or to pay any deficiency, as the same may be determined by proper tradesmen, mutually chosen for the purpose.

It is suggested that it has been a common practice in some parts of Scotland, (which ought to be introduced every where,) to bind tenants to insure their houses from any damage by fire. This clause in leases is attended with another good consequence, the tenants generally insuring their stock and house-furniture at the same time; so that when any accident happens, they are saved from the ruin which otherwise must necessarily ensue.

But the farmer's capital, it will readily be acknowledged, ought to be employed in stocking and improving the farm, rather than in erecting houses; therefore, it is certainly bad policy in the landlord to divert that capital from those channels in which it ought to flow freely, and without interruption. On the other hand, the circumstance of the tenant being obliged to maintain the houses in good condition during his lease, and to leave them of equal value at his removal, would induce him to pay proper attention that the houses be substantially built, and that every necessary repair be completed in proper time, and in the most effectual manner. When repairs only are necessary on the entry, they ought to be promoted at the mutual expence of the parties. The proprietor should advance the requisite sum for materials and workmanship, and the tenant perform all the carriages. A clause should also be introduced into the lease, by which the landlord may have a right to execute repairs, provided they are deemed requisite by proper tradesmen, sent to inspect the houses, intimation thereof being made a reasonable time before to the other party. This, it is thought, would prevent that heavy load of expence which proprietors are frequently subjected to when tenants remove, and a mutual interest in the preservation of the buildings would be formed between the proprietor and tenant. The tenant, although liable to pay for frequent

partial repairs, would avoid the expence of large sums; and, if bound to leave the houses equal in value to what they were when he entered, as he certainly ought to be, the landlord would seldom be put to the expence of large sums in the erection of new buildings of this nature.

The elevation, ground, and chamber plans of a farm-house upon a small scale, calculated for a farmer where he lives with his servants, are represented at *figs. 1, 2, and 3,* in the plate mentioned above. It may be divided on the ground floor, as in *fig. 2,* where *a* is the entry; *b,* the kitchen which should have an oven at *k,* when requisite; *c,* a small apartment off the kitchen, in which a bed may be placed, or it may serve the purpose of a store-room, &c.; *d,* the farmer's private room, or parlour; *e,* the dairy, or it may be at *c,* if thought preferable; *f,* the hen-house, or which may serve for keeping or laying up small tools, such as spades, shovels, rakes, mattocks, &c.

And at *g, g,* in *fig. 3,* is the chamber floor, which is only divided into two bed rooms in the plan, but may be further divided where necessary; *h,* is a pigeon-house over the necessary. The dimensions are marked on the plan, but may be varied to suit particular circumstances and situations.

The representation of the elevation, and two ground plans of a farm house on a larger scale, which by suitable modification may be proper for a farm of any extent, is given at *figs. 4, 5, and 6,* in the same plate. In the plan *5,* it is divided into *a,* the principal entry; *b,* the parlour; *c,* the family bed room; *d,* the kitchen; *e,* the dairy; *f,* the pantry and cellar; the three latter being attached to the back part of the house by a continuation of the same roof downwards. By only permitting the ceilings to be seven and an half or eight feet in height, some small bed-rooms may be provided above them, having a few steps down from the floor of the front rooms, or a few steps up from the first landing place.

In many places farm-houses are constructed on this plan. And the earl of Winchelsea, at Burleigh, has one erected in nearly a similar method; but in it the back-door of the kitchen enters into a brew-house and wash-house; the fire place and copper being behind the kitchen vent. Beyond this brew-house is a place for holding fire wood, &c.; in the back wall of which are openings to feed the swine at. In the kitchen is an oven; and below the grate an excellent contrivance for baking occasionally, but chiefly employed for the purpose of keeping the servants' meat warm. It consists of a plate of cast iron, with a door similar to that of an oven.

The up-stairs part is divided in the front into two good rooms, and into two small ones on the back part, but may be easily further sub-divided where necessary.

And at *fig. 6.* is shewn another mode of dividing the ground floor of the elevation *fig. 4,* in which *a* is the parlour; *b,* the kitchen; *c,* the closet; *d,* the dairy; *e,* the pantry; *f,* the coal-house; *g,* the poultry-house; *h,* the pig sty, which has an opening to the kitchen; *i,* the back entry. The chamber-floor may be divided likewise, where it is requisite, into two good bed rooms, and a light closet capable of holding a bed, or in any other way that may be thought more convenient. It would be easy to introduce a variety of other elevations and plans for constructing farm-houses upon, with perhaps other conveniences than these, but in detached situations from the houses: these examples may, however, be sufficient for affording hints for erecting them so as to suit farms of all extents and descriptions.

FARM Lands, in *Agriculture,* such lands as are in the occupation of tenants, or held in the state of farms.

Farm-Manager, a person who has the overlooking and directing of the business of a farm: the same as bailiff, and land steward. See BAILIFF and LAND STEWARD.

The proper overlooking and managing of a farm is a business of much greater difficulty and importance than is generally supposed. It will demand the whole attention and time of the person who engages in it; and must, in fact, constitute his principal amusement, as where he is apt to be drawn off by other pursuits, it seldom goes on well. In order to proceed in it with ease and convenience, it is proper that he should keep a constant look out to the business which is to be performed, as unless this be well attended to, he will be frequently liable to error and mistake; and much will often be left undone which ought to have been executed. It is essential that he look forward to the business of cropping for several years, to that of team labour for some months, and to hand labour for a few weeks, as the season of the year may direct. In this he will be greatly assisted by the keeping of a proper list of the several fields of the farm, with the crops they have severally produced for different years past, and the manurings which they have each had.

From this list, the arrangement of crops which are to be cultivated the ensuing year should annually be made out in the autumn, classing the fields according to the purposes for which they are designed; as by this means the quantity of each sort of crop will be shewn, as well as the extent of pasture; consequently the amount and strength of team, and other labour, be fully pointed out, in order to be duly provided for; the different crops be put in in proper time; and the summer stock be apportioned with exactness.

In the same, or other list, memoranda should likewise be kept of the works to be done directly and in succession, in every department of the business, so that every thing may proceed in the most regular and proper manner, and nothing be overlooked.

In conducting the execution of the work, whatever the nature of it may be, caution and firmness are highly requisite, as well as an invariable attention, never to attempt too much, or to begin any sort of undertaking in the way of improvement, without the greatest probability of finishing it in due time.

Besides the above, there are several other points in which the good management and correct conduct of this sort of farm-servant is shewn, as:

In keeping the farm-yards and buildings in neat order, and perfect repair, as well as free from all sorts of obstructions to the business which is going on in them.

In taking care of the various private roads of the farm.

In preserving the fences in general good repair, and taking proper care of the young hedges, as well as of the timber raised in them.

In seeing that the gates fasten in a proper manner, and prevent the straying of loose stock.

In taking care that drains and water courses are kept properly open, for the effectual discharge of superfluous water.

During the summer season the watering places of live stock should be well attended to; as well as the state of the pastures, and the proper shifting of the pasturing stock.

The weeds in the grass lands, as well as in the tillage grounds, should also be carefully regarded, to see that not a thistle blows, or any other sort of weed ripens its seed, either in the open parts, or the borders or banks of them.

In the winter season live stock becomes the chief object of the manager's attention, not only to take care that they are properly supplied with suitable fodder and water; but that they have sufficient shelter and convenient resting places.

And the watering of grass lands is another matter which deserves particular regard from the farm manager at this period of the year. It is, however, a sort of work which requires nice attention in its performance.

There are likewise various other points of farm management which may be equally deserving of regard by the person employed in directing the business of a farm, though of much less importance than those which have been noticed.

While the work of the farm is carrying on in the fields, it is the province of the manager to be frequently with the work people, to see that his directions are properly attended to, the different operations executed in a proper manner, and the necessary dispatch observed in performing them. He must be frequently passing from one set of work people to another, keeping a steady eye upon the various kinds of work which are going on, and directing such additional aid as may seem requisite in particular cases, especially where team labour is performing, in order that the whole business may be conducted in the most profitable way.

In directing the work of teams, an even steady pace should be inculcated, both in the view of the animals, and the labour which they are to perform, as hurrying them never answers any good purpose. On particular occasions it may be requisite to have recourse to as much expedition as possible, in which cases the example of the manager, and the holding out of suitable rewards, where necessary, may be the most proper incentives to exertion. Under all circumstances, laziness and trifling should constantly be held in the utmost detestation and contempt by the director of a farm, as being equally fraudulent with that of little pilfering. And their strong reprobation has not unfrequently an useful effect on the farm labourer.

The proper regulating and directing of farm servants, and those work-people who are employed, form an extremely difficult part of the manager's duty. The best method is probably that of encouraging such as are good by every proper means, and never suffering bad ones to continue. It is always the best policy to pay good wages, and have the best workmen that the situation affords, as these are often sixpence or a shilling a day better than ordinary ones, though no distinction has been made by custom in respect to the prices in these cases. It is of great advantage for the manager of a farm to keep a proper distance between himself and the work-people under him, without destroying that freedom of opinion concerning the works carrying on, which is, in some instances, essential to their proper performance. In the directing of work-people, the rule with him should be, in no case, to find fault, without occasion, or to commend without reason; as good workmen cannot brook the former, or bad ones be mended by the latter. Real faults should not, however, be overlooked, but the workmen be told of them in a proper way, according to their nature; and where the case demands it, let such strong language be made use of as may arouse them to due exertion. A great deal, however, depends upon the orders of the manager being conveyed to the workmen in a proper way; as where they are given in a loose, incorrect manner, it is not to be supposed that they can be perfectly executed. It is difficult to explain farm-works in words, so as to be fully comprehended by workmen, and where it is done by the medium of another person, inaccuracy is certain. It consequently

quently becomes essential for the manager to give his orders personally, and when it can be done, even upon the spot, to such workmen as are to execute them, as he can there fully explain himself to them, and where necessary, assist them in setting out the works. The able manager, therefore, constantly attends in person, in beginning new works, and where they are out of the common line of husbandry, remains with the workmen directing them, and returns occasionally to them, until he finds them completely in their work, as, without such attention, much time and labour would often be thrown away.

These, and various other reasons, render it necessary that a farm manager should be perfectly conversant with every sort of agricultural business and operation, as well as with the nature and management of all kinds of tools and machinery, as, where this is not the case, the work of the farm can never be properly directed. When he is deficient he must of course endeavour to perfect himself as speedily as possible by incessant practice. Without some degree of perfection in this way he cannot be able either to detect or correct indifferent workmen, or know when to be satisfied with such as are good, as they will not bear to be found fault with improperly. It is only by such means that he can be enabled to discern when the business of the farm is executed in a proper manner.

In his dealings, and general intercourse with other persons, the farm manager should be scrupulously attentive to punctuality and the keeping of clear accounts, as upon these his character will in a great measure depend.

Where the transmission of the accounts of a farm are required at stated periods for the use of the proprietor, the following method may be adopted.

First, A weekly account of labour, with a journal of the works which are going on, each day, and short notices of such transactions and occurrences as may have taken place during the above period, and are of use to be known.

A proper form for this purpose is necessary to be provided, which consists of eight columns, ruled in a perpendicular manner on a large sheet of paper. The first for containing the names of the teams and workmen, and the last for a money column.

The six intervening columns are for receiving the different works of the six days of the week.

Across these columns are drawn horizontal lines, the uppermost being wide, to receive the works of the several teams, whether of oxen or horses: the rest, of ordinary size, for those of each servant or workman; their several employments, each day, being entered on the lines which lead from their respective names; and the day's wages of labourers in the money column, at their terminations.

Secondly, A monthly account of receipts and disbursements; including the weekly payments for labour; and shewing the balance of money in hand at the end of each month.

Thirdly, An annual account current, consisting of the several totals of the twelve monthly accounts; including the manager's salary; which shews the state of the account at the end of the year.

Fourthly, A granary account, shewing the several quantities of grain of different kinds threshed out, with the disposal or expenditure of every part or parcel of the same. And a similar account of every other sort of marketable produce.

Lastly, An inventory account, taken at the close of each year by persons appointed for the purpose by the proprietor; containing every thing of value on the farm, as live-stock, crops, manure, implements, &c. And a general report of

the state and condition of the farm, as well as a list of outstanding debts and monies due on the day of settlement.

By striking the balance of the whole, the profit or loss of the farm will be satisfactorily shewn.

FARM Offices, a term frequently applied to the different out-buildings which become necessary in the management of a farm. They are of very different descriptions according to the nature of the management which is to be carried on; and it is a very essential point, as has been seen already, that they be distributed in a proper and convenient manner for the sort of business which is to be performed in them; as by such means much time and labour may be saved to the farmer in the preserving of his produce, as well as in the foddering and taking care of his live-stock. See *FARM-Buildings* and *FARM-Yards*.

FARM-Servant, is that sort of servant which is engaged in the performance of some part of the necessary businesses of a farm. These servants are of various descriptions, as bailiffs, ploughmen, yard men, &c. There are likewise cowmen, dairy-maids, &c.

In the hiring, or engaging of all sorts of servants for the purpose of farming, great care and circumspection are necessary to ascertain that they are fully competent to the execution of the sort of work which they wish to undertake, as, where this is not the case, much injury may arise to the farmer from their improper conduct or example. And as much of the improvement of agriculture must necessarily depend upon them, they should be kept in a regular manner, and with a proper degree of subordination, in order that they may be ready to perform whatever is properly required of them by the master or his bailiff. Without this the business of a farm cannot go on with propriety, or in a beneficial manner to the proprietor. The number should likewise be well-proportioned to the nature and extent of the farm, as well as the work to be performed, as the loss is considerable where this is not the case.

By the author of the "New Farmer's Calendar," it has been noticed that Old Michaelmas is the usual time for hiring farm servants throughout the country; but he acknowledges himself entirely of Mr. Marshall's opinion, that it is one of those customs which ought by all means to be changed for a better. Michaelmas brings with it a great pressure of business of every description; and to be looking after servants at that time, or even to admit new ones, entirely unacquainted with your peculiar methods and management, is extremely inconvenient. Old Christmas, as a season of more leisure, would surely, he says, be a more proper period for this affair. As to farming-servants, the best counsel he is able to give is, for an employer to receive no known thief or idler, to give the greatest possible encouragement, to overlook trifles, and to trust implicitly to no man's honesty or industry, but to put both to the severest test; so shall he have a choice of the best labourers in the country, and enjoy the profitable reputation of the best master. In a small concern a farmer may himself superintend his whole business; but a gentleman-farmer, or the cultivator of an extensive tract, particularly if managed in the more varied style of the new husbandry, will, he contends, require a bailiff, and over-lookers, in proportion to the extent of the business. The bailiff of a gentleman who cultivates a hundred acres of land for his convenience or amusement will have leisure to work himself, which is impossible, or rather totally out of question, with one who has extensive business to superintend, since that alone, if he be industrious, will take up his whole time, early and late. In very large businesses, a bailiff will need occasional lookers-on under him. A bailiff ought to have had some years experience of a
least

least the common methods of husbandry and gardening, of the management of all kinds of live stock, and of buying and selling; he should be able to keep common accounts; in short, he must be something, either from nature or habit, above the common labourer. But then he must have a bailiff over him; and such must be the proprietor of the business, unless he rather choose to risk the consequence. As to entrusting these upper servants with buying and selling corn and cattle, he would advise no person to do it, except, indeed, those whose situation is so elevated that such engagements might be thought inconvenient and improper: still it is no derogation from the honour of a prince to be well-informed of market-prices, and to be able, by inspection, to form a judgment of the worth of cattle. He dwells a little on this head, he says, because he has seen too much both of the gross ignorance and iniquitous collusion of bailiffs and managers in bargaining. It is a common saying, "Oh! your master is a gentleman, he don't want to get money, but we must live!" Indeed it is no wonder that gentlemen do often farm their own estates to loss, considering the sottish, ignorant, and knavish instruments which they employ under the name of bailiffs. It is recommended by some, to vest a bailiff with full power of discharging the servants and labourers; the propriety of which he is rather inclined to dispute. Invested with such a power there is no check upon his conduct; whereas, were this particular made matter of reference to the principal, all necessary information on both sides would come out. One of the first qualifications of a bailiff is, the writer says, to have a mind perfectly indifferent to all prejudice in favour of the old system of husbandry; and where things are upon an extensive or improving scale, it ought to be an invariable maxim to receive no servant or labourer who will not positively agree to follow directions; in default of which, he ought instantly to be taken before a justice of the peace. He has known several instances of a combination among the ploughmen not to work without their accustomed number of horses, &c. See BAILIFF and LABOURER.

The author of the "Minutes of Agriculture" has, many years ago, on the most mature calculation, stated the annual expence of a man servant, maintained in the house, to be not less than thirty-five pounds, and that of a boy not lower than twenty-three pounds, supposing the yearly wages of the former to be ten pounds, and those of the latter three pounds. Now, says he, the expence of a day-labouring man for the whole year, were he to work every day, would not be more than twenty-seven pounds ten shillings, which makes a difference of seven pounds ten shillings, against keeping a man in the house by the year, and that of hiring one by the day. And that of a boy is still more in proportion, as the expence of a day-labouring boy for a whole year, allowing him to work every day, is only thirteen pounds, which makes a difference of ten pounds, or more than three-fourths of the boy's day-wages. In this account no deduction is made in the daily pay for rainy days; consequently, the impropriety of keeping plough-boys in the house is considered very obvious; and though it may be convenient to have the carters about the house, the convenience is not conceived to be worth the annual sum of ten pounds seven shillings. It is, therefore, advised to put a woman into a cottage within a small distance of the farm-yard, to take such servants as lodgers, and to keep in the house no more farming servants than a butler and a yardman. It is absolutely necessary to have somebody about a farm-yard in cases of emergency; but the above two are quite sufficient, as the carters in the adjoining cottage will be nearly as handy as if they were in the house. Such a

measure can, however, only be local, though the hint may have a general tendency. It is probable that the farmer who keeps no accounts may imagine he saves money by boarding his servants in the house; but if he keep them in the luxurious manner in which servants of this sort in general expect to be kept, he will be greatly mistaken. The farmer who sits at the head of his kitchen-table may, indeed, without doubt, feed his men much cheaper than a person who eats in a separate room; yet the observation is just, that one fed by his master costs the community as much as two who provide for themselves; for discharge a grumbler, one who pretends to be dissatisfied, though in fact only fatiated, and he will return to his bread and cheese with, perhaps, equal health and equal happiness. He sits down to his master's table with a resolution to eat voraciously of the best, to do himself justice; but at his own table eats sparingly of the meanest, to save his money; self interest being his motive in both cases.

The rise that has since taken place in the expence of servants, in every part of the country, has led to still fewer being kept in the houses of the farmers. But in this there is also considerable disadvantage; they are less obedient to their masters, less in need of characters when they change their situations, are less cheaply kept, consequently raise the price of labour, and liable to the loss of much time, from being out of employ. Besides, they have more opportunities of drinking and associating together, by which combinations are apt to be formed for preventing the introduction of new implements or new modes of husbandry. And great inconvenience is often experienced from the irregular manner in which they come to work, or their not coming at all. The servant who lives on the farm is likewise much more interested in getting forward with the work which is necessary to be done than the mere day-labourer; and there is much less inducement for him to carry away different articles with which he is entrusted, as corn, hay, &c. from his not being able to keep any sort of animals to consume them.

It has been strongly advised by an able writer on rural economy, to employ active young men as much as possible in performing farm work, especially during the hay and harvest seasons, as a few such as are idle and sluggish soon spoil all the others. "Mix," says he, "two or three old women, or two or three boys, with a company of men, and the effect will be very soon visible; for the men will soon conform to the ways of either the old women, or the playfulness of the boys. It is not prudent to employ many women with the men; and nothing but necessity can excuse it. Two women, after the first or second day, will do as much work as half a dozen alone. If it be necessary or convenient to employ a number of both men and women, it is but common good management to keep them separate; with this exception, which may be laid down as a maxim, namely, one man among women, and one woman among men. A crusty conceited old fellow will check the gossiping of the women; and it has been remarked that raking after a young wench has animated as much as a gallon of ale. Two are dangerous; they breed contention, and rather retard than accelerate. The most valuable servant in harvest is a good carter. It is necessary to common management, that he should be able, willing, and careful. Every pitch of hay and corn, generally speaking, passes twice through his hands; he loads and unloads, which are the two most laborious tasks of harvest; he drives the team backwards and forwards; if he loiters by the way the field-men or stack-men must stand idle; if he spill or overturn his load, or if he break his waggon, or set his horses,

horses, the arrangement of the day is broken; and, perhaps, the damage done by the loss of time rendered irreparable by the next day's rain. A good carter will not suffer his waggon to be over-loaded. The field-men, too, that is, the pitchers and assidant loader, should be young and active, and well matched with the carter."

It has likewise been suggested, that the managing servant of a farm should be attentive to a variety of other points and circumstances, in directing the business of it. Nothing, it is contended, contributes more to facility and satisfaction in it than a forecast toward works which are to be done. A miscarriage is ever to be dreaded as a mischief; and, when it is brought on by a want of forethought, it brings with it a degree of discredit, and a train of unpleasant reflections, which sour every enjoyment. This sort of servant, it is hinted, should have a forecast toward crops for three or four years, toward team labour for as many months, and should look forward with the view of hand labour for some weeks, according to the season of the year. And in order to bring the matter to a degree of certainty, it is highly requisite to make out a list of the fields or parcels of land of which the farm consists, with the crops which each has borne for some years back, together with the manurings which they have severally received, in order that the future treatment of each may be decided upon with proper accuracy: and every autumn to form, by the assistance of such lists, an arrangement of the crops that are intended for the ensuing year, classing the fields or pieces of land according to the purposes for which they shall be intended; thus ascertaining the quantity of each crop, whether arable or grass, as well as the quantity of ground intended for pasture, in order that the quantity of team labour may be distinctly foreseen, the required strength be estimated from time to time, and the several crops be sown in due season; and, in order that the stock of the ensuing summer may, in due time, be properly apportioned to the intended quantity of pasture ground, as well as that the works of summer and harvest may be constantly before the eye, and proper hands be engaged in time to perform them in season. And a sort of memorandum list is advised to be kept of the business to be done immediately or in immediate succession, whether in relation to crops, or to any other concerns of the farm, that nothing may escape the memory; and that the most requisite may be brought forward first, or another which is more suitable to the state of the weather. In this, as in other business, the principal object to be aimed at is that of insuring success, which is not only profitable to an employer, but satisfactory to the person employed. Whereas, a miscarriage injures at once the property of the one, and the character, as well as the peace of mind, of the other. Hence a farm manager ought to engage in a work, whether of improvement or ordinary practice, with caution, and to proceed in it with attention and firmness. A standing rule respecting this main object of management is, not to attempt too much; and never to begin a work without a moral certainty of being able to finish it in due season.

It may be observed, that, besides the common work of a farm, as the culture and harvesting of crops, the rearing and fattening of live stock, and the business of markets, there are many other objects of attention which ought to be constantly kept in the mind, or the mind's way, of a manager, as on them the difference between good and bad, between correct and slovenly management very much depends; such as keeping the home-stall in repair, and free from impediments, attending to private roads and drift-ways, keeping up fences every where in thorough repair, attending partic-

ularly to young hedges, and to the rearing of hedge row timber, the seeing the gates swing clear and catch with certainty, equally to preserve them from injury and to prevent loose stock from going astray, the attending to drains and water-courses, to see that superfluous waters have free passage to their proper outlets, and that they be readily discharged; and that in summer strict attention be paid to drinking-pools and other watering places of stock, as well as to the state of pasturage, and the shifting of pasturing-stock; likewise to weeds, as well in grass grounds as in arable lands, to see that not a thistle blows, nor any other weed matures its seed, either in the areas or on the borders of fields. And in winter much care is necessary not only to see that the stock are regularly supplied with proper fodder, but that sufficient shelter and comfortable resting-places are assigned them. At this season, too, the watering of grass lands should be attended to, as much as the nature of the situation will admit; and to the accumulation of manure an unremitting care should be bestowed the year round, as much depends upon it. On the whole, the performing these and other objects with propriety requires repeated examinations of every part and particular under his care, committing to his memory whatever demands his more immediate attention; so that whether he is on the spot, or arranging his plan of operation in the hour of leisure, it may be present to his mind, and take its proper course.

The business of a managing servant, during the time of work, lies in the field, in executing the plans he has formed, in passing from one set of work-people to another, not more to see that the different operations are rightly performed with proper dispatch than to order any required assistance (to the teams especially) in order that every part of the machine may be kept in profitable motion. In the ordinary operations of husbandry, and on common occasions, a steady even pace should be recommended, equally for the good of the working animals and the work which they are performing; yet there are times when quick dispatch is necessary, and then it is his duty to encourage good speed by his example, and by promises of reward, if the occasion require it. At all times, and on every occasion, idleness is a crime which ought not to be suffered to pass with impunity. It is a direct fraud; and a manager should guard against it with the same care and assiduity as against pilfering. A day labourer, who idles away an hour, robs his employer of an hour's wages; and thereby injures him as much as if he were to steal a faggot of equal value. This is a truth which requires to be deeply impressed on the minds of labourers, as the impression has been known to have had a good effect. It is, however, justly observed, that the right ordering of servants and work-people is a difficult branch of moral duty, and which forms an important part of that of the manager of a farm. They require to be treated according to their respective merits; encouraging good ones by extra wages or other rewards. Some men are worth double the wages of others, as day-labourers; yet custom makes no distinction between them in this respect! Hence the propriety of engaging the best workmen the country affords, and retaining them by civil treatment and suitable encouragements. The managing servant should constantly keep his work-people at a proper distance, without destroying that free communication of opinion respecting the work in hand, which, on ordinary occasions, every intelligent workman should be allowed. A standing rule of conduct in the ordering of workmen is, never to find fault without occasion, nor to commend without reason. Good fellows will not brook the former, nor will bad ones be mended by the latter. But it is right to habituate workmen in general to

be told of their real faults; first in the mildest terms the occasion will admit of, reserving the warmth of temper for extraordinary occasions; and then it is prudent to sting them with keen, rather than to load them with heavy words, to endeavour to stir up their pride rather than their malice or resentment. Much of the smoothness and uniform success of business depends on the manner of communicating orders to workmen. If orders be loosely or inaccurately given, it is unreasonable to expect that the execution of them should be faultless. It is difficult to explain business in words with sufficient accuracy to rustic workmen; and if a third person is suffered to intervene, errors are inevitable. The managing servant should therefore make a point of giving orders in person, and, if possible, on the spot, to the men who he means shall execute them. Then he can explain himself to them intelligibly and fully, or assist them in marking out their work. There is always danger in merely verbal orders, and in a message certain mischief. It should be a constant rule with him to set his men to a fresh work in person; and if it be out of the common way of husbandry, to stay by them or direct them with his own hands, and return to them again and again until he finds them completely in their work. In this view, as well as for other reasons, this sort of servant should be master of every implement, tool, and operation belonging to his profession; and if he should find himself deficient in any particular, he should practise it, day by day, until he make it familiar to him; or how is he to correct a bad workman, or to know when to be satisfied with a good one, who, knowing when he is right, will not bear the reproaches of ignorance? He has no other way of securing the esteem and attachment of good workmen, and of finishing in a workman-like manner every thing that he undertakes, than by making himself master of his business; without which little satisfaction will arise from it to himself, or profit to his employer. And in the general principles of conduct, in his dealings and intercourse with other men, punctuality is one of the most essential. Method is the best assistant of punctuality; and clear accounts are some of the best results of method. These should invariably be kept with accuracy, and be sent to the proprietor in weekly, monthly, and annual periods, so as to shew the daily state of the work, the monthly state of receipts and payments, and, lastly, the whole state of accounts and balances. In this way a variety of evils and errors are checked and guarded against.

There is a great variety in the methods of engaging and employing farm-servants. In most of the more northern counties it is the custom to hire them by the year, in which case they commonly live in the house. But in many of the southern districts this is not the case, they being nearly, if not wholly, in the situation of day-labourers. And this method, though by no means to be commended, for the reasons already noticed, seems on the increase, probably owing to there being somewhat less trouble in the family. There are likewise different customs in the manner of employing them. In Surrey it is mostly an established rule for every man in the harvest season to work by the acre, or the month, and not by the day. Where a labourer is constantly employed through the year, he expects in the harvest to be constantly employed in mowing, reaping, and other works of this kind, by the acre; or to have his harvest month; that is, an advance of wages certain, wet or dry, during that length of time, commencing when it is the most suitable to the farmer. This is a convenient practice, as they are always at command in cases of emergency, and nothing but the continuance of rain till the barns are empty can render them burdensome. In many other dis-

tricts, practices somewhat similar are found to prevail, and have an equally beneficial tendency. In these cases they are not allowed, in general, to regard any particular hours in the work, though in other cases the hours of labour are mostly in the summer from six in the morning to six at night, and in winter from the time that it becomes light until it is dark.

The rates of wages are so very different in different places, that it is almost impossible to reduce them to any order; but in most districts they may stand somewhat as below.

	<i>Men.</i>	<i>Wages.</i>	<i>Former.</i>	<i>Present.</i>
Ploughman			10 to 16	15 to 25
Carter or waggoner			8 to 15	15 to 20
Bailiff or yard-man			8 to 14	14 to 16
Boy			5 to 8	8 to 12
<i>Women.</i>				
Dairy-maid			6 to 8	10 to 14
Under dairy-maid			3 to 4	5 to 7

These wages are exclusive of bed, board, and washing in the house. In most of the northern counties they have been nearly doubled in the course of the last twenty years. And in those of the south the rise has been equal in most places, but in some considerably more.

Many suggestions have been offered by writers on rural economy, in regard to the means of regulating the rate of wages of farm-servants and labourers, but hitherto, perhaps, with little success. In the "Agricultural Report of the Board, for the West Riding of Yorkshire," it is stated that the only mode of making them proportional to the rise or fall on the value of money and provisions, is, to pay them in kind; that is, with a certain quantity of corn, as the parties may agree, which, at all hazards, insures them a comfortable subsistence, and prevents them from a daily or weekly visitation of the markets. Where they are paid in money, it is supposed to expose the thoughtless and inattentive to a variety of temptations, but that when paid in kind they cannot raise money to gratify the whims of the moment. It is hinted, that in those counties where this mode of payment has been long established, the ploughmen and labourers are on the whole better fed, live more comfortably, and rear healthier children, than in those parts where, from being paid in money, the currency of the article facilitates the expenditure, and prevents them from laying by a stock of provisions for their support, when out of work, from accidents or distress. In the part of the country where the writer resides nearly the whole of the farm-servants are paid in this manner. They have a certain quantity of grain; maintenance for a cow, summer and winter; a piece of ground for planting potatoes, and raising flax upon; and whatever fuel they require driven gratis. These, with the privilege of keeping a hog and a few hens, enable them to live, and bring up their families in a comfortable manner; and while their income is considerably less than people of their station in other parts, they are on the whole better fed, better dressed, and enabled to give a better education to their children. Placed under these circumstances, they are a respectable set of men; and for frugality, faithfulness, and industry, they will bear a comparison with their brethren in any quarter. It is consequently advised to introduce a similar method of paying farm-servants into this district, which, although it might at first be attended with some difficulties, would contribute to the public good, and to the advantage of the labouring peasantry in various respects. The writer of the "Report for the County of Hereford," has likewise stated, that if a certain proportion
between

Between the price of labour, and the average price of wheat, could be fixed by law, so as to render the applications for parochial relief necessary only in cases of very large families, of unusual illness, of scanty seasons, or any other real emergency; the measure, it is presumed, would be honourable to the country, would stimulate industry and fidelity, check dishonesty, and endeavor to their native soil a numerous class of useful persons.

In attempting any plan of this nature, various difficulties, both of a local and general kind, would present themselves, which no scheme that has yet been brought forward, so far as we know, seems to have sufficiently provided against.

FARM Servant's Rooms, the buildings or other places where servants of this kind sleep and lodge. These rooms, especially where the farms are large, should always, if possible, be quite distinct from the house. Where the farms are of much extent, and consequently a great number of servants wanted, particularly where they are unmarried, suitable and convenient rooms for sleeping in, and where they find their own provisions, for preparing and dressing them in, are not merely requisite, but of considerable advantage to the farmer, as well as the men, as they save much time, which would otherwise be lost, in going to their meals; besides keeping them together in a sober, steady state, ready for their different employments. In this way, too, the servants are a great deal more comfortable, and live far more cheaply than when they go to the public-houses to eat their meals, as is much the case in the more southern parts of the kingdom, and by which their manners too frequently become depraved, their constitutions enfeebled by intoxicating liquors, and much useful time often lost to their employers as well as themselves.

But inconveniences of this kind are probably the best guarded against by having such servants, when it can be done, in the houses of the farmers, in which cases the eating-rooms for them should be so placed as that a facility may be given of overlooking them. But the rooms for lodging in should, at the same time, be quite detached and distinct, as being the safest and most proper when contrived in that way, as such persons are frequently careless and negligent of their candles and fires, besides being irregular in other parts of their conduct. In whatever situation such rooms may be erected, it is essential that the ground-floors should be formed of stone, brick, or some other incombustible material, while the upper ones are laid with plaster, as in some of the midland districts. Or, as being more readily laid, brick in some cases may be had recourse to. See *FLOOR*.

FARM-Yard, in *Agriculture*, is the area or plot of ground, on the sides of which the farm buildings are erected, and which for the most part adjoins, or is connected with, the house. It is the space of ground that comprehends the live flock, and in which they are foddered, the dung prepared, the tools laid up, and the various necessary operations of the farm executed. It is a matter of the utmost importance to the farmer to have these yards conveniently formed and arranged, as, where this is the case, there is a considerable saving of both time and labour in performing the different kinds of work in them. Yards of this kind have very different sizes, shapes, and distributions of their buildings, according to their situations and other circumstances. One principal object should constantly be, that of giving the fodder which is to be consumed, of whatever sort it may be, a progressive course from the barn-yard or stack-yard, through the cattle-houses and sheds to the dung-heap, without incurring unnecessary labour in carrying it different ways.

And another point that should be particularly attended to is, that all the different materials which are converted to the use of animal food should pass from the kitchens, dairies, and other places, to the hog-styes or other convenient places of consumption for them. By a nice attention to the distribution of the buildings, in forming such yards, many other advantages and facilities may likewise be given to yards of this description.

The author of "Modern Agriculture" has remarked, that a farm or foddering yard on a suitable plan is well known to be an highly requisite appendage to all such farms as are well regulated, and is considered as indispensable by the most enlightened farmers. Where the farm buildings are erected in the square form, the court yard ought to be paved to the extent of nine or ten feet from the bottom of the walls all round. The earth should be excavated from the remainder, so as to form a hollow towards the centre. Then a thick coat of gravel, or, what is better, chalk, should be laid over the whole, which would answer the double purpose of keeping the place dry, and facilitate the shovelling up the rotten dung. Care should also be taken to have proper drains to carry off superfluous water, in order that the yard be kept dry. It would be very advantageous to have a pond for the reception of this superfluous water, which should be so placed as to flood any of the adjoining fields at pleasure, during the proper season.

By the writer of the "New Farmer's Calendar," it is observed, that it would be nugatory to hold forth about aspect, straight lines, or right angles, in the formation of a farm-yard; such considerations will ever be postponed to those of local convenience; it will be sufficient to insist, that the space be ample and properly divided, the offices sufficiently numerous and commodious, and the whole sheltered on every quarter. In the arrangement of the offices, namely, the dwelling, barns, stables, cattle-houses, and sheds, the material objects ought to be such a position as may contribute to convenience, and the abridgment of labour, as already noticed, and at the same time afford the largest possible proportion of shelter; this last, however, null obviously, the writer thinks, gives way to the former consideration; and, as a substitute, all the vacant places or exposures may be well barricaded with a lofty, warm, and substantial fence. Mr. Marshall's idea, of an angle of the buildings presenting to the north, by which position the two sides would afford shelter in the most material points, from the north-west to the north-east, is, he thinks, happily conceived. Respecting the number of yards, no precise rule can, he says, be expected any farther than to state, that, in the smallest concern, a division is necessary, and in those of greater magnitude two main yards, with appendages for stacks and other purposes, conveniently situated, will properly describe the home-stall. A barn seems the natural division of two yards, since it will serve the common purposes of both.

The description of the plan of a farm-yard is afterwards offered to the attention of the farmer. A circle of sufficient extent being marked out, and the area properly levelled and hollowed in the centre, the whole of the needful farm-buildings of every description, barns, granaries, milk house, stables, ox and cow-houses, pig-styes, store-rooms, and sheds, are to be erected around, in the most convenient order in point of useful contiguity, and with reference to shelter in the coldest exposures. The area being so spacious that the buildings will not completely surround it, every vacancy is to be filled up with a good fence; with or without a lean-to and roof, as a shed. As many of these sheds as are required may be run up against any of the buildings,

that none of the cattle of the fold need be abroad, or feed in the rain or snow. Divisions and sub-divisions may be made at will, with hurdles, faggots, or posts and rails, for the purpose of every requisite separation of stock. The number and position of the entrances to be regulated by local convenience, the gates being boarded to render the security complete. The stack-yard must be formed without the circle, the corn-stacks being placed within the least distance possible of the barn or threshing-machine; those of hay and straw in an equal degree of convenient proximity to the back-sides of the stables and cattle-houses. It is obvious that the back parts of the buildings will afford convenient walls for sheds or erections of any kind, should a very large flock or peculiar circumstances render it necessary to fold a part without the circle; the communication, or rather the whole system, may, it is asserted, be rendered complete, by furnishing all the principal buildings with entrances for cattle backwards, as well as in front. In the investigation of this scheme, however, it will easily be perceived, that a mere pedantic literal adherence to the figure of a circle, to which every other consideration must yield, is not so much intended, as a generally round compact inclosure; nevertheless, it seems that the nearer the figure approaches to a true circle, the less will be the waste of ground and expence in fencing. Although not absolutely necessary, it would be a point of great convenience, it is supposed, for the back-side of the dwelling-house, consisting of the dairy and other out-offices, to form a part of the fold-yard circle. The wash of every kind from the kitchen and dairy should be saved, with the utmost care, and led by proper sinks and pipes into a capacious under-ground cistern, from whence it may be pumped into the hog-troughs, the styes being placed within a reasonable distance for the sake of that convenience. Adjoining the dairy should be found the cow-houses and fatting-houses for oxen; the pig-styes next; between the styes and the ox-stalls is a handy situation for a boiling and washing-house, in which an oven also, or kiln, is an excellent convenience. The lofts above the different offices might, it is suggested, communicate by doors through their several partitions, with the granary, threshing-mill, and barn, affording the convenience of wheeling sacks of corn, or chaff, to every part. Room above or below must be afforded likewise for hay, potatoes, cabbages, and every other article of provision of that species. In feeding stalled oxen, to approach them at the head instead of the feet is much the best method; for which end a gang-way, sufficient to admit a large barrow, may be left between the wall and their head-boards, these being made to slide. Such is the practice of several distill-houses which feed oxen; and it has been recommended, where cattle feed at racks appending to the barn-side, to have sliding boards, through which the threshers may push the straw, without having to quit the barn, in order to replenish the racks. A chaff-house should be connected with the barn; and we will suppose the opposite range, whether stables, sheds, flore or cattle-houses, to have an appropriate share of those conveniences of connection already stated, that as little waste as possible may be made of time, labour, and materials in executing the farm-yard business.

And it is farther suggested, that, in an extensive farm, where it is ever inconvenient and expensive to cart manure to the distant grounds, the great convenience of out-stalls appears very striking. It is not meant to insinuate that there are never any out-yards upon large farms, but that they are not in general enough attended to, so as to render them of sufficient utility. A yard of this description, well fenced in, might, it is supposed, contain a cottage for a labourer and his family, a stable for a plough-team,

with sheds for straw, cattle, and sheep; but threshing in distant barns is imprudent; and of two evils it would be the least to cart the straw from home, flacking or housing it at the out-stalls. These different hints deserve to be well considered by the proprietors of farms before they begin to erect farm conveniences of this kind.

There are likewise a few other objects that demand particular regard in forming new farm-yards. A great variety of opinions have been offered in regard to the nature of the situation for receiving the stall and yard manure, it being by some considered the best on a surface which is perfectly level; while by others it is conceived better where this is a little raised; and by others again, who are very numerous, the hollow is, on the contrary, decidedly supported as the best. And to this last the author of the treatise on "Landed Property," is, from long experience, inclined to afford his assent. But though he thinks it should be hollow, it does not follow that it should be deep. Its principal use, besides that of holding the dung, being to bring the rain water falling within the yard into the state of stagnation, and to let it pass off superficially, so as to prevent any thing of a ground current from carrying away the dung, either in a mass, or thick fluid condition; merely suffering the more watery particles to run off into a reservoir or receiver, constructed for the purpose of preparing or preserving them for being made use of afterwards. It is suggested, that two feet on the lower side, or deepest part, may be a mean depth; the bottom of the waste water channel being laid six or eight inches lower than the rim of the hollow or basin; the depth of water that it can contain, when free from dung, cannot be more than sixteen or eighteen inches, and as it is necessary to good farm yard management, that as soon as the dung collected during the winter season has been removed, that some sort of earthy materials should be deposited evenly over the bottom of the basin, for the liquid matters to operate upon, and bring into a state of manure, throwing upon them all the different substances that can be brought together in the course of the summer and autumn; by which means, from the basin being nearly filled up at these periods, the dung collected during the winter will be raised and supported out of the way of water, which is supposed by some to prevent the conversion of the different substances into manure. It is evident that suitable drains must be formed from the stalls of the different large animals, as well as from the pig-styes, and other buildings, where any sort of stock is fed and kept, to the hollow or basin, in order to convey the liquid matters; the mouth of the outlet channel being well secured from being choaked up, by piling the dung up to a great height above it; a suitable well or pit being provided and kept ready for the reception of the super-abundant liquid to filtrate and discharge itself into. When the farm has land of the grass kind lying in a suitable manner below the level of the yard, on which the overflowings of such basins may discharge themselves, every part of the dung yard may have a shelving direction towards the receptacle. But, in other cases, it should not receive any more water than is supplied by the atmosphere, which may easily be effected by elevating the rim a few inches above the surrounding surface of the yard, which must be occasionally freed from the matters deposited upon it, by removing them into the basin. In these cases the water falling on the surface of the yard should be conducted to a catch pool to deposit its useful materials, or to a drain made in a convenient manner for the purpose: and that falling upon the buildings be discharged, without passing through the basin; except there should be a greater want of liquid than solid manure.

From the very slow progress which yard manure is found

to make towards the proper state of maturation, in the open air, during the winter season, even when piled up in the driest situation, in consequence of its being constantly saturated with moisture and exposed to a cool atmosphere, the plan of having the receptacle for the dung of a long square form, so as to be covered with a roof to wholly protect it from rain water, and defend it from cold, has been suggested, and long since strongly enforced by the Board of Agriculture. It is supposed that by thus giving it the means of passing into the state of fermentation during the winter months, its conversion into manure would be beneficially expedited for application to those crops which are put in in the spring. But it has not yet been fully shewn whether the advantage would be adequate to the expence of such buildings, and the additional trouble of depositing and removing the manure. It deserves, however, to be ascertained by careful trials, though it is a method that cannot be yet safely advised for the common farmer.

It is a very material object to prevent, as much as possible, the waste of farm-yard manure, which takes place at present in most places; this may perhaps be the most effectually done by piling it up in the situation and manner which has been already noticed, and detaining the depositions of the liquid parts in suitable receivers, making collections of other proper matters where it can be done with propriety. It has been suggested that the having only a *reservoir* for farm-yard liquor is of vast consequence in these cases, even where there are no lands proper for letting the contents upon; particularly where it is provided from time to time, as noticed above, with suitable floorings of good mould or other matters, for absorbing the sediment which is let fall from the liquor, when in this stagnant condition.

In a dry season, when the liquid part is wholly removed by evaporation, the rich compost thus left should be carried out and spread on the grass lands which are under the scythe, as soon as possible after the crops have been removed from them. The benefit of a receiver of this sort, whether formed for carrying on irrigation, or for collecting the muddy sediment, will, it is supposed, be in proportion to its size, and the expence of making it in a given situation will be in a somewhat similar ratio; and will mostly pay in an ample manner for being made. For if one which costs ten pounds increase the annual produce of hay only one load, a tenant may, it is supposed, well afford to pay six pounds *per cent.* for the use of it. It is further stated, that on a sloping wavy surface, a reservoir of this kind may be formed at a very trifling cost in comparison to its utility. And the form or shape of it is considered as of no consequence, provided, when it is designed for irrigation, it be supplied with a valve, that when full, the water may be let off in a sufficient body to be distributed evenly, and with proper effect over the surface of the land.

All these points should be fully attended to in forming new farm-yards, in order that the greatest possible saving of manure may be made.

It has been justly remarked by a late writer on modern husbandry, that where the farm buildings are without order or connection with each other in the yards, as is too commonly the case in many parts of the kingdom, the dung is mostly thrown on spaces of ground allotted for the purpose opposite to the doors of the stables, cow-houses, sheds, &c. where it is allowed carelessly to remain; its more valuable particles, in the mean while, being exhaled by the influence of the weather till the return of the season, when it is usually laid on the lands. If the houses happen to be situated on an eminence, the dung lying in small quantities

is drained of all its moisture. If, on the other hand, they are placed in a hollow, the dung is for the most part allowed to remain soaked in water. In either case its quality must be greatly impaired, and its usefulness in promoting vegetation much less than when, by proper attention, all the essence is retained. The advantages resulting from well-constructed farm or foddering yards are, therefore, the writer conceives, various and important. By means of them the quantity of dung is much increased, and the quality rendered superior: for these reasons, he is of opinion, that the advantages of possessing proper accommodation for the cattle on the farm are more than sufficient to counterbalance the expence incurred in creating them. He feels himself warranted to state this opinion, not merely because it is his own, but because it is considered as well-founded by many intelligent farmers in both kingdoms, with whom he has conversed on the subject. The difference must indeed be obvious to every intelligent reader who is at all acquainted with these matters. Where proper houses and other accommodations are erected, the dung is collected into one mass, the various sorts carefully mixed together, and the superfluous water carried off by proper drains; by which means it retains its properties, and must consequently become useful, and its effects conspicuous, when applied for the purpose of invigorating the soil. Whereas, when the dung is allowed to remain in small, detached loose heaps, the most valuable parts are either drained off or evaporated; so that what remains is comparatively of little value. Although it will be readily admitted, that an active and industrious farmer who labours under the inconvenience of having too few farm-offices, and those improperly situated, may, by his superior attention, lay up as great a store of dung, of a good quality, as his less assiduous neighbour, who is better accommodated as to houses; yet, whoever makes this the subject of general investigation will find reason to be satisfied, that on all occasions where the proprietors, by liberal arrangements with their tenants, afford them the requisite accommodation for their horses and cattle, there the farm yard dung is in general in greater abundance, and of a richer quality.

There has been considerable diversity of opinion concerning the form of a farm-yard, that affords the greatest convenience, some contending for the square, others for the circular, and not a few for the angular or many-sided form. It is evident, however, that the shape must constantly materially depend on the nature of the situation and other circumstances which are connected with it. The square form was that formerly most in esteem; but this has lately given way to those of the circular and many-sided forms, as affording a greater number of conveniences, and more room in the same extent of building.

The following two plans of farm-yards are of the square form, and have been found highly useful and convenient in actual practice. The first is stated, by the author of the "Cheshire Agricultural Report," as being on the farm of Broom-fields, belonging to Mr. Peter Warburton. The buildings are constructed of stone, which was obtained from a quarry in the vicinity, and the whole of them covered with slate. The ground plan of all the various buildings and conveniences are shewn at *fig. 1.* in *Plate XVI.* on *Agriculture.* Here Mr. Becket, the present occupier of the farm, has availed himself of the opportunity afforded him by a gentle descent in the ground from the front of the house, to convey a small stream through the yard over the meadows below the buildings, by which an uncommon degree of verdure and luxuriance has been produced, which fully demonstrates the benefit which has been derived from the practice.

The latter is described in the "Farmer's Magazine," as being

ing constructed by David Hunter, esq. at Edsmount, in the county of Forfar, in North Britain; and the plan of which is represented at *fig. 2.* in the same plate. In this *A, A,* are stone troughs for the fattening beasts to eat out of; being formed of hewn pavement, as well as the divisions which are arched below; by which contrivance they can all be rendered perfectly clean, by pouring water into the westernmost, and making use of a broom as it is discharged at the contrary end. *B B,* is the groove or hollow behind the animals, which receives the dung and urine, and which last is discharged at the opening *C,* in the east wall into a wooden spout *D,* which is moveable at pleasure, so as to deposit it on any earthy material that may have been previously laid down for the purpose, by which means a great increase of manure is made for future use. *E, E, E,* are three small vents made in the north wall for letting off the moisture produced by the breathing of the cattle, by which the timber is greatly preserved, and the animals prevented from sweating too much or being too hot; their breath being lighter than the atmospheric air requires this sort of ventilation to expel it. *F,* a small door in the east corner, where there is a room and bed for a cattle man, that he may be at hand, in case of need. *G, G,* two doors to the southward, through which is an easy conveyance for the dung and dirty litter into the dung court, in which *H, H,* are sheds for containing your wintering stock. *I I,* the shed for holding turnips or other roots, as well as the straw and hay that may be requisite. *K,* the door, which is sufficiently wide to back the carts in, and in which the roots are topped. *L L,* is a roomy dung-stead, for depositing earthy or other substances, for receiving the discharges of the farm-yard, stables, and different stalls and sheds. *M M,* is a raised causeway, which ranges all along the feeding stalls and west side of the dung court.

The great advantages of this construction of farm-yard and buildings are those of keeping the cattle more clean, letting them have their food in a sweeter state; and thereby thriving better; and the preserving of a much larger proportion of the dung and urine of the animals. Besides, in this way there are other advantages in having the turnips or other roots brought from the field without waste, while they can be topped and the tops consumed green; in their being laid in with less labour and trouble; and in there being no necessity for using them in a frosted or improper condition.

This is an excellent plan where the practice of stall-feeding cattle is to be carried on.

The two farm yards which are represented in *Plate XVII.* on *Agriculture,* are formed on the angular or many-sided, and the circular plans, and are calculated for farms of considerable extent, and under mixed cultivation. *Fig. 1.* is the representation of an useful one of the former description; and at *fig. 2,* is the delineation of one of the latter kind. They are either of them capable of being varied so as to suit particular intentions. See *FARM-Buildings,* and *FARM-House.*

FARM-Yard Dung, is that sort of manure which is collected and raised in the farm-yard from the discharge and treading of different sorts of live stock. It consequently consists of the dung and urine of all kinds of cattle, horses, hogs, and other animals, intermixed with litter of various descriptions, and sometimes other sorts of more earthy materials. It is the most abundant and useful manure that the farmer has the command of. From its nature, and the manner in which it is formed, it is evidently a compost or compound substance, though different in some respects from those heaps of manure which are usually denominated com-

posts by farmers. Every opportunity should be taken to increase, as much as possible, this highly useful material, by collecting and depositing different kinds of proper matters in the stalls and farm-yards, which should be suitably formed for receiving them. See *COMPOST, MANURE,* and *FARM-Yard.*

FARM-Yard Manure, is a term frequently applied to the manure which is raised and provided in the farm-yards. See *COMPOST, FARM-Yard Dung,* and *MANURE.*

FARM-Yard Management, in *Rural Economy,* is that sort of management which relates to the business and operations of the farm-yard. In order to augment and procure as much manure as possible, the farm-yard should constantly be kept covered with some earthy material, on which the dung and urine of the cattle may act, and with which they may be combined, and thus increase the quantity of the manure heap. Good mould, peat earth, and the scrapings of roads and ditches, are highly proper for the purpose. Where there is a pit or reservoir for the reception of the urine and other liquid matters from the yard, it may be so placed as to serve two yards, and may be bottomed with rammed clay, and its sides plastered with some composition which will make it retentive. Into it may be shot as much ditch earth or other substances as it will properly hold, without causing an overflow; and, instead of pumping the liquor out in the end, as has been recommended, it is probably better to shoot in earth sufficient to wholly absorb it, afterwards carting the whole away to the compost-hill, which is believed to be the easier method of the two. Upon the bottom, in the yard, the layer of manure earth is to be spread to the thickness of a foot, if possible, throughout the whole area, the quantity in the centre, or drain, being increased two or three fold, as having the greater part of the moisture to imbibe. The whole must be kept sufficiently littered, that the cattle may not poach in the earth with their feet. The above, or some method of similar effect, for the preservation of articles so precious to the farmer as the dung and urine of his cattle, one would suppose, a late writer says, so simple and obvious, that common sense could never miss it. How strange then is it, that we see such beneficial measures generally neglected, and that by men who have it in their power to compass them, and who pretend to be sensible of the value of the measure? How many hundreds of farm-yards are there either mere bogs, or with bottoms which absorb and devour the most valuable part of the manure, or with a descent towards a pond, a road, or a ditch, where it runs off, to be in part or totally dissipated and lost? But what is still more singularly absurd is, that a pond or drain shall fortunately stop the grosser part of this waste, and yet it shall be suffered to accumulate for years unobserved and untouched! This is by much too frequently the case.

With the view of promoting still more the purpose mentioned above, from every stable or cattle-house, a drain, it is observed, will be necessary, in order to conduct the urine to the proper receptacle; not a mere common gutter, in which the liquid sinks or stagnates, keeping a constant puddle at the heels of the animals: there ought to be a grating, or sink-plate, to every two stalls at least, which, with the drain itself, should always be kept free and pervious. The entrance to the chief cattle-house is usually over a pavement of convenient width. The dung from the different houses must, both for convenience and preservation sake, be stowed near at hand; for, should it be wheeled into the area, it would be trodden to waste, that is to say, either bound down too hard, or too much scattered, instead of which it may be at once placed in a state proper for fermentation and putrefaction. Either slight pits may be made opposite to the

the stable door, and bottomed with marle or earth, or the dung may be made up in clumps or hills; in both which cases the nice and scientific cultivator may, if he please, cover with straw or stubble, in order to prevent exhalation, and to promote the putrefactive process. The heaps growing to an inconvenient bulk, an auxiliary dung-hill must be pitched in the nearest situation; thus, in a certain, perhaps sufficient, degree, with attention and a little ingenious contrivance, the dung may be preserved from exposure to the external air. In case of its too great aridity or drought, in the hot season, and with the view of re-producing fermentation, no method is better, the writer supposes, than to stir into the heap mud, weeds, slop of any kind, or foul water from ponds, ditches, and other similar places. Others, however, advise that the manure raised in the fold-yards should be wholly removed from them every six or eight weeks, and thrown up into heaps, in order that fermentation may be more fully carried on, in consequence of the more free admission of air and moisture, as by suffering it to continue longer in such places it is liable, from the excessive treading of the cattle and other sorts of live stock, to become so hard, in particular parts, as to prevent the regular process of conversion from going on; and in case of the season becoming dry for some length of time, to undergo decay in a partial manner only, which is very disadvantageous to the farmer. On this principle, therefore, the practice sometimes had recourse to, of turning over the manure in the farm-yards, in the vernal season, when the weather is dry, and the dung so compact and destitute of moisture as to require being cut and removed in large lumps, is evidently wrong, as by blending the dry parts with the more moist ones, the process of decay is greatly checked and retarded, and the forming of good manure prevented. The lighter and more evenly the heaps of the materials can be thrown together, the more quickly they take on heat, decay, and become good manure. And if the manure of several different sorts of animals be blended together, such as that of hogs, neat cattle, and horses, it is supposed by some to be so much the better, the fermentation proceeding more rapidly.

It is considered by many a very improper practice to have this sort of manure, in a state ready for application, any great length of time before it is wanted, as was formerly much the case; as the most rich parts of it are continually going off by evaporation and solution, and of course the strength of the manure much lessened.

Where this sort of manure is to be formed from the roots of different kinds of weeds and other plants, and various coarse vegetable productions, a much greater length of time will be required to bring it into the condition of good manure, than would otherwise be the case.

It has been the subject of dispute, the writer noticed above says, whether or not it be preferable, in point of interest, to keep cattle enough to consume all the straw as meat, without any being allowed for bedding: the affirmative, he thinks, not improbable; but it is a length in cattle-feeding to which few will be disposed to proceed. But to go upon the supposition of foddering abroad, nothing can be more plain than the benefit derived to cattle from warm littering and shelter; and it is equally obvious, that young and growing stock thrive much better in the range of a yard, than when confined in a stall, being also much more agreeable to their natural liking. This idea extends to store-pigs, which are almost indispensable in a yard, as gleaners of what would be waste to every other description of animals. Some are for confining all cattle to the house throughout the winter, and even recommend the expence

of entirely covering in the yard with a roof of deal boards, a greater premium, in his opinion, for the perfection of dung, than such perfection, if attained, would ever repay. In case of a very large flock, it would be to incur no slight risks of contagion. It would be to run into the extreme of the continental practice, where they exceedingly injure the health of their cattle by too close housing, stifling heat, and hot watery slops. Theirs and our common system form, he thinks, two extremes. He has long also been decidedly of opinion, that sheep are equally entitled to the benefit of the home-fold with any other description of stock, and that they will repay it in an equal proportion: they must, however, be folded apart from the other cattle. By keeping yards properly formed for them, well littered down with straw or other suitable matters, and having them put into them during the night, vast stores of excellent manure might be formed. Where deer are kept they might also be had recourse to in the same way with great benefit in the view of manure.

Great care and attention are requisite in the management of every kind of stock in the farm-yard, as well in respect to the proper foddering of them as the keeping of them clean. Each should be performed with great regularity and exactness. The farmer should himself make frequent examinations, and see that all the different descriptions of stock go on in a proper manner, and that nothing is neglected by the servants who are employed in the yard business.

The present mode of managing farm-yard manure, previous to its being laid on the land, is stated by a late writer to be in almost every part of the kingdom, where regular farm-buildings have not been erected, extremely negligent and improper, and such as calls loudly for reform. This will appear more especially necessary, he thinks, when we reflect on the small number of farms that are properly accommodated with farm-offices, compared with those that are deprived of necessary accommodations in this respect. We must, then, perceive that the evil, in regard to the mismanagement of farm-yard dung in Great Britain, is as extensive as it is serious. The loss of manure in this way must be prodigious all through the country. Reform has, however, begun to take place in most of the improved districts, and will, no doubt, be gradually introduced into the others, as the advantages of it become better understood. See *MANURE*, and *FARM-YARD*.

FARMS, Letting of, is the custom, practice, or business of getting, or providing them with such tenants as are proper and adequate to the cultivation and management of them. This is evidently a matter of great consequence to the proprietors, as their advantage depends materially upon both, in so far as their rents and the improvement of their lands are concerned. It of course behoves them to act with considerable attention in the adjusting of the business. There are several different methods of managing it, as by public auction, the highest bidder being the tenant; by ticket or written proposals, the highest offer having the farm; and by the asking of more rent than the farm is worth, so as to close with the person promising the largest rent, without regarding his qualifications or fitness as a tenant.

The two first methods are easy and convenient for obtaining tenants for farms, where the owners or managers of them are not well acquainted with the value of the lands, or the qualifications of the tenants. And where the silly imprudent custom prevails on estates of letting the manager have a profit on leases or agreements for farms, this manner of letting them becomes still more agreeable, as it is three to one that either the farms are let too dear, or that the tenants are unequal to their management; consequently

there is a fair prospect to the drawer of the leases of their being to be re-let in the course of a very few years. Further, if he have not only a handsome profit upon every pair of leases, but is allowed or accustomed to take fees of entry, the prospects are still more bright and promising. And where, in addition to these, there is a further profit on deeds of distress and surrender, how can a person be blamed who has probably a large family to support, for letting farms by auction or by proposals; or for agreeing with an adventurer, or with any man as ignorant as himself of their real value, for more money than they are worth; or for screwing up the tenants in possession to rents they can never possibly pay; when he knows, perhaps, that by so doing he shall not only enhance his income, but gratify his employer. It is justly suggested that it is the employer not the agent, who, under this false principle of management, is playing the losing game! Excessive rents are only nominal. They look well on a rent-roll while they have a right to stand there. But if the arrears of rent be received through the distress and ruin of the tenant, the injury done to the estate, not to mention its loss of character, is to be deducted from the nominal rent. At length, when the lands are completely exhausted, the buildings let down, the gates and fences broken and destroyed, the water courses choked up, and the roads impassable, the tenant, says Mr. Marshall, runs off, and the farm lies unoccupied, a very blank in the rent-roll. Such, he contends, is the impropriety of this method of proceeding in the tenancing of the estates. To the life tenant of an estate, who has no interest whatever in the remainder, and whose life is worth but a few years' purchase, such a mode of proceeding might claim, he supposes, a sort of justification. But that, in the possessor of an hereditary property, which is expected to descend to the son and son's son, such an improvident practice becomes, he says, altogether irrational. It might be deemed an act of folly in a young man; and of cruelty as well as folly in one of riper years; whose success might thereby be involved in perpetual difficulty; and his own memory in consequence be shrowded in disgrace. The writer, in his various examinations and reviews of the different departments of the kingdom, has seen much mischief and misery resulting from this improvident and impolitic plan of management in the letting of farms.

It is strongly suggested, that if the intimate connection which subsists, which must subsist between owners and occupiers, be well considered, and how much the interest of the former depends upon the conduct of the latter, it is but common prudence to be scrupulously nice and attentive to the choice of tenants. And as in every situation there is at all times a fair rental value, or market price, of lands, as of their products, there appears to be only one rational and eventually profitable method of letting a farm, which is that by *fixing* the rent and *choosing* the tenant. As in this mode there is the greatest chance of securing proper tenants, especially in so far as the good cultivation of the land is concerned and the due payment of the rent.

FARMER, a term which signifies a person whose business is the cultivation and management of farm lands, and the several kinds of live stock necessarily connected with them, as well as the different products which are afforded from both. Farmers may be still further distinguished, according to the nature of the farms, and the sorts of management under which they are conducted, into arable, grazing, dairying, and hay or grafs farmers.

The farmers of this country may now probably be divided into two classes, the large and the small, which differ very materially in their habits and opinions. The

views and notions of the latter are mostly narrow and confined, in consequence of the want of education, resulting from their situation in society, which does not permit them to improve themselves in any high degree. It is perhaps on this account that farmers of this sort are so backward in admitting any innovations on the methods of husbandry to which they have been accustomed: incapable of perceiving the benefits that might be derived from proposed alterations, they are too apt to adhere to the practices which they have received from their ancestors, and to transmit them unchanged to their posterity. Their habits having been formed to some particular system or practice, they continue to pursue it with a blind unvarying attachment.

On the contrary, the large farmers, having their minds more enlarged by education, are much more intelligent, and actuated by a more judicious and rational spirit of improvement. It is to the influence and exertion of this valuable class of farmers that most of the improvements which have lately been made in husbandry in this country are to be ascribed. They have likewise contributed in a very material degree to the extension and spread of that spirit of investigation and experiment which, while regulated by judgment, cannot fail of leading to the most important and useful results.

But a late writer on agriculture has arranged the farmers of this country under the following several classes or heads: 1st, the king; 2dly, the great proprietors and country gentlemen; 3dly, yeomen, and farmers properly so called; 4thly, possessors of small farms; 5thly, cottagers, including different descriptions of people who cultivate small farms, and a few acres adjoining towns and villages; and, 6thly, the unproductive class of husbandmen.

It is supposed that in regard to the first, it will not be denied that the governments of modern Europe have hitherto encouraged the towns in preference to that of the country; and in some measure depressed agriculture in order to advance manufacturing and commercial industry. While, on the other hand, the government of the immense territory of China encourages agriculture more than all the other arts; inasmuch, that the condition of a farm labourer in that country is said to be as superior to that of an artificer, as with us it is inferior. It is not believed difficult to trace these different systems of policy to the same source, however apparently inconsistent they are in themselves. The increase of commerce and manufactures in the different kingdoms of Europe has always been attended with an increase of revenue to the state, and which, in consequence of being brought more speedily, and with less expense into the exchequer, than that arising from agriculture, becomes thereby more advantageous; while the sovereigns of China derive the greatest part, if not the whole, of their revenue from the produce of the soil. From these opposite systems of political economy, another might, it is imagined, be established, infinitely better calculated to promote the interests of the nation, by affording the means of supporting a more numerous population than is possible to be done by adhering to either of the former. Were agriculture, manufactures, and commerce alike encouraged, they would all prosper in an equal degree; and though the revenues arising from the former might not be so well calculated to answer any sudden exigence, yet experience has proved, that, in this kingdom, they form the most sure and permanent resources of the state, as is evident from the land and malt taxes, excise on ale, beer, British spirits, cyder, perry, leather, candles, and almost every other article produced in the country.

If this proposition be well founded (and it is presumed it will not be controverted), it must give the most sincere satisfaction to every lover of his country to see that the sovereign of this great kingdom, which has risen so high in fame among nations for the extent of its manufactures and commerce, has, like another Cato, turned his attention to the cultivation and improvement of his native soil, and thereby done more for the encouragement of agriculture than could probably have been effected by any other means. The example which his majesty thus holds out for the imitation of the higher classes of his subjects cannot, the writer thinks, fail to be attended with consequences highly beneficial, as has been eminently testified by the meritorious exertions of his grace the duke of Bedford and many others; while the attention of the other branches of the legislature will naturally be turned to the formation of such laws and regulations in favour of those who practise this most useful art, as will in all probability tend in a very great degree to the further improvement of the country.

It is stated, that on his majesty's farm, and under his personal attention, farm-houses have been built, swamps and morasses drained, plantations formed, and every means adopted that could contribute to improve the soil or embellish the landscape. In carrying on these works, liberal expenditure has been combined with minute savings, which is indispensably necessary in all the operations of husbandry, either where the object is profit, or, as in this case, a desire to promote the public good, by endeavouring to create a spirit in others for undertaking improvements of a similar nature.

In considering the second class, the writer remarks, that a considerable portion of the cultivated lands in Britain is possessed by the great proprietors, and such as generally reside on their estates, who may therefore very probably be denominated country-gentlemen. Exclusive of their domains, or lands around their manor-houses, these proprietors commonly hold farms, which are kept under regular modes of cultivation. Many of these characters merit high commendation for their steady and unwearied attention to that great source of national wealth, the introduction of better systems of husbandry; while others have gone farther, and not only endeavoured, both by precept and example, to induce their tenants to adopt such systems as they from experience had found beneficial, but also granted leases of such duration, and on terms so liberal, as induced men possessing knowledge, enterprise, and capital, to apply them to the art of husbandry. It is to be regretted, however, that this cannot be said of all the great proprietors and country-gentlemen of this island. Many there are who, with a cool indifference respecting either the improvement of the country or the situation of their tenants, seem to think the chief business of a landlord ought to be an unremitting attention to the extension of his rent-roll, without ever duly considering, that if additional rents are demanded, means should be furnished by the introduction of better systems of husbandry, improved breeds of live-stock, and the expenditure of money in the improvement of the property, by which tenants may be enabled to discharge such farther obligations. But from the spirit of improvement which has of late evinced itself so conspicuously, it may be hoped, that in a little time no instance of this kind will be found amongst this highly respectable class of farmers and proprietors of land.

Regarding the third class, or the yeomen and farmers, properly so denominated, they may be considered the strength of the state. The yeoman and the farmer here alluded to differ only in one particular; the lands which the former cultivates are either in part or in whole his own property,

while the latter rents his farm from another. In regard to industry, perseverance, and attention to business, there is no difference. Happy in their situation, removed on the one hand from the vanities and superfluities of high life, and, on the other, by their honest industry from the fear of poverty, the improvement of their farms constituting their chief study and delight, they spend their days in independence, enjoying health and all the rational comforts of life. It is supposed probable that near three-fourths of this kingdom are possessed by people of this description. Fortunate it is for Britain that this is the case; for although many of the proprietors are entitled to much praise for introducing improvements into various parts of the country, it is to this class that the nation is indebted for these improvements having become so general and extensive as they now are.

Concerning the fourth class it may be stated, that in all the best cultivated parts of Great Britain, as well as where improvements have not become general, there are many small farms. These, though not as yet in every case managed in such a manner as to produce the greatest crops which the soil is capable of yielding, are, however, much better cultivated than they were 30 or 40 years ago; and the spirit for improvements among tenants of this description appears to be more general than at any former period, although, from the want of capital, and the little attention generally paid to them by their landlords, added to their own attachment to ancient prejudices, they are yet very far from having attained that degree of usefulness, in an agricultural view, to which, by adopting proper means, they may be advanced. The possessors of small farms are, however, very useful and valuable members of the community: honest, peaceable, and industrious, they breed up their children in the same principles, and to these are the manufacturers of our island most indebted for a never-failing supply of virtuous and useful artificers and labourers in various ways.

The fifth class, or cottagers, are those who either reside in the neighbourhood of large farms adjoining to moors or commons, or in small hamlets. They generally possess a few acres of tillage-lands, from the cultivation of which, together with what they receive for labour performed to the farmers, or from carrying on the occupations to which they had been bred, as weavers, tailors, shoemakers, blacksmiths, thatchers, &c. they are enabled to maintain their families, and to be of great service in the business of cultivation. Being for the most part industrious and inured to labour, they bring up their children not only without becoming burdens on the public, but in such a manner as to render them extremely useful as members of society. These hamlets and cottages are also nurseries whence the British farmer draws his constant supply of labourers for performing his work.

In regard to those who cultivate small farms, adjoining to towns or villages, they fall to be described under two characters. The first are such as reside in towns, and are engaged in commerce and manufactures; but who, for their amusement, or the convenience of their families, possess small farms in the neighbourhood. These may be denominated good farmers only in a rational point of view. Their farms are indeed in some cases well cultivated, the crops luxuriant, and a full proportion, corresponding to the extent of the farms, comes to market; but, owing to their time and attention being occupied with other matters, in the success of which they are more immediately interested, few of them derive much benefit from their farming operations. The reason is obvious; there is no business requiring more unremitting care than that of husbandry; and, though

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people so employed may have it in their power to pay attention to the great leading points, as that of seed-time and harvest, it is not to be supposed they can spare time to superintend the execution of many of those more minute operations, on the proper attention to which the profits of a farm, particularly one so situated, principally depend. The second are those who reside in or immediately adjoining to towns, and farm so many acres as enable them to keep a few milch-cows, or two or three horses to hire, either for the saddle or the cart. It is only necessary to say, that as, on account of local situation, they commonly pay very high rents for their lands, they therefore find it for their interest to cultivate them in the best manner, so as to insure the greatest possible crops. The uses to which these crops are applied, it will be readily admitted, tend in a material degree to the convenience and accommodation of the inhabitants, and therefore cultivators of this description are to the inhabitants of these towns and villages what the British farmers are to the nation at large; namely, the means by which they are furnished with many of the necessaries and comforts of life. Without the aid of this industrious class of men, it is evident that manufactures cannot flourish, as those engaged in them in the various towns would be obliged to disperse, and seek those supplies in the country, without which their situation would be in a great measure unsupportable.

While summing up this account of the cultivators of the British soil, there yet remains a very numerous class to be taken notice of; and it is to be regretted, that the appellation of the unproductive class but too well applies to them. These are, the great body of the inhabitants in the remote parts of Scotland, who are without doubt the most useless inhabitants in the island. This, however, it is but justice to say, does not arise from any fault of theirs, but from the negligence of those who should be their natural guardians and protectors. They are well known to be capable of the most indefatigable exertion and perseverance, when taught to look forward to any object, either of glory or of interest. But they are permitted to waste their time in sloth and indolence. Were the landholders to bestow the proper attention, which an object of such national importance merits, these people might, in a few years, be taught the first principles of improvement; namely, the value of time, and the beneficial effects of labour. Then, but not till then, will a knowledge of agriculture and other useful arts prevail amongst them, and take the place of that gloomy melancholy which was introduced under the feudal system, and has too long held its reign. The greatest part of the cultivated lands in the highlands and islands of Scotland is possessed in townships; that is, a number of tenants reside in the same town or hamlet, and rent small lots adjoining. In almost every such case the modes of cultivation, and the implements of husbandry, are probably little improved from what they were five hundred years ago, at least they are wretched in the extreme, the culture of potatoes being the only improvement of any consequence that has taken place for ages. When to this it is added that few attempts have been hitherto made to introduce either commerce or manufactures, it will appear evident to every British reader, that this great body of his fellow-subjects may, with too much propriety, be termed an unproductive class, and in their present situation be considered as a burden, rather than an advantage to the state. There are notwithstanding many in those districts who, from the extent of land which they possess, their knowledge of agriculture, and the attention which they bestow on the improvement of the different species of live stock, are justly entitled to be ranked among

the number of British farmers; and if proper encouragement was given by the proprietors, and such modes of improvement introduced as the country is most susceptible of, that number would, it is supposed, naturally increase in a high degree.

It is of much consequence to farmers in general, that they consider the nature of their different situations with attention, as by such means they may introduce the most advantageous systems of management on their farms. They should likewise be particularly attentive to the raising of various sorts of seeds, as well as to the practice of cropping; and above all to the keeping of regular accounts. See FARM.

FARMER, in *Law*, he that tenants a farm, or lessee thereof. Also generally every lessee for life, years, or at will, is called farmer. Farm, or feorme, being an old Saxon word, signifying provisions (see FARM), came to be used instead of rent or tender, because anciently rents, or the greater part of them, were reserved in provisions, in corn, poultry, or the like, till the use of money became more frequent. Hence a farmer, *firmarius*, was one who held his lands upon payment of a rent or feorme; though at present, by a gradual departure from the original sense, the word farm is brought to signify the very estate or lands to held upon farm or rent. See LEASE.

As this word implies no mystery, except it be that of husbandry, husbandman is the proper addition for a farmer.

FARMER, in *Mining*, is the lord of the field, or one that farms the lot and cope of the king.

FARMER, HUGH, in *Biography*, an eminent divine among the Protestant dissenters, no less distinguished by his popular talents as a preacher, than by his learning as a theologian, was a descendant from respectable ancestors in North Wales, and born at Shrewsbury in the year 1714. Having laid a suitable foundation of classical literature at a school near Towyn, in Merionethshire, and afterwards under the tuition of Dr. Charles Owen, a learned dissenting minister at Warrington, in Lancashire, he was initiated as a student for the ministry, in the year 1730, at the academy in Northampton, then under the superintendance of Mr. (afterwards Dr.) Doddridge. After he had finished his course of studies, very much to his own honour, and to the satisfaction of his tutor, he settled at Walthamstow near London, as chaplain to William Coward, esq. and also as minister to the dissenting congregation in that village. Mr. Coward, although he made liberal provision by benefactions and bequests for the education and relief of Protestant dissenting ministers, was a man of a peculiar temper, which obliged his chaplain suddenly to remove, and to take up an asylum in the house of William Snell, esq. an eminent solicitor of distinguished probity and worth. Here he was hospitably received, and in this family he continued, on terms of the closest intimacy and friendship, for more than 30 years. The congregation at Walthamstow flourished under his pastoral care, and became one of the most considerable, as to the number and opulence of its members, in the vicinity of the metropolis. Mr. Farmer, whilst he regularly discharged the duties of his pastoral office, devoted himself to those studies, that contributed to the high reputation which he afterwards acquired in the department of biblical literature. The first publication of this kind, which attracted notice, appeared in 1761, under the title of "An Enquiry into the Nature and Design of our Lord's temptation in the Wilderness," 8vo. The subsequent editions of this tract in 1765, and in 1776, afforded to the author an opportunity of establishing his peculiar opinions concerning the nature and design of this event, and of replying to his opponents.

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For an account of his sentiments on the subject, we refer to the article TEMPTATION.

In the year 1771, Mr. Farmer published his larger and more valuable work, entitled "A Dissertation on Miracles, designed to shew that they are arguments of a divine interposition, and absolute Proofs of the Mission and Doctrine of a Prophet," 8vo. This work, the subject and arguments of which will be more particularly detailed under the head of MIRACLES, is entitled, as one of his biographers says, "to pre-eminent distinction for extent of inquiry, profundity of erudition, matterly criticism, accurate discrimination, and perspicuity and fairness of reasoning." By ably "refuting those principles of demonism, which have done so much discredit to the argument drawn from miracles in favour of the Jewish and Christian revelations," and by establishing the belief "that the world is under the government of God alone, and that no created spirits, much less such as oppose his wise and benevolent designs, can disturb that course and order of things which he has established," it leads to the proof of what is announced in the title, in a manner that will ever rank it, in the opinion of competent judges, among the most important productions in the cause of sacred literature. A charge of plagiarism having been unjustly alleged against the author, in consequence of this "Dissertation," he took occasion to publish, in the year 1772, "An Examination of the Rev. Mr. Le Moine's Treatise on Miracles," in which he evinces the contrariety of Mr. Le Moine's opinion to the sentiments which he had advanced, and farther confirms them. Mr. Farmer's next publication appeared in the year 1775, under the title of "An Essay on the Dæmoniacks of the New Testament." In this treatise he pursues the reasoning adopted in his "Dissertation on Miracles," and distinguishes himself as the advocate of an hypothesis, which had been previously adopted and supported by Mr. Joseph Mede, Dr. Sykes, Dr. Mead, and Dr. Lardner. It is hardly necessary to mention in this place, that these writers have attempted to shew "that the disorders imputed to supernatural possessions proceed from natural causes, and not from the agency of evil spirits." (See the articles DÆMON, DÆMONIAC, and DÆMONIACAL Possession, and DÆMONOMANIA.) Mr. Farmer's publication led to a fresh discussion of this interesting subject: and drew upon him the attacks of Dr. Worthington, a learned clergyman of the church of England, and of Mr. Fell, an acute writer, and a Protestant dissenting minister. To the former opponent Mr. Farmer thought proper to reply in a series of "Letters, &c." published in 1778; but to the latter, whom our author has, perhaps too freely, censured for want of candour, he addressed no direct answer. However, Mr. Fell's work produced an elaborate treatise, which appeared in 1783, under the title of "The General Prevalence of the Worship of Human Spirits in the Ancient Heathen Nations, asserted and proved;" 8vo. (See DÆMON.) In this treatise the author has incidentally introduced several strictures on Mr. Fell's performance, and some reflections, which have been thought, particularly by that gentleman's friends and the advocates of his opinion, too acrimonious and contemptuous. In this controversy, which was again pursued by Mr. Fell in the year 1785, candid persons, whatever may be their peculiar sentiments with respect to the subject in dispute, have regretted that they have been able to discover too great a degree of personality, and of invective that goes beyond the bounds of the "retort courteous." Mr. Farmer declined any further reply, and resumed the prosecution of those general inquiries, in which he excelled; and from which the literary world might have derived further advantage, if his health had continued, and if he had not enjoin-

ed on his executors the unpleasant charge of committing all his sermons and manuscripts to the flames. Among the latter was "A Dissertation on the Story of Balaam," which had been transcribed for the press, and a collection of papers, prepared for an improved edition of his Treatise on Miracles.

Having remained sole minister of the congregation at Walthamstow for several years, he was provided with an ingenious and able associate, the Rev. Mr. Ebenezer Radeliffe; and, in 1761, he accepted the office of afternoon preacher to the respectable society at Salters' Hall, in the city of London, where for several years he exercised his ministry to a numerous auditory. He was also soon after elected one of the Tuesday lecturers at the above-mentioned place, a trustee of Dr. Williams's charities, and one of the trustees of Mr. Coward's bequests. But as he advanced in years, he found it necessary to discontinue his public services; not without the regret of the societies with which he was connected. In the year 1785, the close of his life was embittered by a total failure of sight; for which, however, he obtained relief by a surgical operation, to such a degree as to enable him to pursue his favourite studies. But his infirmities gradually increased; and in 1787 he terminated his course of honourable labours, having attained the 73d year of his age. "Of Mr. Farmer's character as a scholar," says one of his biographers, "his learned labours afford sufficient testimony. As a preacher, he was distinguished by a happy variety of thought and expression, judicious criticism, liberality of sentiment, and energy and eloquence of language. His voice was uncommonly clear and harmonious, and his manner of delivery natural, manly, and impressive. He was a man of ardent but cheerful piety, who recommended the religion he taught by the exemplariness of his moral conduct, and adorned it by his beneficence and candour. In conversation he was lively, and often brilliant; and in his manner polite and complimentary, sometimes to excess. On disputable topics, it was no easy matter to draw from him a decided opinion. Upon the whole, Mr. Farmer is entitled to a high rank among the dissenting ministers of his time, and supported an honourable station in the literature of the age." Biog. Brit. Gen. Biog.

FARMER, RICHARD, D. D. a celebrated scholar and critic, was the son of a hosier at Leicester, where he was born in 1735. He received the elementary parts of his education at his native town, whence he removed to Cambridge, and was entered a pensioner of Emanuel college: here he took his degrees, and, in 1760, was appointed classical tutor of his college. In 1767, he became one of the preachers at Whitehall. In London he resided very much with Dr. Aikew, a physician, well known for his curious and very valuable library, of which Mr. Farmer did not fail to make a good use. He had already engaged in a course of reading which laid the foundation of a work to which he was indebted for the principal part of his literary reputation. This was entitled "An Essay on the Learning of Shakspeare," first published in 1766. In this essay, Mr. Farmer undertook to shew that, in the time of our great poet, English translations existed of most of the classical writers, and by tracing even the expressions and mistakes of the translators in those passages of his plays which allude to the subjects treated by these writers, he proved that the untutored Shakspeare had read the translations instead of the originals. The essay, which went through several editions, was printed in the edition of Shakspeare, by Stevens and Reed, in 1793.

The notice Mr. Farmer acquired by his performance was

the means of his advancement in the church, and he obtained the chancellorship and prebendal stall in the cathedral of Litchfield; and, in 1775, he was chosen master of Emanuel college, on which occasion he took his degree of D. D. He was afterwards made principal librarian to the university, and served in his turn the office of vice-chancellor. Being a zealous advocate for the existing order of things, and attached to the church in its present state, he was singled out for preferment. Lord North conferred upon him a prebend of Canterbury, and he was twice offered a bishopric by the late Mr. Pitt, but he preferred a residentiaryship of St. Paul's, which he exchanged for his prebend. He was now obliged to reside three months in the year in the metropolis, which he spent very agreeably in the society of his friends, and among the first literary characters, to whose esteem his own learning and acquirements gave him high claims. He was hostile to certain academical reforms which were proposed in his time, but was the chief promoter of improvements in the police of Cambridge, particularly those of paving and lighting the streets; and it was in a great measure owing to his exertions that the cathedral of St. Paul's was permitted to receive those decorations of monumental sculpture which, while they exhibit high merit and national gratitude, will gradually clothe, and highly adorn the present nakedness of the edifice. Dr. Farmer died in September, 1797, at Emanuel college, and to his memory an epitaph was inscribed on a tomb by Dr. Parr. He published nothing but the essay referred to, though, while young, he issued proposals for a history of Leicester; for this he collected only a few materials, which were afterwards put into the hands of Mr. John Nichols. Necrology.

FARMER, JOHN, an English madrigalist of some merit, but not so much as he imagined. In 1599, he published his first set of English madrigals, to four voices, professing in his preface to have "fully linked his music to *number*, as each gives to other their true effect, which is to move delight; a virtue," he adds, "so singular in the Italians, as under that ensign only they hazard their honour." This boast made us examine his accentuation of the words of his madrigals, with some expectation of finding greater accuracy in that particular than was general at the time; but, on the contrary, his assertion is so far from true, that there appears more false accent in his songs, than in those of his contemporaries.

FARMERY, in *Agriculture*, the site or place where the farm buildings are erected, and the general business of the farm principally carried on; the same as home-stead and home-stall. It is a matter of much importance to have it conveniently placed for performing the work of the farm.

FARMING, signifies the art of managing, or general detail of the business of a farm. It is an employment of considerable difficulty and trouble, as requiring constant care, united with great activity and judgment. In order to conduct it with propriety and advantage, it demands an intimate practical knowledge of the various sorts of cultivation and management which are in use, as well as of the nature and value of every description of live stock; likewise a perfect acquaintance with the various methods of buying and selling, and the constant state of different markets and fairs. And, besides these, there are other minutiae which are of equal importance to the success of the farmer. The advantages of farming differ materially according to the nature, situation, and circumstances of farms, as well as the care and management that are bestowed upon them. It is stated by the writer of the "Survey of the County of Middlesex," that the profits of farming, under

the old course of two crops of corn and a fallow, have seldom afforded more than a mere subsistence to the farmer, and the means of establishing his children to run the same course. But even this, he contends, is no proof against the profits of farming *per cent.* on the capital employed, which is generally so small a sum, that the foregoing produce may be a large *per centage*, and with sedulous attention this has been the fact; as from the accounts of particular families which he has examined, a profit of thirty-two *per cent. per annum* on the sum made use of has been demonstrated for thirty-five years in succession. Indeed it seems to be evident that a person who employs only 500*l.* and with it brings up a large family, and places them in a situation equal to his own, while himself retires with an easy fortune, could not have done it with a less return. But the great improvements which have for some time past been taking place in agriculture, aided by high prices for the produce of the soil, are occasioning such a rapid rise in rents; the taxes also, and every expenditure are so greatly on the increase, as must, he supposes, at the lowering of the price of corn and cattle, put farmers of the old school to considerable difficulties, and become one of the means of inducing them to adopt the new and better practice. Changes in this way, however, except under particular circumstances, are very slow in their progress.

The profits of arable farming are, in general, tolerably well understood, therefore they need not be introduced here.

The following is a statement of the produce and expence of 150 acres of good grass-land, at the distance of eight miles from the London markets.

	<i>Acres.</i>
Hedge rows, and waste of farm	20
Mowing ground	130
	<hr/> 150
Produce at one cutting for hay	200 loads.
	<hr/>
Average sale of ditto for five or six years,	
5 <i>l.</i> per load, is	£ 1,300
After-feed fold for	65
	<hr/> £ 1,365

<i>Expences.</i>	
Four hortes 36 <i>l.</i> each	£ 140 0
Three men all the year, at 12 <i>s.</i> per week	93 0
Extra labour, of mowing, hay-making, stacking, straw, thatching, and pulling, at 15 <i>s.</i>	97 10
Taxes, assessments, and tithes	130 0
Marketing 260 loads of hay, at 4 <i>s.</i>	52 0
Paid for 300 loads of manure, at 2 <i>s.</i> 6 <i>d.</i>	37 10
Tenants' repairs of buildings	10 0
Insurance of stock, and tax on	4 0
Pilfering	10 0
Frauds of hay-falefmen	10 0
Mole-catcher	1 0
Interest of 700 <i>l.</i> for one year	35 0
	<hr/>
Total expences	620
Remains for rent and attention	745
	<hr/>

which is equivalent to 5*l.* the acre.

Suppose the farmer to pay 3*l.* the acre rent, it will leave

27. which, on 150 acres, is 30*l.* a-year profit, or 40 *per cent.* upon the capital employed.

These charges stand too low for the present period, and the produce is in some degree undervalued, but the profit is in some measure shewn.

FARMINGTON, in *Geography*, a large and flourishing township of excellent land in Kennebeck county, in the state of Maine, North America, situated on Sandy river, which, in the S.E. part, has falls, that furnish good mill-seats, for saw-mills, a carding machine, grist-mill, and fulling-mill, already erected. It has a post-office, and contains 942 inhabitants; 204 miles N.N.E. of Boston.—Also, a large, pleasant, and wealthy post-town in Hartford county, Connecticut; 10 miles S.W. of Hartford city. This town is beautified and enriched by a river of the same name. In the compact part of the town, the houses stand chiefly in a street which runs N. and S. along the gentle declivity of a hill; and about the centre of the street is a large and handsome congregational church. This town was settled in 1645, and has 2809 inhabitants.—Also, a river of Connecticut, which rises in the state of Massachusetts, and runs south-easterly through Hartland, Bark-Hempstead, and New Hartford. On the borders of Hartford county it receives a western branch, which rises from several ponds in Colebrook, and continuing this course to Farmington, it meets with mountains and turns northerly, seeking a passage to the Connecticut. After running 15 miles, it unites with Salmon river, and rushing through the mountains and down a cataract of 150 feet, is afterwards called Windfor river, and in a S.E. course mingles with Connecticut river, 4 miles above Hartford.

FARMSTEAD, in *Agriculture*, the place or situation where the farm offices are built, and the chief work of the farm conducted. It is of much consequence to have it situated as central as possible in the farm.

FARMVILLE, in *Geography*, a small post-town of America, in Prince Edward county, Virginia, situated on Appomatox river, 210 miles from Washington. The river is passable by boats from hence to Petersburg.

FARN ISLANDS, two groups of small islands and rocks, amounting to 17 in number, and situated in the German sea, near the English coast, opposite to Bamborough castle, in Northumberland. They have all their respective names, and produce kelp, feathers and eggs of fowls, and some seals: some of them bear a little grass, and feed a cow or two. The principal, called "Farn," is about a mile in compass, and has a fort, and a light-house, which being never furnished with fire is of no use. N. lat. 55° 29'. W. long. 1° 44'

FARNABY, THOMAS, in *Biography*, son of a carpenter in London, was born about the year 1575. Having a turn for learning he was well grounded in the elements of grammar, and laid a good foundation in classical knowledge. In 1590 he was admitted a servitor of Merton college, Oxford; but he soon quitted that university, and went to Spain, where he studied in a college of the Jesuits. With this situation he was dissatisfied, returned, and entered on board the fleet of Drake and Hawkins in their expedition of 1595. After this he served in the Low Countries as a soldier, and having led an unsettled life for some years, he landed in Cornwall, so much depressed with poverty, that he was under the necessity of teaching children their letters for a very scanty subsistence. He next taught a grammar school at Martock in Somersetshire, and from thence he removed to London, and opened a seminary near Cripplegate, where he attained to so high a reputation, that he is said to have had sometimes as many as three hundred scholars at a time. He now sustained a considerable rank in the

literary world, by his editions of Juvenal and Persius; of the tragedies of Seneca, of Martial's Epigrams, and of Lucan's Pharfalia, and took his degree of M. A. at Cambridge in 1616.

At this period he sought for a more retired residence, and removed to Seven-Oaks, in Kent, where he contrived to take boarders. His profession was prosperous, and he became sufficiently rich to purchase some considerable estates in Kent and in Sussex. In the neighbourhood of Seven-Oaks it is presumed the descendants of this industrious and learned man lived till within these few years, when sir Charles Farnaby, if we mistake not, removed to another part of Kent, or to the borders of Surrey. At the commencement of the civil wars, Mr. Farnaby incurred the suspicion of being concerned in an insurrection at Tunbridge in favour of the king. This suspicion caused him to be imprisoned in Newgate; he had a narrow escape from being banished to America, and was, after his release from Newgate, confined at Ely House. He died at Seven-Oaks in 1647, aged 72; highly respected as a benefactor to early classical education. Besides the works already mentioned, he published notes on Virgil, Ovid, and Terence; and many small pieces for schools. He drew up also, among other things, a "Systema Grammaticum," by order of king Charles, who intended to substitute a new Latin grammar for that taught in schools. Biog. Brit.

FARNABY, GILES, a great organ-player and able composer, was organist of Christ church, Oxford, and in 1592 admitted bachelor of music. There are extant of his composition "Canzonets to four voices, with a song of eight parts," London, 1598. He assisted Ravenscroft in setting parts to some of the psalm-tunes, published at the beginning of the next century. There are near twenty lessons in queen Elizabeth's virginal book, by Giles Farnaby, little less difficult than those of Bird and Bull. These great musicians, the wonder and delight of their times, seem to have had no conception of brilliancy or embellishment, but what arose from breaking common chords into arpeggio, or rapidly running up and down the scale in notes tied three, and often four times. They seem, however, to have been the greatest players in Europe, till Frescobaldi introduced a superior style of treating the organ, divested of rapid and frivolous divisions, which disgrace that most noble and comprehensive of all instruments.

At present, the pieces of Bird, Bull, and Farnaby, must doubtless appear dry and monotonous, for want of air, variety of movement, and modulation; yet before these qualities were cultivated, expected, or indeed existing, they fed the ear with pure and simple harmony, in a manner which none but keyed-instruments could effect; and perhaps their favour with professional musicians was not a little augmented, by the learning of their contexture, and difficulty of execution. For however the old masters may be celebrated for their simplicity and sobriety of style, and the moderns indiscriminately censured for multiplied notes, rapidity of performance, tricks, whip-syllabus, froth, tumbling, and mere difficulties; it would not be very easy to find, among the most complicated pieces of modern times, difficulties equally insurmountable with those in which these old fancies and variations abound. Farnaby was of Truro, in Cornwall, and nearly related to Thomas Farnaby, the famous school-master in Kent.

FARNBACH, in *Geography*, a town of Germany, in the county of Henneberg; 6 miles E.S.E. of Salzungen.

FARNESE, ALEXANDER, in *Biography*, duke of Parma, son of Octavio Farnese, duke of Parma, and of Margaret

Margaret of Austria, was born in 1546. He was educated in the court of king Philip II., and early embraced the profession of arms, and was present in his eighteenth year at the battle of Lepanto. From this period he interested himself in every thing that concerned the army; rejected all indulgences to which his rank might have laid claim, and was clad more like a soldier than a prince. He distinguished himself in the Low Countries during the administration of Don John of Austria, and upon his death, in 1578, was appointed to succeed him. He now carried on his military projects with great success, obliged Maestricht to surrender, recovered most of the towns in Brabant and Flanders, and laid siege to Antwerp. This last town afforded him ample opportunity for the display of all his skill; at length he shut up the Scheldt by a vast bridge or mound, an enterprise which occupied him nearly a year, during which he took Brussels, Ghent, and other places, and then entered Antwerp in a most triumphant manner in 1585. He granted favourable terms to the town, and completed his conquest of the Low Countries, which have ever since, till the late war, remained under the Spanish or Austrian sovereignty. He now extended his views to the Dutch provinces, openly aided by queen Elizabeth of England; and to carry his point he took the command of the army, under the title of duke of Parma, his father being dead, destined to the conquest of England. The disasters of the grand Armada rendered the design abortive. After this he made an attempt upon Bergen-op-Zoom, but was again foiled. Incessant toils and exposure to an unhealthy climate had undermined a naturally strong constitution, and some serious symptoms of dropsy began to appear in him; but he was too important a character to be allowed the repose which the nature of the case required. In 1590 he was obliged to march to France in succour of the league which Philip II. was determined to support in its resistance to Henry IV. The duke performed all that was hoped for, and raised the siege of Paris, in which he displayed great military skill. Henry was so much hurt at the conduct of the duke, that he sent him a challenge, to which he replied, "that he was accustomed to fight at his own pleasure, and not at that of his adversary, and that he should not shun an engagement when he found such a measure expedient." Two years afterwards he was again opposed to Henry, and again victorious. This was at Rouen, which was besieged by the king of France, but being relieved by the duke, he immediately advanced to the siege of Caudebec, where he was wounded in the arm. The king now pressed closely upon the duke, and reduced him to great straits for want of provision. Henry anticipated the surrender of the whole army, when the duke, by unexpectedly crossing the Seine in his rear, escaped the difficulty, and led back his troops safely to Flanders. This retreat excited the admiration of all military men, and sealed the reputation of its conductor. The duke was at this period in extreme ill health, and demanded a successor, but the king his master with much inhumanity refused to listen to his request, and sent him new orders; but death, a still greater tyrant than Philip, stopped his career in December 1592. A statue of bronze was erected to his memory at Rome. Moreri.

FARNHAM, in *Geography*, a town in the hundred of Farnham and county of Surrey, England, is situated partly on a hill which rises from the river Wye. A castle was built here by Henry, bishop of Winchester, brother to king Stephen; and since that period has continued to belong to the bishop of that see. At different times the building has been injured by sieges. During the civil wars, in the time of king Charles I. it was nearly demolished; being garrisoned for the monarch, it was invested by the parlia-

mentary forces, who, after a long conflict, obtained possession, and blew up and destroyed most of the walls and towers. Soon after the restoration, bishop Morley repaired the greater part of the fortrefs, and fixed his residence within its walls; and since that period it has been rendered a handsome, commodious residence. The keep is called Jay's tower, the ascent to which is by 63 stone steps. The area at the summit is now occupied as a kitchen-garden.

The town of Farnham is paved and lighted, and having several good houses, has a respectable appearance. It contains 437 houses, which are occupied by 2508 inhabitants. The civil government of the place is vested in 12 burgesses, who act under the bishop. In the reign of Edward II. it sent members to parliament. In the vicinity of the town is More-park, which formerly belonged to sir William Temple. Here is a curious cave, called Mother Ludlam's Hole, through which passes a continual stream of fine water. This grotto is formed and decorated by rocks, marble, troughs, &c. Near this park was Waverley abbey, some few fragments of which only now remain. Farnham is noted for its large market for oats, between Michaelmas and Christmas; for wheat about Midsummer; and for hops. Many plantations of the latter are in the vicinity of the town; indeed, the Farnham hops have long been celebrated in the annals of commerce. Here are three fairs annually.

FARNHAM, a post town of America, in Richmond county, Virginia; 159 miles from Washington.

FARNI, a town of Africa, in Bambarra. N. lat. 13° 40'. W. long. 4 8'.

FARNIA, or FARNIA *Italorum*, a name by which some authors have called the bitter oak; the *ceruus ægyptus* and *aspris* of other writers.

FARNOVIANS, in *Ecclesiastical History*, a sect of Socinians, so called from Stanislaus Farnovius, or Farnesius, who separated from the other Unitarians in the year 1568, and was followed by several persons eminent for their learning and rank. This sect did not last long; for having lost their chief, who died in 1615, it was scattered abroad and reduced to nothing. Farnovius was engaged by Gonesius to prefer the Arian system to that of the Socinians, and consequently asserted that Christ had been produced out of nothing by the Supreme Being before the creation of this terrestrial globe. His sentiments concerning the Holy Ghost are not certainly known; however, it appears that he warned his disciples against paying the tribute of religious worship to that Divine Spirit.

FARO, in *Geography*, an island of Sweden, about 30 miles in circumference, separated from the N.E. part of the island of Gothland by a narrow channel. This island is populous and fertile. The principal town of the same name is situated on the S.E. coast. N. lat. 57° 50'. E. long. 19° 12'.

FARO, an open, regularly built trading town of Portugal, in the province of Algarva, or Algarvez, the see of a bishop, suffragan of Evora. It is situated at the extremity of a small bay, in a level and sandy territory, is defended by a small citadel, and contains two parish churches, four convents, and 5000 inhabitants. The harbour is 1½ league below the town. Another arm of the river, or of the sea, forms an island, in which is the sandy cape of Santa Maria, very near the land. The tract between the town and the sea is marshy; on the opposite side it is flat and sandy; and at a distance appear the steep hills of San Miguel. The road to Tavira, 20 miles S.W. of it, is uncommonly pleasant. Its environs produce good wine and fruits, particularly figs, which are chief articles of exportation. N. lat. 37° 2'. W. long. 7° 52'.

FARO, a town of the island of Siphanto. N. lat. $36^{\circ} 55'$. E. long. $24^{\circ} 49'$.

FAROF Messina, a strait of the Mediterranean, between Sicily and Calabria, about 5 miles wide, remarkable for the tide's ebbing and flowing every six hours.

FAROE', a small island of Denmark, near the S. coast of Zealand. N. lat. $54^{\circ} 57'$. E. long. 12° .

FAROER ISLANDS. See **FEROE ISLANDS**.

FARON, a river of France, which runs into the Meuse, 2 miles below Vifet.

FARONAGUR, a town of Hindoostan, in the soubah of Delhi; 35 miles W.S.W. of Delhi. N. lat. $28^{\circ} 30'$. E. long. $77^{\circ} 4'$.

FAROUT, or **FAR-OUT**, *Head*, a cape of Scotland, on the N. coast of the county of Sutherland; 30 miles E. of cape Wrath. N. lat. $58^{\circ} 40'$. W. long. $4^{\circ} 38'$.

FARQUHAR, GEORGE, in *Biography*, son of a clergyman in the north of Ireland, was born at Londonderry about the year 1678. He received his university education at Trinity college, Dublin, where he was not distinguished for superior talents, and from which it is supposed he was expelled for want of moral conduct. He discovered an early taste for poetry and dramatic exhibitions, which led him to try his powers as an actor; but in one of his early attempts he had the misfortune to wound a brother-player, by using his sword in mistake instead of a foil, which put an end to his hope in that profession. In 1696 he came to London, obtained a lieutenant's commission through lord Orrery, and sustained the military character a considerable time. He brought out, in 1698, a play, entitled "Love and a Bottle;" this was his first effort as a writer for the stage, and it obtained for him much popularity. The "Constant Couple, or a Trip to the Jubilee," was his next play, which was acted with great applause, and which has maintained its reputation to the present day. At this period Mr. Farquhar was in Holland, probably in his profession as a soldier; but his letters contain humorous descriptions of the manners and customs of that country. In 1702 he published a volume of miscellanies, consisting of poems, letters, essays, &c.; and in the following year the "Inconstant, or the way to win him," was acted. He now married a lady, whose violent attachment induced her to pass herself upon him as one possessed of a large fortune. When he discovered the stratagem, he freely forgave her for the motive. He still continued to bring out new pieces; and in 1706 the "Recruiting Officer" was acted. This has proved one of his most popular plays, and is now acted with much applause in all our country theatres; the humour of serjeant Kite, with the incidents of the captain in country quarters, being levelled particularly at those auditors who are usually found there. His last piece was entitled "The Beaux Stratagem," which, though composed in six weeks, is reckoned the author's master-piece. Notwithstanding his successes as a writer, he was a necessitous man, and was obliged before his death to sell his commission to supply his need. He died in the spring of 1707, at the early age of 30, leaving behind him two daughters wholly unprovided for. His comedies, though not equal to those of Congreve, are sprightly, pleasant, and natural, interesting in their plots, and easy in their dialogue. They are, however, very licentious; a character which belonged to all the comedies of that period, and which has undoubtedly given a distaste for theatrical amusement to multitudes who would otherwise resort to the theatre for instruction as well as pleasure. *Biog. Brit.*

FARQUHAR'S Island, in *Geography*, an island in the Mer-

gui Archipelago, of an oval form, about 8 miles in circumference. N. lat. $11^{\circ} 4'$.

FARR, a small sea-port of Scotland, in the county of Sutherland, on a bay to which it gives name, in which is a good salmon fishery; 48 miles N. of Dornock.

FARR Bay, a bay on the N. coast of Scotland, in the county of Sutherland. N. lat. $58^{\circ} 34'$. W. long. $4^{\circ} 2'$.

FARRA, a town of Japan, on the S. coast of the island of Niphon; 40 miles S. of Jeddo. N. lat. $36^{\circ} 4'$. E. long. $139^{\circ} 12'$.

FARRA, in *Ichthyology*, the name given by authors to a species of the corregonus, not differing essentially from the lavaretus or bezola. This species has had a great number of different names, and been described as five or six different fish. But all the descriptions of the several authors agree to prove it to be that species only of the corregoni, which Artedi has distinguished by the name of the corregonus, with the upper jaw longer and flat, and with fourteen rays in the back fin. This name equally agrees with the several descriptions of the farra or ferro, bezola, lavaretus, &c. and they agree in all the essential characters with one another. See **LAVARETUS** and **SALMO**.

FARRANT, RICHARD, in *Biography*, one of the gentlemen of Edward VI. and queen Elizabeth's chapel, and some time master of the children of St. George's chapel at Windsor, died about 1585. Dr. Boyce has published several of his productions, which are grave and solemn, but somewhat dry and uninteresting.

FARREATION, FARREATIO, in *Antiquity*, the same with consarration.

FARRENBACH, in *Geography*, a river of Franconia, which runs into the Rednitz, 2 miles below Furth.—Also, a town of the principality of Anspach, 5 miles E. of Langenzen.

FARRIER, a person whose office is to shoe horses, and cure them when diseased or lame.

An action on the case to recover damages lies against a common farrier, who lames a horse in shoeing him. See **ASSUMPSIT**.

FARRIER'S Pouch, in the *Manege*, a leathern bag, in which they carry drivers, nippers, shoes for all sizes of feet, good sharp nails, and all that is proper for new-shoeing a horse that has lost his shoe upon the road.

FARRINGDON, in *Geography*, a market-town in the hundred of the same name, and county of Berks, England, is situated about two miles from the river Thames, on the west side of a hill, thence called Farringdon-hill. The church, which stands on an eminence, is an ancient and spacious structure, displaying different specimens of styles of architecture. It was built in the form of a cross, but with a double transept. The east end is remarkable for its antiquity; the windows being of the same form as those of the Temple church in London. Part of the spire was destroyed in the civil wars; the remainder is very little higher than the body of the church. A castle was erected here in the reign of king Stephen, by Robert earl of Gloucester; but the king soon reduced it and levelled it with the ground. The site is said to have been granted by king John, in the year 1202, for building an abbey of the Cistercian order. The death of king Edward the Elder is recorded in the Saxon annals to have happened in this town. Farringdon is 68 miles distant from London; has a good market on Tuesdays, and two annual fairs. The population, as returned to parliament in 1801, was 1691; the number of houses 309. *Lynson's Magna Britannia*, vol. i. 4to.

FARRUCH, CAPE, a cape on the E. coast of Majorca. N. lat. $39^{\circ} 47'$. E. long. $3^{\circ} 18'$.

EARSA,

FARSA, a town of European Turkey, in Thessaly, anciently *Pharjilia*, the see of a bishop; 15 miles S. Livadia.

—Also, a town of Italy, in Sabina; 16 miles N. of Tivoli.

FARSANG. See PARASANG.

FARSCHOUT, a town of Upper Egypt, which is ill-built, and bears every appearance of wretchedness. It is situated on the west side of the Nile, at more than two leagues from it, and is about a mile in compass. It is the residence of a scribe, who is not only the governor of this town, but also of several adjacent districts, to a considerable extent. The environs are pleasant, and most of the roads that lead to the town are planted with Acacia trees. Between it and the Nile lies a town called "Basjoura," the residence of a kiaschef. The harbour of both these places is a small village, named Sahet. Sonnini thinks it probable that Farschout stood upon the site of Acanthus, an ancient city of Egypt, near which there was a sacred wood. Another city of the same name stood on the spot where Dasehour is now built, a little to the south of Saccara. At Farschout there is a convent of Franciscans. It lies 20 miles S. of Girgê, the capital of Upper Egypt.

FARSIDUNGA, a town of Bengal; 40 miles N.W. of Beyhas.

FARSISTAN, FARS, *Perfis*, or *Perfa Proper*, a province of Persia, surrounded with mountains on the N.W. and S., and on the E. separated by a desert from Kerman. Irak lies northward; Chufistan or Chofistan to the west; Laristan and the Persian gulf towards the south, and Kerman east. This province contains the beautiful city of Shiraz, or Schiras, the capital; together with Itakar, and the ruins of Persepolis. It is about 420 miles long from N. to S., and 360 from E. to W. Towards the south the air is very hot, and the land so sandy, that it produces little else than palm-trees: towards the north it abounds with mountains, on which are found the most beautiful falcons in Persia, wild swine, and wild cats. The principal productions of the cultivated parts are rice and fruit. See PER-SIA.

FARTACK, or FARTACH, a sea-port of Arabia Felix, in the province of Hadramaut, belonging to the scribe of Keschim, 132 miles S.E. of Hadramaut. N. lat. 15° 36'. E. long. 51°.

FARTACK, or *Fartakh*, *Cape*, a cape on the east coast of Arabia Felix, opposite to Gardesin or Gardesin; the distance between them, in a line drawn across from one to another, being not above 50 leagues. The breadth between these two lands diminishes gradually for about 150 leagues, till at last it ends in the straits, whose breadth does not seem to be above 6 leagues. Bruce's Travels, vol. i. p. 315. N. lat. 15° 30'. E. long. 51° 4'.

FARTHEL, or FARTHELLING, among *Seamen*, was used for the same with what they commonly call *furl*, or *furling*, which is taking up the sails, and binding them close to the yards.

FARTHING, a small English copper coin, amounting to one-fourth of a penny.

It was anciently called fourthing, as being the fourth of the integer or penny.

FARTHING of *Gold*, a coin used in ancient times, containing in value the fourth part of a noble, or 20d. silver, and in weight the sixth part of an ounce of gold. It is mentioned in the stat. 9 Hen. V. cap. 7. where it is enacted, that there shall be good and just weight of the noble, half-noble, and farthing of gold.

FARTHING of *Land*, in *Rural Economy*, a term anciently employed to signify a certain quantity of land, but which, at present, is not well ascertained. It would seem, however,

to differ from that of farding-deal, as Blount has shewn from an entry made in an old survey-book of the manor of West-Hampton in the county of Devon, in which it is stated that A. B. holds six farthings of land at 126*l.* per annum. Consequently the farthing of land must be of considerable extent, a great deal more than a rood, which is the quantity supposed by the former term.

FARTIN, in *Geography*, a small river of the county of Kerry, Ireland, running into the Atlantic ocean, opposite to Valentia island.

FARTREY, a river of the county of Wicklow, Ireland, which runs into the Irish sea, at the town of Wicklow.

FARUGANIE, a town of Egypt, on the east branch of the Nile; 18 miles N. of Cairo.

FARUNDEL, of *Land*, a term formerly used to signify the same as *farding-deal*.

FASAD, in *Geography*, a town of Persia, in the province of Segellan; 35 miles S. S. W. of Zareng.

FASCE, FASCIO, in *Il.valdry*. See FESSE.

FASCES, in *Antiquity*, axes tied together with rods or staves, and borne before the Roman magistrates as a badge of their office and authority.

Florus, lib. i. cap. 5. assures us, that the use of fasces was introduced by the elder Tarquin, the fifth king of Rome, and that they were then the mark of the sovereign dignity. In after-times they were borne before the consuls, but by turns only, each his day; "ne si ambo fasces haberent duplicatus terror videretur." (Livy, lib. ii. cap. 1.) They had each of them twelve, borne by so many ushers, called lictors. (See LICTOR.) Dionys. Halicarn. lib. iii. cap. 84.

Others will have Romulus the author of the institution, and ascribe the number twelve to the number of birds, which foretold him his kingdom. Others hold that he borrowed it from the Etrurians, and that the number twelve answered to the twelve nations of Etruria, who, in creating him king, gave him each an officer to serve him as lictor. Silius Italicus ascribes their first invention to a city of Etruria, called Vetulonia.

These fasces consisted of branches of elm, in the middle whereof was a securis or ax, the head whereof stood out beyond the rest. Plutarch relates the reason of this disposition. Publicola took the ax out of the fasces, as Plutarch assures us, to remove from the people all occasion of terror. After the consuls the praetors assumed the fasces. Censorin, De Die Natal. observes, that the praetors had only two, though Polybius and Plutarch give them six.

In the government of the decemviri it was the practice at first for only one of them to have the fasces; afterwards each of them had twelve, in the same manner as the kings.

In funeral processions it was the custom to carry the fasces reversed, as a token of grief.

FASCETS, in *Glass making*, the irons thrust into the mouths of the bottles when made to remove them into the annealing-tower.

FASCH, CHARLES, in *Biography*, chamber musician to the late king Frederic II. of Prussia, and son of the celebrated chapel-master. He succeeded Emanuel Bach as harpichord player at his majesty's concerts. His reputation as a performer was very high 30 years ago, and in his compositions for his instrument the greatest fire and delicacy are united.

FASCIA, in *Architecture*, by the workmen called *Facia*, *Facio*, or *Face*, a broad list, fillet, or band, particularly used in architraves and pedestals.

The architrave consists of three fasciæ or bands; thus called by Vitruvius, as resembling swaths, called in Latin *fasciæ*.

That author admits of no fasciæ in the Tuscan and Doric architrave; *i. e.* he makes it all plain, without any division or cantoning into parts or fasciæ; but the modern architects take the liberty to differ from him in this particular.

In brick-buildings, the jutting out of the bricks beyond the windows in the several stories, except the highest, are called fasciæ or fasciæ.

These are sometimes plain, and sometimes moulded; but the moulding is only a *cima reversa*, or an ogee, at the bottom, with two plain courses of brick over it; then an astragal, and lastly a bouline.

FASCIÆ, in *Anatomy*, is the thin tendinous covering which furrounds the muscles of the limbs, and binds them in their places. The term seems to have been suggested by the analogy of these parts to bandages; which they resemble in embracing and closely pressing the muscles, &c. which they cover. The word *aponeurosis* is sometimes employed. A general account of the structure of these organs will be found under the article *FIBROUS System*: we have to describe at present the situation and connections of the individual fasciæ.

These organs, consisting of thin sheets of a fibrous texture, differ considerably in their strength at different parts; at the outside of the thigh and fore-arm they are very strong; much thinner on the inner side of the limbs; and particularly thick and dense in the sole of the foot. Where they surround the whole of a limb, they generally are connected to one or more tensor muscles which have the power of stretching them. These muscles, being put in action when the rest of the limb is exerted, render the fasciæ tense, and thus bind down firmly the other muscles. They are relaxed when the limb is at rest; and the fasciæ consequently become loose. We cannot explain very clearly how the action of muscles is facilitated, nor how the amount of their exertion is increased by the pressure of the fasciæ; yet some effect of this kind is probably produced. Workmen often bind their limbs when about to exert considerable muscular power, on the supposition that it favours exertion; and firm bandaging, as employed in surgery, serves in many instances to strengthen parts very considerably. A person who had bruised the muscles of the loins found great benefit in a firm bandage round the body; which diminished his pain, and enabled him to move his trunk with ease, which before he could accomplish only with the greatest difficulty. Couriers in the East, who go on foot for great distances, find themselves benefited by bandaging the trunk.

The habitual compression of the fasciæ favours the circulation of fluids in the limbs. Hence the varices, which are common in the superficial veins, placed externally to the fasciæ, are never met with in the deeper-seated vessels: and the most effectual method of curing these affections is by the artificial compression of bandages. For the same reason, anasarca deposits in the cellular membrane always appear much later and to much smaller extent within the fasciæ than in the sub-cutaneous cellular texture.

Fasciæ are connected, on their internal surfaces, generally by means of loose cellular texture, to the muscles: sometimes, however, the fleshy fibres derive their origin from the fasciæ, which cannot, in such cases, be dissected away without cutting the substance of the muscle. Sometimes septa extend from their inner surface between the muscles down to the bone. These add to the strength of attachment, and offer a surface for muscular origin. Externally, fasciæ are connected to the integuments by a yielding cellular structure; and the superficial nerves and veins are generally interposed between these parts.

The fasciæ of the arm—is one of the thinnest and most

delicate of these organs, and approaching in its texture almost to a condensed cellular substance. It seems to arise among that substance in the axilla, and is manifestly continuous, at the front and back of the armpit, with expansions proceeding from the latissimus dorsi and pectoralis major. On the anterior and external aspects of the deltoid it does not seem to exist, commencing apparently below this muscle. Behind, it is continuous with the aponeurosis covering the infra-spinatus. Descending along the arm, it envelops the brachial muscles, and adheres to the septum at the outer edge of the brachialis internus. It is continuous in a great measure with the fasciæ of the fore-arm, and has attachments to the two condyles of the humerus.

Every where sub-cutaneous, this fasciæ is covered merely by the superficial veins, lymphatics, and nerves of the arm. It encloses all the brachial muscles, as well as the arteries, veins, and nerves, which form a large fasciculus descending on the inner surface of the limb. Its texture, simply cellular in many points, offers manifest tendinous fibres in others; and it exhibits very clearly the continuity of the aponeurotic and cellular structures. The pectoralis major and latissimus dorsi are to be regarded as its tensor muscles; but they cannot act on it with very great efficacy, as their fibres pass very obliquely with respect to the fasciæ.

Fasciæ of the fore-arm.—This covers the muscles of the fore-arm. Its origins above are, from the fasciæ of the arm, with which it is continuous, from the production furnished by the tendon of the biceps, and from the condyles of the humerus. It descends over the whole surface of the fore-arm, terminates behind at the annular ligament, which binds down the extensor tendons at the back of the wrist, and in front at the annular ligament of the hand. Separated from the skin by the superficial veins, nerves, and lymphatics, this fasciæ covers all the superficial muscles of the fore-arm, connected to these generally by cellular tissue. Near the cubital end of the limb it adheres closely to the muscles; and sends aponeurotic septa between them; *viz.* in front between the pronator teres, palmaris longus, flexor sublimis, and flexor carpi ulnaris; behind between the extensor carpi radialis brevis, extensor communis digitorum, extensor digiti minimi, extensor carpi ulnaris and anconeus. On the radial side of the limb it has no attachment: it is fixed to the olecranon, and to nearly the whole inner edge of the ulna, where it affords origin to the flexor carpi ulnaris.

The anti-brachial fasciæ differs from that of the arm by its much greater density and strength. Its component fibres decussate each other in various directions, without following any fixed course. The biceps flexor cubiti is the tensor of this fasciæ, by means of the production arising from its ulnar side, covering the brachial vessels at the bend of the arm, and expanding into the fasciæ at the upper and inner part of the limb.

The annular ligament of the fore-arm may be regarded as a part of the fasciæ, terminating it towards the back of the hand. Several fibrous sheaths belonging to the extensor tendons (see *EXTENSOR*) are placed under this ligament: *viz.* those of the three extensors of the thumb, the extensores carpi radiales, extensor digitorum communis, indicator, extensor proprius auricularis, and extensor carpi ulnaris. The sheaths belonging to these muscles are independent of each other; each possessing peculiar trans-circular fibres of its own. They are all covered by the annular ligament, which consists of longitudinal parallel fibres, very white and distinct, and separated by vascular intervals. Implanted in the external and anterior part of the radius, it crosses the back of the wrist obliquely, covering and intimately adhering to the above-mentioned fibrous sheaths, and is attached

tached slightly to the extremity of the ulna, but chiefly to the os piforme.

Palmar fascia, aponeurosis palmaris—is a very strong aponeurotic layer, composed of firm and close fibres, possessing a triangular form, and covering particularly the middle of the hand. Towards the wrist it arises from the annular ligament of the hand (which is described in the article *EXTREMITIES*), and from the tendon of the palmaris longus. It is continued to the digital extremities of the metacarpal bones, growing broader, having its fibres separated from each other, and divided at last into four distinct portions. There are, however, very obvious transverse fibres connecting together the longitudinal ones after they have separated. Each portion of the fascia splits into two divisions, embracing the flexor tendons, and there inserted into the ligaments belonging to the digital ends of the metacarpal bones.

From the edges of the palmar fascia a thin continuation is sometimes observed to extend over the muscles of the thumb and little finger.

The palmar fascia is closely connected to the skin, some of its fibres being apparently connected to the inner surface of that organ. It covers the flexor tendons of the fingers, the lumbricales muscles, the trunk and ramifications of the ulnar artery, and the digital branches of the ulnar and median nerves, confines these organs in their relative situations, and gives to the palm a firmness well suited to its office of seizing and holding external objects.

The two following are its tensor muscles.

Palmaris longus, ulnaris gracilis, petit palmaire,—are the different names given to a long and very slender muscle, placed in the fore-arm near the ulnar edge of the flexor carpi radialis. It arises from the common tendon connected to the internal condyle, and from the aponeurotic septa, which separate it from the neighbouring muscles. A small rounded fasciculus of fibres very soon forms a thin and flat tendon, which takes a straight direction to the annular ligament of the hand, where it becomes broader. It is inserted by a few fibres into that ligament, but is chiefly expanded into the palmar fascia. This muscle sometimes does not exist. It is placed between the fascia of the fore-arm and the flexor digitorum sublimis. It will exert a most marked effect in rendering the fascia tense; and it has an equally decided influence in bending the wrist.

The *palmaris brevis, or cutaneus*,—is a small thin and flattened plate of fibres, generally disposed in separate fasciculi, situated under the integuments on the ulnar side of the palm of the hand. It arises from the edge of the palmar fascia, takes a transverse course, and is attached to the integuments of the inner side of the palm. Covered every where by the integuments, it lies upon the adductor and flexor minimi digiti, on the ulnar artery and nerve. It renders the fascia tense, and draws the integuments inwards.

Fascia of the thigh, fascia lata, vagina femoris, aponeurose crurale.—This, which is the largest and strongest fascia in the body, covers all the muscles of the thigh. It is strongly connected to the crural arch, in the groin, and it extends over the bones of the pelvis into the abdomen. It is also concerned in covering the femoral vessels where they appear at the front of the thigh, under the crural arch.

The iliacus internus is covered by a thin fascia, to which the broad tendon of the psoas parvus is connected when that muscle is present. This fascia is attached above to the internal edge of the crista ilii; on the inner side to the brim of the pelvis; externally, to the posterior surface of the crural arch, where it consists of two layers, with the

circumflex vessels of the ilium passing between them; and in front it is continued over the os innominatum into the thigh. This has recently been described by the name of *fascia iliaca*. Its posterior surface covers the iliacus internus, a part of the psoas magnus, and of the anterior crural nerve. Its anterior surface is covered by the small superficial branches of the lumbar nerves, which pass through perforations in the fascia, near the crural arch; by the external iliac artery and vein; and by the peritoneum; all which parts are connected to it by the intervention of a loose cellular texture. The attachment of this fascia to the crural arch is continued only so far as where the iliac vessels pass out; at that point it descends to the thigh, forms the posterior part of the sheath including the femoral vessels, and is continuous with the fascia lata. The second origin of the fascia of the thigh is from the anterior surface of the crural arch, from the anterior superior spine of the ilium to the point at which the arch begins to be attached to the pubes. In the whole of this space the fascia lata and aponeurosis of the obliquus, externus abdominis, are continuous, and are maintained by their continuity in a state of reciprocal tension. Hence, when the thigh is extended on the pelvis, all these parts are very tense; and they all become loose on bending the limb. Hence, too, in the extended state, the crural arch is drawn down towards the thigh, so as to represent a convex line. The third origin of the fascia is from the front edge of the pubes, just over the attachment of the pectineus, and under the point at which the crural arch is inserted into that bone. This portion is continuous with the iliac division of the fascia. The rami of the pubes and ischium, and the outer edge of the crista ilii, are other points of origin. Behind, its commencement cannot be very clearly developed; it appears to arise insensibly among the cellular substance over the gluteus maximus, and is first distinctly visible about the tendon of that muscle.

From the various attachments now enumerated the fascia descends over the thigh, embracing all the muscles, sending various productions between them, and terminates at the knee; it, by mingling in front with the common tendon of the extensors of the knee, and with its lateral productions; 2dly, behind, by extending over the hollow of the knee, and being continued into the aponeurosis of the leg; and, 3dly, at the sides, partly by mixing with the last-mentioned aponeurosis, and partly by insertions into the internal and external tuberosities of the tibia.

The fascia is covered in general simply by the integuments, with the addition of the superficial veins, nerves, and lymphatics. The absorbing glands, through which the latter pass, are found in the groin externally to the fascia. And at this point the fascia lata of the thigh, as well as the lower part of the aponeurosis of the obliquus externus abdominis, is covered by a thin sheet of condensed membrane, consisting of several layers intermixed with the absorbing glands, and seldom shewing a very distinct fibrous texture. This has been described by the name of the *superficial fascia*; and, together with the lymphatic glands, it lies exterior to the fascia lata.

The internal surface of the fascia is in contact with the various superficial muscles of the thigh. On the front it covers the rectus and vasti, and includes the sartorius in a peculiar sheath. Behind it is placed over the semi-tendinosus, semi-membranosus, and biceps; sending between the short head of the latter muscle and the vastus externus a strong septum, implanted in the external lamina of the linea aspera, and affording origin to the two muscles. It is interposed, for a short space, between the gluteus maximus and medius; and afterwards the front edge of the latter has a most extensive

F A S C I A.

tensive and powerful connection to it. (See *GLUTEUS*.) In front of the edge of the latter muscle it covers very closely the *gluteus medius*, which arises here from the inner surface of the fascia. It then encloses its own tensor muscle in a peculiar sheath, which unites it closely to the *gluteus medius* and *minimus*. On the inside of the thigh it covers the muscles, without dispatching any productions between them.

It is extremely dense and thick on the outside of the thigh; much less so before and behind; and thinnest on the inside; when in the neighbourhood of the perineum, it can hardly be recognized as possessing a fibrous texture. Fibres decussating each other in every variety of direction, compose its substance. Vessels and nerves perforate it in various situations; *viz.* the *saphena minor* vein in the ham, and several superficial nervous twigs on the front and upper part of the thigh. The most conspicuous opening, however, is near the inner end of the crural arch, where the great *saphena* passes to the femoral vein. Here we find a large oval depression, bounded upwards and outwards by a crescent-shaped production of the fascia, called the *semi-lunar edge* of the fascia lata, or the *falciform process*. In describing the origin of the fascia lata, we have mentioned its continuity with the crural arch. Tracing this from the ilium downwards, we come to a part, near the front of the arch, where the fascia is folded inwards, and connected with the thin posterior border of the tendon of the *obliquus externus*. This portion covers the passage of the femoral vein, and forms the anterior boundary of that division of the fascia which arises from the crural arch. It terminates here by a thin, sharp, and lunated edge, of which the upper corner is connected to the crural arch, the concavity is turned towards the opposite limb, and the inferior corner turns again upwards and inwards, so as to form another very sharp edge, bounding the oval space below. The *saphena interna*, or *major*, passes over this inferior sharp edge to join the femoral vein. The parts now described bound the oval opening above, on the outside, and below. The internal boundary is wanting, and the depression is here continuous with that part of the fascia lata which covers the *pectineus* muscle. By pressing the handle of a knife close on this portion of the fascia, we elevate the femoral vessels, so as to shew that they are not here covered by fascia lata; and we prove that the fascia passes behind them, and becomes continuous on the opposite side with the semi-lunar edge.

The tensor muscles of this fascia are the *gluteus maximus*, (see *GLUTEUS*.) and the *tensor vaginæ femoris*. The latter, called also *musculus fasciæ latæ*, and *tensor aponeurotique crural*, is placed at the upper and outer border of the thigh. Elongated and flattened in its form, it increases gradually in breadth from above downwards. Its origin is from the anterior and superior spine of the ilium, where it lies between the *fartorius* and *gluteus medius*; it descends, passing obliquely outwards, and growing broader by the divergence of its fibres, and terminates by a broad insertion into the external part of the fascia lata. It is in contact, at both surfaces, with layers of the fascia, which include it, and unite into one lamina at its insertion. The thin portion of fascia, which covers it externally, separates it from the integuments; and the posterior layer from the *rectus* and *vastus externus*. On its outer edge, it is in contact with the *gluteus medius* and *minimus*.

Besides the tension of the fascia lata, which is the first effect of this muscle, and by which it may be supposed to aid the action of the subjacent muscular organs, it rotates the thigh inwards; and it will assist also in bending the

limb on the pelvis. Supposing the thigh to be fixed, the *tenor vaginæ* may incline the pelvis laterally; and, in the attitude on one foot, it may rotate the pelvis outwards.

The *fascia of the leg*, *fascia aponeurotica cruris*, *aponeurose jambiere*—analogous in structure, but inferior in strength to that of the thigh, envelopes the muscles placed on the corresponding part of the lower extremity. Behind, it is continuous with the fascia lata; as also on the outside, where it arises further from the extremity of the fibula, and from the tendon of the *biceps flexor cruris*; on the inside its origins are from the expanded tendons of the *fartorius*, *semi-tendinosus*, and *gracilis*. The crural aponeurosis descends from these points over the posterior, external, and anterior aspects of the leg; but not over the internal, consisting of the broad surface of the tibia, which is immediately subcutaneous, and has the fascia attached to its two edges. Below, this fascia is continued into the superior annular ligament; on the outside it is continuous with the fibrous sheaths enclosing the tendons of the *peronei*; within, with the internal annular ligament; and behind, it is insensibly lost towards the heel, being apparently confounded with the cellular substance.

This fascia lies immediately on the muscles, being covered externally by the integuments, superficial veins, &c. It is thick and very tense on the front and outside of the leg, binding the muscles together very closely. In these aspects its internal surface gives origin above to the fleshy fibres of the *tibialis anticus*, *extensor longus digitorum pedis*, and *peroneus longus*; while below it is connected to the muscles by cellular substance. Two septa are continued from it; between the *extensor communis* and *peroneus longus*; and between the latter muscle and the *soleus*. Both these partitions are attached to the fibula. It is much thinner, and more loose on the calf of the leg; and is attached to the muscles by a loose cellular texture. At the lower part of the back of the limb it divides into two layers; a superficial and thinner one covering the *tendo Achillis*; a thick and deep-seated division passing in front of the tendon, embracing very closely the muscles which lie on the back of the bones, and separating them from the muscles of the calf. The latter is fixed to the edges of the tibia and fibula below, and is insensibly lost in the cellular substance above.

The *biceps flexor cruris*, on the outside; and the *fartorius*, *gracilis*, and *semi-tendinosus* on the inside are the tensors of this fascia.

Superior annular ligament of the foot.—This is a strong tendinous plane, covering and confining the tendons on the back of the foot, and continuous with the crural fascia. Arising from the superior depression of the *os calcis*, where its fibres are surrounded by much fat, it passes inwards, dividing into two layers, which form a sheath including the tendons of the *peroneus tertius*, and *extensor longus digitorum*; then continues over the tendons of the *extensor longus hallucis*, and *tibialis anticus*; and is fixed in front of the internal malleolus. A production of it is continued over the last mentioned tendons to the *os scaphoides* and *plantar fascia*. This ligament differs from that of the hand, as the sheaths of the tendons are formed in it by the separation of its fibres. Continuous above with the crural fascia, it ends below in the dorsal aponeurosis: it is covered by the integuments, and lies upon the tendons, and the *extensor brevis digitorum*.

The internal annular ligament—is a thick and broad fibrous plane, arising from the lower and front part of the *malleolus internus*, and inserted into the inner and lower edge of the

the os calcis. It forms the internal concavity of the latter bone into a channel, containing the fibrous sheaths of the tibialis pollicus, and flexors of the toes; the posterior tibial nerves and vessels, and a considerable quantity of fat. The crural fascia is continued into it above; it gives origin below to the abductor hallucis; and it is covered externally by integuments.

Dorsal fascia of the foot.—This is a thin, and sometimes hardly distinguishable fibrous plate, arising from the front edge of the superior annular ligament; descending over the extensor brevis digitorum; slightly attached to the sides of the metatarsus; and lost towards the toes in cellular substance.

Plantar fascia; fascia aponeurotica plantaris; aponeurose plantaire.—This is a very thick, dense, and firm fibrous organ, covering the middle and sides of the sole of the foot. Its origin is from the posterior and inferior part of the os calcis; passing forwards, it soon divides into three portions separated by two deep grooves. The lateral divisions closely cover the abductor hallucis, and the abductor minimi digiti; and grow thinner towards the front, where they are connected to the edges of the foot. The external is strongly attached to the last metacarpal bone. Their opposite edges are connected by cross portions to the middle division. The latter, which is the principal portion, passes forwards, growing broader and broader, and divides at the front of the metacarpus into five pieces. Each of these subdivides into two others, which have lateral attachments to the metatarsal bones, and leave an interval occupied by the flexor tendons, lumbricales muscles, and the digital vessels and nerves.

The plantar fascia is extremely thick and close in its texture behind; but its fibres are more scattered in front. Many filaments proceed from its inferior surface to the skin, intercepting portions of fat. Its upper surface is in contact with the three superficial muscles of the foot, and affords a point of origin to their fibres. It dispatches between these two septa corresponding in situation to the two grooves already mentioned. It has no tensor muscle.

The *fascia transversalis*—is a thin production extended from the crural arch between the transversus abdominis and peritoneum; see *OBLIQUUS externus abdominis*.

Bichat; Anatomie descriptive, vol. 2. Murray, De fascia lata, Upsal; 1777. Barth, Muskellehre; with plates. Cooper's plates of hernia, part 2, with the descriptions. Burn's observations on the structure of the parts concerned in crural hernia; in the 2d volume of the Edinburgh Medical and Surgical Journal; p. 265.

FASCIA, in *Surgery*, a bandage, fillet, roller, or ligature. See *BANDAGE*.

FASCIAE, or *Fasciolaræ*, in *Roman Antiquity*, were pieces of cloth, used by the Romans, who wore neither stockings nor breeches, for wrapping their legs and thighs; and they were denominated from the parts which they covered, *viz. tibialia* and *femoralia*.

FASCIAE, in *Astronomy*, two rows of bright spots observed on Jupiter's body, appearing like swaths or belts.

The fasciae, or belts of Jupiter, are more lucid than the rest of the disk, and are terminated by parallel lines. They are sometimes broader, and sometimes narrower; nor do they always possess the same part of the disk.

M. Huygens likewise observed a very large kind of fascia in Mars; but it was darker than the rest of the disk, and took up the middle thereof. See *BELTS*.

FASCIALIS, in *Anatomy*, a muscle of the leg, called also *Sartorius*.

FASCICULATE, in *Botany*, applies to leaves when

gathered together into a tuft, as in the larch and cedar; and occasionally to such small leaves as form axillary clusters in several plants, witness the pink or Sandwort tribe, some species of *Selago*, and many others. A fasciculate or clustered stem is a preternatural luxuriance, or disease, of that part, in which numerous branches or stems appear to cohere longitudinally into one, assuming a broad, flat figure, crowded with leaves, flowers, or both, at the extremity, and bearing occasionally a few scattered leaves here and there at the sides. We have seen it in the Ash, Holly, *Daphne*, *Antirrhinum*, *Ranunculus*, &c. In compound flowers, as the *Antemis* or *Matricaria*, the receptacles are sometimes united into one linear series. In the Top-knot Pea, *Pisum comosum*, Rivin. Pentap. Irr. t. 38, the fasciculate stem is a permanent variety, propagated by seed. The legume of this pea has no cartilaginous lining, and is therefore eatable entire.—Fasciculate flowers are such as grow in a peculiar form of inflorescence, termed a *fasciculus*. See that article. S.

FASCICULUS, a fascicle, is one form of inflorescence, composed of several flowers, supported on little stalks variously inserted and sub-divided, collected into a close bundle, level at the top; as in the Sweet William, *Dianthus barbatus*.

FASCICULUS, in the *Materia Medica*, a term sometimes used to express a certain quantity or measure of herbs.

By fasciculus is meant so much as may be held in the arm when bent, and rested on the top of the hip. Physicians note it in prescription by *fasc*.

FASCINATION denotes a sort of witchcraft, supposed to operate by the influence either of the eye or the tongue.

The word is formed from the Greek, *ἑστάναι*, which signifies the same.

Ancient writers distinguish two sorts of fascination, one performed by looking, or the efficacy of the eye. Such is that spoken of by Virgil in his third eclogue:

“Nescio quis teneros oculus mihi fascinat agnos.”

The second by words, and especially malignant praises. Such is that mentioned by the same poet in the seventh eclogue:

“Aut, si ultra placitum laudârit, haccare frontem
Cingite, ne vati noceat mala lingua futuro.”

Horace touches on both kinds in his first book of epistles:

“Non istic obliquo oculo mea commoda quisquam
Limat, non odio obscuro, morsuque venenat.”

Among the Romans there was a deity called *Fascinus*, who prevented fascination or enchantment.

FASCINE, a bundle of boughs, twigs, &c. firmly bound together, and made of certain dimensions, according to the use for which it may be intended. Fascines are much used in field-fortification, for the purpose of retaining loose soil within certain spaces, such as the merlons of batteries, the defences of trenches, the raising of epaulements, &c. Simple as the formation of a fascine may appear, for it is nothing more than a faggot, much attention to method is requisite towards their being rendered equal in size, and compact in every part. When such a convenience can be had, it is proper to make them on trestles, or any kind of support placed at about two feet asunder from centre to centre: forked sticks driven into the ground answer admirably, as they receive the several sticks, but allow ample space for the bands, which should be of hazle, birch, or other pliant tough wood, that will bear to be well twisted. In the

first instance a strong piece of very smooth cord, technically termed a "choke-rope," should be passed round so as to draw the bundle as tight as possible, and to bring the whole within a certain girth marked on the rope by means of any distinct token; if deficient, the fascine must be fill'd up to that measurement. That being effected, the bands are severally passed round at least twice, and firmly secured by twisting their ends together, and by passing them between some of the twigs: these bands should never be more than a foot apart.

Five men should be employed at each fascine; three to make up on the trestle, and two to collect and prepare the twigs, bands, &c. attention being paid to placing all short pieces in the middle of the diameter. Birch and fir are considered the best wood for this work. It is also found expedient to double some very long pieces at the ends of a fascine, so as to form a loop, through which a stake may be driven for the purpose of securing the ends more firmly than they can possibly be when left ragged. Fascines are made of various dimensions, according to the works for which they are intended; generally, they are about 18 feet in length, and 10 or 12 inches in diameter; such being suited to the revetement, or facing of embrasures. When intended for the exterior, or the lining of the merlons, they are usually made 8 feet long for the former, and 12 for the latter purpose: the diameter the same as those for the revetements of embrasures.

French fascines, from 4 to 6 feet long, and from 4 to 9 inches diameter, are used in sieges, chiefly for the purpose of binding works of small bulk, and for upholding loose soil in parts where no great strength is requisite.

Water fascines are usually made about 6 feet long, and from 1 to 2 feet thick: they are used to cover marshy spots, so as to give a firm footing; but where the water is more than a few inches deep, they should be well laden with stones, &c. to cause their settling to the bottom. Great care must be taken to arrange them properly, so that the wheels of carriages may not be obstructed: with this view they are generally laid across the road, having their surfaces well filled up with sap-saggots, which are rarely more than 3 feet in length, or more than 8 inches in thickness.

Covering fascines are used to form the tops of magazines, or of saps. These should be made remarkably strong, of the thickest branches, and generally bound upon substantial poles, that they may bear a great weight; it being common to load them to the depth of many feet, with soil, so as to defend the interior from ricochet shots, grenades, &c. The dimensions of fascines for this purpose must depend on circumstances; where timber can be obtained, it, of course, is preferred, otherwise every endeavour must be used to render this substitute as firm as circumstances may admit.

The general computation is, that five men will make two fascines 18 feet long, and a foot thick, within an hour, provided materials are at hand: if to be brought from a distance, more men must be employed. The trestles, or, which are better, the forked sticks, should stand at such a height as may enable the binders to put on the bands with little or no stooping. Experience proves that except for the lining of embrasures, for which fascines 18 feet long are preferable, those of from 8 to 12 feet are the most convenient; such may be easily carried, and rarely require any cutting. It is proper, however, to have several 18 feet long made, for the purpose of binding the corners of a merlon, &c. and to remark, that care should be taken not to let two joints stand one above the other.

The following will be found requisite for the construction of a fascine battery of two guns, or howitzers.

90 Fascines each 9 feet long.

20 Ditto 18 ditto.

This number will face the outside, as well as the inside, of the epaulement; which, if the earth be stiff, will not always prove necessary, at least not higher than the soles of the embrasures on the outside. In the latter case, five fascines, of nine feet each, will be spared for other uses.

A mortar-battery will not require any long fascines, (*i. e.* of 18 feet,) for lining the embrasures; but if a battery be so exposed as to require a shoulder (epaulement) to cover it in flank, about fifty fascines, of nine feet, will be necessary for that purpose. The simplest method of ascertaining the number of fascines for a mortar battery, or for any other plain breast-work, is to divide the length of work to be fascined, by the length of each fascine in feet; multiply by the number of layers, and the result will shew the number of fascines required.

Every fascine will require a picket for every yard of its length, and one for its extremity; thus, one of 18 feet will require seven pickets; nine feet, four ditto.

Observing, that where any fractional part exceeds a foot, an additional picket must be given. By adding to the above computation 30 fascines of nine feet, and 10 of 18 feet, the number of fascines, and consequently of pickets, for every additional gun may be ascertained. But as, owing to the damages usually sustained from the fire of the enemy, repairs will often be necessary, it is proper to have a certain number of spare fascines, at some secure depot, for that purpose; and as parts of the wadding, &c. are apt to be impelled towards the fascine-revetements of the embrasures, water should always be at hand for their extinction. Nothing is more common than for the besieged to make a sortie, with the intention of burning the breaching and mortar batteries.

FASCINERY, in *Engineering*, signifies wattled wood or hedge-work for groins, &c. to retain the pebbles or beach, and break the waves on the sea shore. Smeaton's Reports, i. 271.

FASCIOLA, in *Zoology*, a genus of intestinal worms, with which man, and various animals, are afflicted. The body is flattish, with an aperture at the anterior extremity, and another in the middle of the abdomen, or at a distance beneath. Some are of considerable magnitude, being from an inch to two inches or more in length, while others are scarcely perceptible, and they differ also in their habits of life, being either solitary or gregarious. They occur most frequently in the mucus of the stomach, or the intestines, and liver; or sometimes in the flesh immediately under the skin, examples of which have been observed in many kinds of fishes, and in some quadrupeds. When they occupy the biliary canal in animals, they tumefy all the parts, and become the source of many maladies, an effect too generally experienced in that useful creature the common sheep, and also in cattle. The particular kind with which the sheep is infested (*F. hepatica*) is known among agriculturists by the familiar name of Fluke, or Gourd-worm, and is sufficiently understood to be the occasion of the dropsy; and also of that disorder usually called the rot, in which case the wool falls off the infested carcass, and the animal perishes miserably. Sometimes these pernicious internal depredators are found in brooks, and other watery places, where it is concluded they have been vomited up by the afflicted sheep, and dropped into the water.

The labours of Goeze, Müller, Bloch, and other naturalists have tended, in a remote degree, to elucidate the history

FASCIOLA.

history of those particular species which infest the more useful kinds of domestic animals in Europe. Much, however, we are persuaded, still remains to be observed, even in this partial branch of the enquiry; there are probably many other species which infest those animals already examined, but which, from their ambiguity of character, or extreme minuteness, have hitherto eluded the vigilance of the observer. Again, those which infest the inferior tribes of European animals have scarcely claimed the least attention, and such as are peculiar to animals in hotter climates than those of Europe appear, with one or two exceptions, to be utterly unknown. The latter we conceive to be numerous indeed, and this idea is rendered probable, when we consider how exceedingly conducive the heat, even of our own climate, is known to be to the increase both in size and numbers of those destructive inmates.

These vermes are declared hermaphrodite, and the supposition is plausible, because it has been ascertained, from accurate inspection, that among the immense numbers of the gregarious kinds which occasionally occur together every individual is furnished with ovaries; but it must also be admitted that we are not so fully conversant with the mystery of their generation and manner of life as to speak with certainty even from this circumstance, although it hence appears an admissible opinion. The fasciolaræ adhere by means of the abdominal as well as the anterior pore, the latter of which is however the true mouth through which they derive sustenance, and from whence the intestinal cavity may be traced to the intestines, and thence to the vent or abdominal pore. The intestines are flexuous, and the ovaries placed laterally.

Species.

* *Infesting Man.*

HUMANA. Doever, verm. Cleric. Lumbr.

** *Infesting Mammalia.*

VULPIS. Orbicular; head thick, rounded, and separated from the trunk by a circular arch; posterior part flexuous at the sides; tail with two cylindrical membranaceous appendages each side. Goeze.

Found in the intestines of the fox, and is not perhaps of this genus.

PUTORII. Minute and subrotund, with two approximate pores. Goeze.

Length an inch and a half; the species found in the intestines of the polecat.

MELIS. Thick; head triangular. Goeze.

Inhabits the intestines of the badger.

VESPERTILIONIS. Elongated and tapering with red intestines. Müll.

Body reddish fuscous, and fleshy, with minute dots disposed in transverse striæ. This kind is found in the intestines of the long eared bat, which it frequently penetrates and occasions death.

HEPATICÆ. Ovate and sub-petiolate Linn. Depressed-ovate, whitish fuscous with the anterior part lengthened and tubular. Fabr. &c. *Limax ovate*, livid with acute margin, Amoen. Acad. *Planaria latiuscula*, Goeze.

Infests the liver of sheep, where it is generally found adhering by a pore at the extremity, and another in the middle of the abdomen, and occasions the disorder in sheep called the rot. The body is about an inch long, broader on the fore part, and terminated by a tube, the back marked with furrows. The five following kinds are considered by some as varieties of hepaticæ.

BOVM. In the liver of cattle. Müll.

PORCORUM. In the liver of swine. Goeze.

APRI. In the liver of boar. Cleric.

CERVI. In the liver of deer. Borlase.

EQUI. In the liver of the horse. Buffon.

ELAPHI. Body conic-ovate, with a very large aperture behind; mouth assurgent and remote.

Inhabits the stomach of the stag, and is gregarious.

*** *Infesting Birds.*

BILIS. In the gail-daft of the black eagle. Braun.

Body thick, and gregarious.

BUTEONIS. Inhabits the intestines of the buzzard. Goeze.

Body with two pores.

MILVI. Body flat with a double pore; intestines frondose. Goeze.

Small. Found in the intestines of the kite.

STRIGIS. Body roundish, with a single pore. Goeze.

In the intestines of the kite. Perhaps not of this genus.

PUPILLA. Very minute; shape various, inclosed in a cyst, and tenacious of life. Braun.

Found in the thorax of the owl, (*Strix aluco*) and also under the skin in the common hedge hog. Probably not of this genus.

ANATIS. Reddish and roundish, with a single pore. Goeze. *Cuculus conoideus*, Bloch. *Hirudo fasciolaris*. Müll.

An internal worm, supposed to be of this genus, and which is found in the intestines of the common domesticated duck. The body is small, pellucid, and sometimes white; the anterior part ending in a truncated triangle, the posterior rounded; intestines black and flexuous; ovaries lateral.

ANSERIS. Oblong-ovate, with opposite papillæ placed in two rows; pores approximate. Froelich.

Found in the rectum of the common goose.

GRUIS. Inhabits the intestines of the crane. Bloch.

This may not be specifically distinct from fasciola anatis.

ARDEÆ. Sub-orbicular. Goeze.

Found in vast numbers in the intestines of the bittern, which it often penetrates.

**** *Infesting Reptiles.*

SALAMANDRÆ. Oblong, sub-linear, resembling an oil-flask; pores remote. Froelich.

In the rectum of the salamander.

RANÆ. Sub-clavated, mouth sessile. Goeze.

Found in the intestines, lungs, and liver of the frog; is very slow in motion, contracting itself into a globular form, and when dilated is broad and flattish.

UNCINULATA. Posterior part of the body armed with two elastic hooks. Braun.

Inhabits the frog under the common integuments of the abdomen, and occurs either solitary, or in number; its motion resembles that of the common leech.

***** *Infesting Fishes.*

BIONIS. Elongated, round, and caudated, with a papillary lateral pore. Müll. Zoega, &c.

Infests the intestines of various fishes; the body is of equal thickness, with papillary pores; the anterior one larger, and extending over the fore part of the body; tail filiform, and half as long as the body.

DITISCHÆ. Elongated, round, with a projecting excavated lateral pore. Zoega.

Infests the intestines of various fishes; the body is wrinkled, and tapering behind; the anterior part somewhat

what bifid at the end, the divisions unequal, and excavated at the tip.

ANGUILLÆ. In the common eel. Lewenh.

SCABRA. Elongated, round, transversely striated, and ferratulate at the margin. Müll.

In the stomach of the whiting pout. The body is scarcely perceptible to the naked eye; pellucid, and protruding from the mouth a hard and hollowed spherule, with a white double filiform vessel, and another blackish flexuous one filled with eggs extending the whole length of the body.

ÆGLEFINI. Linear, and slightly depressed; no neck. Müll.

Length half an inch, colour cinereous, form rounded at the extremities.

BLENNII. Linear, and flat; neck inflated with a divergent truncated base. Bloch.

Found in the intestinal mucus of the viviparous blenny; size small, being almost imperceptible to the naked eye; colour white, pellucid, and generally curved into an obtuse angle; lateral pore large, placed in the angle of the body, and prominent when in motion with two white vesicles.

SCORPII. Elliptic, and perforated at one end with a minute papilla; no neck. Müll.

In the intestines of the Father lasher; invisible to the naked eye, pellucid, whitish grey, obtuse at each end, and filled with eggs.

PLATESSÆ. Elliptic, and green. Müll.

Extremely minute, opaque, divided into six alternate spaces of green and white; terminal pore large, lateral one placed in the middle; eggs deep green. Found in the intestinal mucus of the plaïse.

LUCIOPERCÆ. Ovate-oblong, and slightly ventricose; neck short; margin of the terminal pore dilated and smooth. Müll.

Size of a grain of sand; colour brownish; neck cylindrical; lateral pore slightly prominent, and narrower downwards. In the intestines of perca lucioperca.

PERCÆ. Ovate, ventricose; neck short; terminal, pore nodulous at the margin. Müll.

Found in the intestines of the ruffe, and in size rather exceeding the former. The body is brown; neck white and cylindrical, granulated, and terminated by a pore; lateral pore seated at the base of the neck; body obtuse behind.

LAGENA. Body rotund; neck long. Braun.

In the intestines of the common river perch.

VARICA. Linear, round, neck divergent, obtuse, and perforated beneath the tip. Müll.

Found in the stomach of the salmon. This is of an elongated form, often diverging into an acute angle, smooth when extended, and rather wrinkled when contracted; lateral pore nearly in the middle; a double filiform white vesicle down each side, and connected below with two white opaque bodies of an ovate form; eggs numerous, scattered, yellowish green, and contained in a flexuous hyaline tube; each of the eggs included in a pellucid membrane.

ERIOCIS. Elliptic, hyaline, and rufous in the middle. Müll.

Infests the intestines of salmon eriox; the size very minute; anterior part of the body retractile, and extensible, including a filiform conglomerated intestine, and two vesicles.

FARIONIS. Oblong and a little depressed; the fore part with six equal lobes on the margin. Müll.

In the intestinal mucus of the salmon. The body is yellowish, and about the twelfth part of an inch in length;

the margin obtusely crenulated; the anterior lobes nearly square and membranaceous.

UMBLÆ. Oblong, flat, with a narrower retractile neck. O. Fabr.

Found in vast numbers beneath the skin in the back of the salmo umbla. The length is one-eighth part of an inch; the body is whitish, and resembling a flask, broader behind, and obtusely truncated, the margin acute.

LUCII. Lanceolate, with a crenated depressed margin; neck long and round. Müll.

An inch and a half in length, the colour bright red; found in the stomach and œsophagus of the common pike.

HALECIS. Found in the stomach of the herring. Leuwenh.

BRAMÆ. Oblong, round, tapering, and obtuse at the base; neck rounded and slightly incurved. Müll.

In the intestines of the bream. The body is white, the lateral pore at the base of the neck.

JESIS. Body ovate, the anterior part narrower. Bloch. Found in the intestines of cyprinus jeses, and resembles a flask, or long-necked bottle.

TRUTTÆ. Oblong, with two white lucid orbicular spots behind the lower aperture. Froel.

In the rectum of the trout.

CLAVATA. Body roundish, livid, wrinkled, and clavated behind. Linnæan Trans.

Found in the stomach of the scomber pelamis, in the Pacific ocean. The length is about two inches; the body whitish brown, with a blueish cast, and annulated with fine wrinkles; towards the lower extremity spherically gibbous, and terminating in an aperture; neck slender; pore larger than the terminal one.

SPARI. In the mucus of sparus aurata, &c. *La fasciole de la dorade*, Bosc.

BRUNNEA. In the mucus of sparus aurata. *La fasciole bruné*, Bosc.

CAUDATA. In the mucus of sparus aurata. *La fasciole caudate*, Bosc.

***** *Infesting Worms.*

LOLIGINIS. Body oblong, white; mouth with transverse papillæ. O. Fabr.

Found in the intestines of the cuttle-fish.

FASHION. The word is French, *fagon*, which signifies *making*.

FASHION is particularly used among *Artificers*, for the trouble, time, and labour, employed in a piece of work, particularly of silver or gold.

It is by the fashion that the workmen's wages, or salary, are regulated.

The word is also used to denote the prevailing mode or taste.

FASHIONS, a name sometimes given to the farcin.

FASHION-Pieces, in *Sea Language*, two pieces of timber which form the breadth of a ship at the stern, and are the outmost timbers of the stern on each side, forming its shape, and united to the stern-post, and to the extremity of the wing-transom, by a rabbit, and a number of strong nails or spikes driven from without.

FASIANO, in *Geography*, a town of Naples, in the province of Bari; 12 miles S. of Monopoli.

FASIKANI, a town of Japan, in the island of Nippon; 30 miles W. of Xenday.

FASSETS, among *Jewellers*. See FACETS.

FASSUS, in our *Old Writers*, is used for a fagget of wood. It seems to come from the French *faisseau*.

FAST,

FAST, a space of time wherein a person takes little or no food.

For the advantages of fasting with regard to health, see **ABSTINENCE**.

The Bramins never bleed their sick, but make them fast.

FAST is peculiarly used for an abstinence on account of religion, or a space of time wherein the church prohibits the use of food, or at least restrains it to certain kinds, and to certain hours.

Fasting has been practised by most nations from the remotest antiquity. The Jews observed fasts from their first establishment. Moses appointed one solemn fast before the feast of expiation; and others were instituted by the following prophets on different occasions; so that in the time of Zacharias there were four regular fasts, *viz.* in the months of June, July, September, and December. To these they have since added three others, in memory of sore distresses they have at different times suffered. Besides these there are various kinds of fasts, some for devotion, others for the new moons; and some among them kept an anniversary fast, in memory of the translation of the Septuagint, in order to expiate the base compliance of their doctors for a foreign prince, and the outrage offered to the dignity of their law, which, in their opinion, was only designed for themselves: "Non fecit taliter omni nationi."

There is no occasion to describe exactly the various observances that accompanied these acts of humiliation, as they are generally known. Their abstinence lasted twenty-seven or twenty-eight hours, beginning before sun-set, and not ending till some time after sun-set the next day. On these days they were obliged to wear white robes, in token of their grief and repentance; to cover themselves with sackcloth, to lie on ashes, to sprinkle them on their head, and on great occasions to cover the ark of the covenant. In order to complete their abstinence, they eat nothing at night but a little bread steeped in water, seasoned with salt, and bitter herbs and pulse. Some of them continued the following day and night praying in the temple, or synagogue, bare-footed, and occasionally scourging themselves.

Those that would be particularly informed of these austerities may consult Maimonides, Leo of Modena, and Buxtorf.

The Egyptians, Phœnicians, and Assyrians, neighbours to the Jews, had also their fasts. The fast of the Nivites, occasioned by the preaching of the prophet Jonas, is too well known to be insisted on.

Nor were the Greeks without their fasts. Aristotle informs us, that the Lacedæmonians having resolved to succour a city of the allies, ordained a general fast through the whole extent of their dominions, without excepting the domestic animals; and this they did for two ends, one that they might spare provision in favour of the besieged, and the other to draw the blessing of heaven on their enterprize. The Athenians, among others, had the Eleusinian and Thesmophorian fasts, the observation of which was accompanied with strict fasting, particularly among the women, who spent one whole day sitting on the ground in a mournful dress, without taking any nourishment; on which account this day was called *ves-tice*.

In a word, all the Pagan deities, whether of the male or female sex, required this duty of those that desired to be initiated into their mysteries, of the priests and priestesses that gave the oracles, and of those that came to consult them.

In Italy fasting was observed much in the same way. The inhabitants of Tarentum, being besieged by the Romans, demanded succours from their neighbours of Reg-

gium, who immediately ordained a fast throughout their whole territories, with the same intention as the Lacedæmonians, *viz.* to render the gods favourable, and to spare provision for their allies. Their enterprize having had good success by their throwing a convoy with provisions into the town, the Romans were obliged to raise the siege; and the Tarentines, in memory of this delivery, instituted a perennial fast. So that here we have two fasts for the same event; that observed by those who were the means of obtaining the deliverance, and that observed by them who received it. The Roman senate, Livy tells us, being alarmed by many prodigies, happening in a train one after another, ordered the decemviri to consult the Sibylline books; who having executed their commission, declared, that to prevent the fatal consequences, it was necessary to establish a fast in honour of Ceres, to be observed every fifth year. That Jupiter had stated fasts at Rome, appears from the following passage of Horace, where a mother is introduced praying to Jupiter for the recovery of her son from a quartan ague, and promising that the patient should purify himself in the Tiber on the morning of the fast-day sacred to that god:

"Frigida si puerum quartana reliquerit, illo
Manc die quo tu indicis jejunia, nudus
In Tiberi ilabit."

Fasting must have been very sacred at Rome, since we find it practised by kings and emperors. Numa Pompilius, Julius Cæsar, Augustus, Vespasian, and others, we are told, had their stated fast days; and Julian the Apostate was so exact in this observance as even to outdo the priests themselves, and the most rigid philosophers.

In a word, every country, nation, and religion have had at all times their priests, druids, gymnosophists, and philosophers, who distinguished themselves by their frugality, austerities, and abstinence. The practice of the Pythagoreans is well known; their whole life was a continued lent, but with this difference between them and us, that they believed the use of fish equally unlawful with that of flesh. They lived entirely on bread, fruits, and pulse, with great sobriety, in imitation of their master Pythagoras; though in this respect they must have fallen far short of him, if we may believe Diogenes Laertius, who says that he continued his fasts for no less than forty days. Apollonius Tyaneus, one of his most famous disciples, could never by all his endeavours equal his master in this point, though his fasts greatly exceeded the ordinary intervals.

The gymnosophists or brachmans reckoned fasting among their religious duties. Father Le Compte, in his memoirs, tells us, that the Chinese have at all times had regular fasts with form of prayers, for preserving them from barrenness, inundation, earthquakes, and such like public calamities. The Mahometans too, who possess so large a part of Asia and Africa, have times of fasting, called by them *ramadan* (which see) as regular as we have lent; and their dervises are remarkable for their mortification and fasting. Compte, Mem. tom. ii. p. 142.

The Turks are so scrupulous on the point of fasting, that they will not at those times so much as take the smell of any perfume by the nose. They hold that odours themselves break fast. If they bathe, it is forbid to put the head under water for fear of swallowing any of it; and as for women, they are forbid to bathe at all on fast-days, for a reason peculiar to the sex.

It was not unusual among the ancients to fast on account of dreams.

Mr. Bayle observes, that whole books have been written

on long fasting. Cyriacus Lentulus has composed one, "De Prodigiosis Inediis." Fortunius Licetus, professor of medicine at Padua, besides a great many others, has published one book in folio, "De us qui diu vivunt sine Alimento," or "De Feriis Altricis Animæ."

Though fasting is not positively enjoined by Christ or his apostles, a practice prevailed among the first Christians of joining abstinence with their prayers, especially when they were engaged in affairs of extraordinary importance. But in the most ancient times we find no mention of any public and solemn fasts, except upon the anniversary of Christ's crucifixion. However, in process of time, days of fasting were gradually introduced, first by custom, and afterwards by positive appointment; though it is not certain what those days were, nor whether they were observed in the first century. Mr. Mosheim acknowledges, that those who affirm, that in the time of the apostles, or soon after, the fourth and sixth days of the week were observed as fasts, are not destitute of specious arguments in favour of their opinion. Eccles. Hist. vol. i. p. 131. 8vo.

Towards the close of the third century fasting was held in much greater esteem, from a notion that it served as a security against the power of demons, who directed their stratagems principally against the luxurious. The Latins, contrary to the general custom, fasted the seventh day of the week; and as the Greeks and Orientals refused to follow their example, this afforded a new subject of contention between them. About the end of the fourth century this notion still more generally prevailed; and fasting was also considered as the most effectual means of appeasing the anger of an offended deity. Hence proceeded the establishment of this practice as an indispensable duty, by express laws enacted by the rulers of the church. The Quadragesima or Lent fast was held more sacred than all the rest, though it was not yet confined to a certain number of days. But as fasting became more general, it was contrived to render it more easy; and therefore a mere abstinence from flesh and wine was judged sufficient; which opinion prevailed from this time, and became universal among the Latins. Ib. vol. i. p. 293. 398.

The strict canonical fast only allows of one meal in twenty four hours. F. Thomassin observes that the ancient fast was to sup without dining, *i. e.* only to take one meal, and that not till after noon: adding, that to dine without supping, was a breach of the fast. The practice of the Latin church was to fast thirty-six days in the year; which is, as it were, the tithe of the year.

Tertullian wrote an express treatise, "De Jejunis," of fasts, to support the new laws of fasting, which the Monks were for imposing.

The ancient catholics allowed of no obligatory or commanded fasts besides that preceding Easter, since called *Lent*; the terms of which were to forbear eating till the evening.

The other fasts observed were only of devotion; such were the fourth and sixth *feriæ*; *i. e.* Wednesdays and Fridays.

This Lent fast was called *station*. Besides these there were occasional fasts enjoined by the bishops, &c. See *ABSTINENCE* and *LENT*.

Some introduced the xerophagy into fasts; that is, the use of dried fruits for their meals; and made a practice of abstaining not only from all meats and wines, but also from succulent fruits, for the whole twenty-four hours; and some reduced themselves to bread and water: but this was more than was commanded.

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FAST-days are those appointed by public authority, to be observed by fasting and humiliation. See *ABSTINENCE*.

FAST-ground, or *FAST-country*, a term used by some of our *Miners* to express what others call the *shelf*; which see.

FASTAGE, signifies the seagh, fleet, or refuse small spar from a vein.

FASTERMANS, or *FASTING-MEN*, *q. d. homines habentes*, was used in our ancient customs for men in repute and substance; or rather for pledges, sureties, or bondsmen, who, according to the Saxon polity, were fast bound to answer for one another's peaceable behaviour.

FASTI, in *Antiquity*, the Roman calendar; wherein the several days of the year, with their feasts, games, and other ceremonies were expressed.

The Romans had their greater and lesser fasti. The greater fasti were called the fasti of the magistrates; and the lesser, the fasti calendares.

The fasti calendares, which were what was properly and primarily called fasti, are defined by Festus Pompeius to be books containing a description of the whole year; *i. e.* ephemerides, or diaries, distinguishing the several kinds of days, festi, profesti; fasti, nefasti, &c. The author of these was Numa, who committed the care and direction of the fasti to the "pontifex maximus," whom the people used to go and consult on every occasion. This custom held till the year of Rome 450, when C. Flavius, secretary to the pontifices, exposed in the forum a list of all the days on which it was lawful to work; which was so acceptable to the people, that they made him curule ædile. Liv. lib. ix. cap. 46. Ed. Crevier. tom. i. p. 573.

These lesser fasti, or fasti calendares, were of two kinds, *urbani* and *rustici*. The fasti *urbani*, or fasti of the city, were those which obtained, or were observed in the city. Some will have them thus called because they were exposed publicly in divers parts of the city; though by the various inscriptions or gravings thereof on antique stones one would imagine that private persons had them likewise in their houses. Ovid undertook to illustrate these fasti *urbani*, and comment on them in his "Libri Factorum," whereof we have the six first books still remaining; the six last, if ever they were written, being lost. Beside Ovid, several other authors had undertaken the same subject, particularly L. Cincius Alimentatus, Fulvius Nobilior, Maturius Sabinus, Cornelius Labeo, C. Licinianus, and Nisus; of all whom Macrobius makes mention in his "Saturn." and preserves fragments of each; besides a work of one Barbium Marcus, intitled, "De Fastis Diebus," quoted by Fulgentius, "De Prisco Sermones."

In the greater fasti, or fasti of the magistrates, were expressed the several feasts, with every thing relating to the gods, religion, and the magistrates; the emperors, their birth-days, offices, days consecrated to them, and feasts and ceremonies established in their honour, or for their prosperity, &c.

With a number of such circumstances did flattery at length swell the fasti, when they became denominated *magni*, to distinguish them from the bare calendar, or fasti calendares.

In the fasti *rustici*, or country fasti, were expressed the several days, feasts, &c. to be observed by the country people; for as these were taken up in tilling the ground, fewer feasts, sacrifices, ceremonies, and holidays, were enjoined them than the inhabitants of cities; and they had also some peculiar ones not observed at Rome.

These rustic fasti contained little more than the ceremonies of the calends, nones, and ides; the fairs, signs of the zodiac, increase and decrease of the days, the tutelary gods

of each month, and certain directions for rural works to be performed each month.

FASTI was also a chronicle or register of time, wherein the several years were denoted by the respective consuls, with the principal events that happened during their consulates; these were called also *fasti consulares*, or consular *fasti*.

Omphrius Panvinius, Pighius, Sigonius, and Janssen d'Almeooven, have given us the *fasti consulares*; the two first, with long and learned comments, wherein are expressed not only the consuls, but also the dictators, magistri equitum, triumphs, and ovations. Pighius even adds as many of the other officers as he could find, *viz.* prætors, tribunes, &c. J. d'Almeooven confines himself to the consuls alone.

FASTI is still applied to the archives and public records wherein are kept historical memoirs of public and remarkable events that have happened to a people.

In the like sense the martyrology is called the sacred *fasti* of the church.

The Jesuit Du-Londel has compiled the *fasti* of Louis le Grand, &c.

FASTI, or *Dies Fasti*, also denoted court days. See DAY.

The word *fasti*, *fastorum*, is formed of the verb *fari*, to speak, because, during those days the courts were open, causes might be heard, and the prætor was allowed *fari*, to pronounce the three words, *do, dico, addico*; the other days wherein this was prohibited were called *nefasti*: thus Ovid,

“ Ille nefastus erit, per quem tria verba silentur:
Fastus erit, per quem lege licebit agi.”

These *dies fasti* were noted in the calendar by the letter F: but observe, that there were some days *ex parte fasti*, partly *fasti*, partly *nefasti*; *i. e.* justice might be distributed at certain times of the day, and not at others. These days were called *intercessi*: they were marked in the calendar thus; F. P. *fastus primo*, where justice might be demanded during the first part of that day.

FASTIGIATI FURNI, in *Chemistry*, furnaces fitted with several aludels.

FASTIGIUM, in *Architecture*, the same with *pediment*.

FASTING MEN. See FASTERMANS.

FASTNEL, in *Geography*, the name of a rock in the Atlantic ocean, not far from Cape Clear, on the southern coast of Ireland. N. lat. 51° 17'. W. long. 9° 30'.

FASTOLFF, JOHN, in *Biography*, knight and knight-banneret, a renowned general, governor and nobleman in France during our conquests in that kingdom, under Henries IV. V. and VI. of England, was son of John Fastolff, esq. of Yarmouth, and of Mary, daughter of Nicholas Park, esq. and born, it is presumed, about the year 1377. He is supposed to have had a good education, and his father dying while he was young, he became ward to John duke of Bedford, who was afterwards regent of France. The first public employments in which Fastolff was engaged seem to have been under Thomas of Lancaster, afterwards duke of Clarence, the then lord-lieutenant of Ireland, which was in 1401, and it is probable he was with him again in that country in 1405, 6, and 8, as in the beginning of 1409 he was married in that kingdom to a rich young widow of quality, named Milcent, lady Cattlecomb, relict of sir Stephen Scope. The marriage was solemnized on the feast of St. Hilary, and Fastolff obliged himself in a bond of a 1000*l.* to pay her an hundred pounds a-year in

the nature of pin-money during her life. There seems good evidence that shortly after his marriage he went to France, where he was, according to the testimony of Caxton, full forty years, so that he could not have been a companion with, or follower and corrupter of prince Henry; of course Shakespeare could not have drawn his sir John Falstaff from this gentleman: “The one,” says the writer of the article in the *Biographia Britannica*, “is an old humourous, vapouring, and cowardly, lewd, lying, and drunken debauchee, about the prince’s court, when the other was a young and grave, discreet and valiant, chaste and sober commander abroad, continually advanced to honour and places of profit, for his brave and politic achievements, military and civil; continually preferred to the trust of one government or other, of countries, cities, towns, &c. or as a general and commander of armies, in martial expeditions while abroad, made knight-banneret in the field of battle; baron of France, and knight of the garter in England,” &c. &c. In the year 1413 Fastolff had the castle and dominion of Veires in Gascony committed to his custody and defence. He was afterwards engaged in the celebrated battle of Agincourt, in which, it is said, he signalized himself by taking the duke d’Alençon prisoner. For his eminent services in this and other great battles he received the honour of knighthood, and the manor and demesnes of Fritense, near Harfleur, bestowed upon him during life. For various other instances of high military prowess he was elected, about the year 1425, knight of the garter. In October 1428 sir John Fastolff with others were dispatched with supplies to the English army who were besieging Orleans: two immense French armies were sent to prevent the succours being delivered; these, by the valour of sir John, were defeated, and he accomplished the task for which he was sent without difficulty. This circumstance has been celebrated as almost unparalleled in history. After fresh victories, and much active service in France, where many years he had the government of Normandy, he returned to his native home, and though living in retirement he was a zealous friend of those to whom he could be serviceable. He died in the year 1459 or 60, and was buried in a chapel of the abbey church of St. Bennet in Norwich; so highly was he venerated, that John Beauchamp, lord of Powyke, appointed by his will a chaunt especially for the soul of sir John Fastolff. Biog. Brit.

FAT, in *Anatomy*. See CELLULAR Substance.

FAT, *Animal*. For the chemical properties of this substance, see the articles OIL, *animal*, and SEBACIC acid. See also ADEPS.

The way of preparing fat for medicinal purposes is to take out the skins, veins, fibres, &c. wash it till it becomes unbloody; then melt it by a gentle heat, with a little water, till the water is evaporated; strain, put it into an earthen vessel where it will fix, and preserve it from air.

FAT of Whales. See BLUBBER.

FAT, in *Agriculture*, is a term which is frequently applied to such neat cattle and sheep flock as are ready for the butcher.

FAT, in *Rural Economy*, is a term which is often applied to the large wooden vessels in which various sorts of liquors are contained, while they undergo the state of preparation, as ale, beer, cyder, &c. It is, however, more frequently written *vat*. See VAT.

And it likewise signifies, with brewers and maltsters, the large wooden vessel which, for expedition, is employed to measure malt, and which contains one quarter, or eight bushels,

bushels, according to statutes 1 Hen. V. cap. 10, and 11 Hen. VI. cap. 8.

It is also applied to a vessel or pan of lead, which is made use of in the preparation of salt. See SALT.

FAT also denotes an uncertain measure of capacity: thus, a fat of singlafs contains from $3\frac{1}{2}$ hundred weight to 4 hundred weight; a fat of unbound books half a maund, or 4 bales; of bristles, 5 hundred weight; of wire, from 20 to 25 hundred weight; and of yarn, from 220 to 221 bundles.

FAT-Hen, in *Rural Economy*, is a term often provincially used to signify the weed called goose-foot.

FATA MORGANA, or the *Castles of the Fairy Morgana*, which is sometimes seen in the Faro of Messina, or straits of Reggio, between the island of Sicily and the coast of Calabria. The origin of this appellation is doubtful, or rather unknown; yet some authors are pleased to derive it from *μελας*, melancholy, and *γνώσις*, inducing exhilaration; alluding to the pleasure which its appearance gives to the spectators; for whoever has been an eye-witness of this phenomenon, expresses himself as having been highly delighted by it.

This phenomenon has been noticed and described by various authors; viz. Kircher, Angelucci, Scotus, Giardina, Gallo, Leanti, Minasi, Brydone, Swinburne, and others; but of all these authors, Fr. Antonio Minasi, who had thrice been spectator of this remarkable appearance, seems to describe it in a more explicit manner. His dissertation on the subject was published at Rome in the year 1793.

The north-east angle of the island of Sicily comes very near the southern extremity of the kingdom of Naples. The channel between these coasts is narrow, and confined between two ridges of mountains. In this channel the water is continually agitated, and thrown into ridges and whirlings by the violence of the current, by the particular direction of certain winds, and by the irregular conformation of the coasts. At times it likewise happens that a very dense vapour is accumulated, and condensed over the water of the channel. "When," Minasi says, "the rising sun shines from that point whence its incident ray forms an angle of about 45 degrees on the sea of Reggio, and the bright surface of the water in the bay is not disturbed either by the wind or the current, the spectator being placed on an eminence of the city, with his back to the sun, and his face to the sea; on a sudden there appears in the water, as in a catoptric theatre, various multiplied objects; viz. numberless series of pilasters, arches, castles well delineated, regular columns, lofty towers, superb palaces, with balconies and windows, extended alleys of trees, delightful plains with herds and flocks, armies of men on foot and horseback, and many other strange figures, in their natural colours and proper actions, passing rapidly in succession along the surface of the sea, during the whole of the short period of time while the above-mentioned causes remain.

"But if, in addition to the circumstances before described, the atmosphere be highly impregnated with vapour, and dense exhalations not previously dispersed by the action of the wind or waves, or rarefied by the sun, it then happens that in this vapour, as in a curtain extended along the channel to the height of about four or five and twenty feet, and nearly down to the sea, the observer will behold the scene of the same objects not only reflected from the surface of the sea, but likewise in the air, though not so distinct or well defined as the former objects from the sea.

"Lastly, if the air be slightly hazy and opaque, and at the same time dewy, and adapted to form the iris, then the above-mentioned objects will appear only at the sur-

face of the sea, as in the first case, but all vividly coloured, or fringed with red, green, blue, and other prismatic colours."

These appearances induced this author to distinguish the phenomenon into three species under distinct denominations; viz. calling the apparition on the water by the name of marine morgana; that in the air by the name of aerial morgana; and that which is attended with fringes of colours, the prismatic morgana.

This description of the phenomenon coincides upon the whole with other accounts, so far at least as to the appearance of something extraordinary on the surface of the sea, or in the air, vapour, fog, &c. not much above the surface of the water; but when the minuter particulars are inquired into, then all the accounts differ considerably from each other. In truth, the phenomenon is always different, transient, and surprising; hence it is no wonder that the accounts should be found to differ. The imagination, which readily supplies the imperfect perceptions of the senses, may doubtless influence considerably the correctness of the accounts. The objects which are described as appearing perfect and well defined by some, are said to be extremely indistinct and indefinite by others; yet all seem to coincide in saying that figures of human beings and of other terrestrial objects are exhibited by the fata morgana; thus Leanti says that the sky appears crowded with a variety of beautiful objects, such as palaces, woods, gardens, vessels, and such like, together with figures of human beings, and other animals, that appear to move amongst those fixed objects.

Notwithstanding the disagreement of the accounts with respect to particulars, the appearance of the phenomenon, which has been observed by a vast number of creditable authors, ancient as well as modern, cannot possibly be doubted; hence philosophers have endeavoured to account for it upon the known laws of optics, and of other natural powers; but notwithstanding their exertions, a thorough explanation of the appearance still remains a desideratum. In his attempts to explain this phenomenon, Minasi first describes the city of Reggio on the coast of Calabria, opposite to Messina, together with the adjacent parts, and then endeavours to prove that all the objects which are seen in the fata morgana are the representations of those objects which stand on the coast. He says, "that the sea in the straits of Messina has the appearance of a large inclined speculum; that in the alternate current or tide which flows and returns in the straits for six hours each way, and is constantly attended by an opposite current along the shore to the medium distance of about a mile and a half, there are many eddies and irregularities at the time of its change of direction; and that the morgana usually appears at this period."

After various other considerations he at last accounts for the appearances, by the supposed inclination of the surface of the sea, and its sub-division into different plains by the contrary eddies. He explains the aerial morgana by referring it to the reflective and refractive powers of effluvia suspended in the air.

Mr. Brydone, in his tour through Sicily and Malta, speaking of the attempts that have been made for explaining the phenomena of the fata morgana, says, "they think it may be owing to some uncommon refraction or reflection of the rays, from the water of the straits; which, as it is at that time carried about in a variety of eddies, and vortexes, must of consequence, say they, make a variety of appearances on any medium where it is reflected. This, I think, is nonsense; or at least very near it. I suspect it is something in the nature of our aurora borealis; and, like many of the great phenomena of nature, depends upon electrical causes;

which, in future ages, I have little doubt will be found to be as powerful an agent in regulating the universe, as gravity is in this age, or as the subtle fluid was in the last."

We shall lally present our readers with a statement of the conjectures which Mr. Nicholson was enabled to derive from an examination of the accounts, observations, &c. "It seems," he says, "that, by the situation of the Faro of Messina, the current from the south, at the expiration of which this phenomenon is most likely to appear, is so far impeded by the figure of the land, that a considerable portion of the water returns along shore. 2. That it is probable the same coasts may have a tendency to modify the lower portion of the air in a similar manner, during the southern breeze; or, in other words, that a sort of basin is formed by the land, in which the lower air is more disposed to become motionless and calm than elsewhere. 3. That the morgana marina presents inverted images below the real objects, which are multiplied laterally, as well as vertically; and that there are repetitions of the same multiplied objects at more considerable vertical intervals. 4. That the aerial morgana is not inverted, but, as I am disposed to conjecture, is more elevated than the original objects. 5. That the fringes of prismatic colours are produced in falling vapours, similar to many appearances which have been described by authors, but not accurately explained by the general principles of refraction through spheres of water. The ship is referred to by Minasi as an object surrounded by these fringes, whence it appears that the colours apply to the direct rays from objects, as well as to those of the marine morgana. 6. The various other objects in the description afford matter for question and conjecture; but none perhaps which it may be proper to enlarge upon, until the theory be better known. 7. It seems, at all events, more probable that these appearances are produced by a calm sea, on one or more strata of super-incumbent air, differing in refractive, and consequently reflective power, than from any considerable change in the surface of the water, with the laws of which we are much better acquainted than with those of the atmosphere. 8. By attentive reflection upon the facts and reasonings in Mr. Huddart's paper, (Phil. Trans. for 1797,) we may form a theory to account for the erect and inverted images: the polished surface of the sea may perhaps account for the vertical repetition; but for the lateral multiplication we must have recourse to reflecting or refracting planes in the vapour, which appear nearly as difficult to deduce or establish, as those which have been supposed on the water." Phil. Journal for August, 1797.

FATAGAR, in *Geography*, a country of Africa, situated to the south-east of Abyssinia; about N. lat. 9°. E. long. 39°.

FATATINDA, a town of Africa, in the country of Woolly, on the river Gambia, about 500 miles from its mouth, where the English had a factory, but were compelled to abandon it in the year 1734, by the conduct of the king of Tomani; 15 miles S. of Medina. N. lat. 15° 20'. W. long. 13° 8'.

FATE, FATUM, in a general sense, denotes an inevitable necessity depending on some superior cause.

Fate is a term much used among the ancient philosophers. It is formed *a fando, from speaking*, and primarily implies the same with *effatum, viz.* a word or decree pronounced by God; or a fixed sentence, whereby the Deity has prescribed the order of things, and allotted every person what shall befall him.

The Greeks call it *μιασμα*, *quasi εμψ*, *nexus, a chain, or necessary series of things indissolubly linked together.*

All things, says Plato, are in fate; *i. e.* within its sphere or scheme, but all things are not fated; and he thus explains the distinction: it is not in fate, says he, that one man shall *do so and so*, and another *suffer so and so*, for that would be destructive of our free agency and liberty; but if any one should choose such a life, and do such or such things, then it is in fate that such things and such consequences shall ensue upon it. The soul, therefore, is *αδеспотος*, free and uncontrolled, and it lies within itself to act or not; and there is no compulsion or necessity here; but what follows upon the action shall be accomplished, *καθ' εμαρτησιν*, according to fate, or the constitution of things; *e. gr.* that Paris should bear off Helen by force was something dependent on himself; but that a war should ensue is the consequence. Ex. Alcinoos de Platon. Dogmat.

The same philosopher, as cited by Hierocles, observes to this purpose: the choice of action is in our own power; but the just award or retribution of good or ill which ensues upon the choice, lies in the breast of those ethereal judges who are appointed under God.

But beside this sense of the word wherein it is used, sometimes to denote the connection of causes in nature, and sometimes in the divine appointment, the word fate has a farther intention, being used to express a certain necessity or external designation of things, whereby all agents, both necessary and voluntary, are swayed and directed to their ends. See NECESSITY.

Some authors divide fate into *astrological* and *stoical*.

FATE, *Astrological*, denotes a necessity of things and events, arising, as is supposed, from the influence and positions of the heavenly bodies, which give law both to the elements and mixed bodies, and to the wills of men.

In which sense the word is often used by Manilius, "Certum est & inevitabile fatum: materisque datum est cogi, sed cogere stellis."

FATE, *Stoical*, or *fatality*, is defined by Cicero an order or series of causes, wherein cause being linked to cause, each produces the other; and thus all things flow from one prime cause. Chrysippus defines it a natural invariable succession of all things *ab eterno*, each involving the other. The Stoic idea of providence is, not that of an infinitely wise and good being, wholly independent of matter, freely directing and governing all things, but that of a necessary chain of causes and effects, arising from the action of a power, which is itself a part of the machine regulated by it, and which, equally with that machine, is subject to the immutable law of necessity. Hence, it appears, that providence, in the Stoic creed, is only another name for absolute necessity or fate, to which God and matter, or the universe which consists of both, is immutably subject.

Thus the poet: the Parent of all things made laws at the beginning, by which he not only binds other things but himself. So Seneca: "Eadem necessitas & deos alligat. Irrevocabilis divina pariter & humana cursus vehit. Ipse ille omnium conditor & rector scripsit quidem fata, sed sequitur: semel scripsit, semper parat." (See STOICS.) The doctrine of the Stoics concerning fate, was strenuously opposed by Carneades. See CARNEADES.

The eternal series of causes mentioned by the Stoics the poets call *Μοιρα* and *Parca*, or *Destinies*.

Fate is divided by some later authors into *physical* and *divine*.

FATE, *Physical*, is an order and series of natural causes appropriated to their effects.

This series is necessary, and the necessity is natural. The principle

principle or foundation of this fate is nature, or the power and manner of acting which God originally gave to the several bodies, elements, mixts, &c. By this fate it is that fire warms, bodies communicate motion to each other, the sun and moon occasion the tides, &c. and the effects of this fate are all the events and phenomena in the universe, except such as arise from the human will. See NATURE.

FATE, *Divine*, is what we more usually call *Providence*. Plato in his *Phædo* includes both these in one definition, as intimating, that they were one and the same thing, actively and passively considered. Thus, "Fatum est ratio quædam divina, lexque naturæ comes, quæ transiri nequeat, quippe a causâ pendens, quæ superior sit quibusvis impedimentis." Though that of Boethius seems the clearer and more just, "Fatum," says he, "est inhærens rebus mobilibus dispositio, per quam Providentia suis quæque necit ordinibus."

FATESH, in *Geography*, a town of Russia, and district of the government of Kusk; on a rivulet falling into the Svopa.

FATHER, PATER, a term of relation, denoting a person who begot a child, either male or female.

Among the ancient Romans the fathers of three children had very considerable privileges allowed them as such. By the law of Romulus a father had an absolute and unlimited power over his children. Amongst the Lacedæmonians, as we learn from Aristotle's *Politics*, the father of three children was excused from the duty of mounting guard for the security of the city; and a father of four children was exempted from every public burden. Concerning the duties and claims of fathers and mothers; see PARENT.

FATHER, *Adoptive*, is he who takes the children of some other and acknowledges them as his own. See ADOPTION.

FATHER, *Putative*, is he who is only the reputed or supposed father. Joseph was putative father of our Saviour.

FATHER, *Natural*, is he who has illegitimate children.

FATHER-in-LAW, is a person married to a woman who has children by a former husband, &c. to which children he is said to be a father-in-law,

FATHER is also used in *Theology* for the first Person in the Trinity.

FATHER is also used in a figurative sense on divers moral and spiritual occasions. Thus, it is applied to the patriarchs; as we say Adam was the father of all mankind, Abraham the father of the faithful, &c.

FATHERS, *Apostolical*. See APOSTOLICAL.

FATHERS, in an *Ecclesiastical Sense*, denote the ancient prelates and doctors of the church.

The fathers assembled at the council of Nice: Chrysostom, St. Basil, &c. were Greek fathers, and St. Augustine, St. Ambrose, &c. were Latin fathers.

The appellation of fathers is usually confined to the theological writers of the first six centuries.

Learned men have differed in their opinion concerning the degree of esteem that is due to the ancient fathers, more especially as moral writers. Whilst some represent them as the most excellent guides in the paths of piety and virtue: others place them in the very lowest rank of moralists, considering them as the very worst of all instructors, and treat their precepts and decisions as perfectly insipid, and, in many respects, pernicious. Although we allow that in the writings of the primitive fathers there are several sublime sentiments, judicious thoughts, and many things that are naturally adapted to form a religious temper and virtuous character; yet it must be confessed that they abound still more

with precepts of an unreasonable and excessive austerly, with stoical and academical dictates, vague and indeterminate notions, and, what is still worse, with decisions that are absolutely false, and in evident opposition to the precepts of Christ. In later ages, and particularly towards the close of the eighth century, the labours and industry of divines were totally employed in collecting the opinions and authorities of the fathers, *i. e.* the theological writers of the first six centuries; and so blind and servile was their veneration for these doctors, that they regarded their dictates as infallible, and their writings as the boundaries of truth, beyond which reason was not permitted to extend its researches. The Irish, or Hibernians, who in the eighth century were known by the name of Scots, were the only divines who refused to dishonour their reason by submitting it implicitly to the dictates of authority. Naturally subtle and sagacious, they applied their philosophy, such as it was, to the illustration of the truth and doctrines of religion: a method which was almost generally abhorred and exploded in all other nations. It is much to be lamented, that the fathers of the Christian church soon departed from the simplicity of the apostolic age, and corrupted the purity of the Christian faith. This is chiefly to be ascribed to the two following causes; *viz.* first, the practice which at that time so generally prevailed of clothing the doctrines of religion in an allegorical dress; and, secondly, the habit of subtle speculation, which the more learned converts from Paganism brought with them from the schools of philosophy. The practice of allegorical interpretation prevailed in a very great degree among the Gentile converts, who had been educated in the Alexandrian schools, and among those Jewish Christians who, by the same help of allegory, had been instructed in the Cabbalistic doctrines, which before this time had sprung up in Egypt, and passed thence into Judæa. Several of those sects of Christians, who were called Heretics, particularly the Valentinian Gnostics, made use of allegorical language to disguise the unnatural alliance which they had introduced between the fanciful dogmas of the Oriental philosophy, and the simple doctrine of Christ. The orthodox fathers of the church, too, defended themselves with the same armour both against heretics and infidels; applying with more ingenuity than judgment the symbolical method of interpretation to the sacred scriptures. In the same manner in which Philo and other Alexandrian Jews had corrupted the Jewish church, Clemens Alexandrianus, Origen, and other disciples of the Alexandrian school, in the second century, introduced error and corruption into the church of Christ. Among the Christian fathers, who had abandoned Paganism on account of its inferiority to the doctrine of Christianity, there were not wanting advocates for different sects of Grecian philosophy. When Origen and his followers, together with many others, favoured the Eclectic method of philosophizing, which had been followed in the Alexandrian schools, they easily persuaded themselves, that as a coalition had been effected in these schools, between Plato and Aristotle, it would not be difficult to accomplish a similar coalition between Jesus Christ and Aristotle. Others reasoned in the same manner with respect to the doctrines of the Stoics. The Epicurean was almost the only sect which met with no patrons among the Christian fathers. But the sect which obtained most favour in the Christian school was the Platonic. See PLATONIC.

It should be readily acknowledged, that the early teachers of the Christian church were honest and zealous advocates for the cause of Christ; and that many of their apologies discover an extensive acquaintance with ancient philosophy and learning, and serve to cast much light upon the philosophical

sophical and theological history of preceding times. But it must, at the same time, be candidly confessed, that in the heat of controversy they not only fell into various mistakes, but made use of unsatisfactory methods of reasoning, which betray imbecility of judgment, or inattention to the principles and rules of good writing. The works of the fathers, instead of being distinguished by correctness and strength of argument, furnish innumerable examples of feeble reasoning, of interpretations of scripture irreconcilable with good sense, and of a careless admission of spurious writings, as genuine authority. This charge might be easily substantiated against Irenæus, Lactantius, Arnobius, Jerom, and others. For their defects in sound argumentation we may assign several reasons. Their injudicious zeal induced them to grasp at every shadow of argument against their opponents; and their want of skill in the art of reasoning led them often to mistake shadows for realities. Their fondness for allegory dazzled and confounded their understandings, so that they were unable to distinguish between fanciful resemblances and solid arguments. They had not learned to distinguish accurately between the light of revelation and that of reason, and therefore supposed that their reverence for the former obliged them to depreciate and vilify the latter. Ambrose, a learned man, but a bad logician, advised that in disputes where faith is concerned reason should be laid aside. Basil called reasoning the devil's work. Others who admitted the carefulness of using the weapons of Aristotelian logic in defence of Christianity, contended that Christians were possessed of a better logic, consisting in the demonstration of the spirit, and that they who possessed this might defend their cause without the arms of human reason. It might be alleged, as another proof of their want of judgment, that they gave easy credit to false tales, and received, without due examination, supposititious writings, which they obtruded upon others, and to which they referred as sufficient authorities. Nor is it possible to exculpate them from the charge of having made use of, and even justified, dishonest acts and pious frauds, after the example of their adversaries. Besides, the style in which their works are written is, for the most part, tumid and puerile; and in search of the dazzling ornaments of false eloquence, they soon lost themselves in the clouds of obscurity.

Among the causes which promoted the corruption of their moral doctrine, we may reckon the practice which they borrowed from the Alexandrian Jews, of affixing an allegorical meaning to the words of scripture. Indeed it could not be expected that they should succeed better in their interpretation of the sacred writings, when they undertook to deduce moral doctrines from them without strictly adhering to the rules of sound criticism, and without being accurately acquainted with the general principles of morals. Another principal cause of the corruption of the Christian doctrine of morality was, that it was very early tinged with the enthusiastic spirit of the Alexandrian philosophy. To this source we are to trace back the numerous adulterations of the simple morality of the New Testament, which are to be found in the "Shepherd of Hermas," and in the writings of Justin Martyr, Irenæus, Athenagoras, and Tertullian. Upon the whole we may observe, that the Christian fathers contributed little towards the improvement of true and sound philosophy. Through several centuries they partook of the spirit of the Alexandrian school, and the Eclectic method of philosophising platonised Christianity. And when, in process of time, the philosophers themselves began to forsake Plato and follow Aristotle, the Christian fathers preferred the Stagyrte as the more accurate philosopher. In this preference they were confirmed by the example

of the Saracens; and hence arose that pernicious corruption, both of theology and philosophy, the "Scholastic system." At the same time, the adulterated Platonism of Alexandria continued among the Greek Christians, and produced the "Mystic Theology."

The Christian fathers, from the beginning of the second to the seventh century, may be divided into two classes: those who flourished before, and those who flourished after, the institution of the Eclectic sect. The first class commences with Justin Martyr; the second with Origen. The apostolic fathers, who had derived their knowledge of Christianity, and their habits of thinking, from the apostles and evangelists, manifest, in their genuine writings, few traces of the Grecian or Alexandrian philosophy. But, when men who had been educated in the Pagan schools became converts to the Christian faith, they brought with them their philosophical ideas and language, and associated them with the doctrine of Christianity. Among these Christian philosophers, the first, and most celebrated, was Justin Martyr, who blended Platonic notions and language with the simple doctrine of Christianity, and wrote concerning God and divine things like a Christian Platonist. Tatian was his disciple; and his apology for Christianity, entitled, "Oratio ad Græcos," every where breathes the spirit of the Oriental philosophy, and the whole tenor of it concurs with his history to prove, that he was a Platonic Christian. We may also rank among the Platonising fathers Theophilus of Antioch, Athenagoras, Irenæus, Tertullian, and Clemens Alexandrinus. To these we may add, among those who flourished after the establishment of the Eclectic system, Origen, Anatolius of Alexandria, Arnobius, Eusebius Pamphilus, Didymus of Alexandria, Augustine, Synesius, an African bishop, and others, who chiefly flourished in the eastern countries. In the western world appeared Claudianus Mamertius, Boethius, Æneas Gaza, Zacharias, Philoponus, and Nemesius. See Brucker's Hist. of Phil. by Enfield, vol. ii.

FATHER is also a title of honour given to prelates and dignitaries of the church. The right reverend father in God, lord Bishop of, &c. "Ab curæ similitudine patres appellantur."

FATHER is also applied to the superiors of convents, &c. (See ABBOT.) The father-general; father-provincial, ex-provincial; father prior, sub-prior; father definitor, in the order of Benedictines; father guardian, in that of the Franciscans; father corrector, among the Minims, &c.

FATHERS is also applied plurally to all congregations of ecclesiastics, whether regular or secular; as the fathers Cordeliers, Capuchins, Augustins, Jacobins, &c. The fathers Jesuits, fathers of the Oratory, Barnabites, Theatins of the Mission, &c. See each under the proper article.

FATHERS of the Christian Doctrine is a denomination belonging to two religious orders: one instituted in France by Cæsar de Bus, and confirmed in 1597 by Clement VIII. and another in Italy founded by Cusani, a Milanese knight, and established by the authority of Pius V. and Gregory XIII.

FATHERS of Somafgus, or regular clerks of St. Maieul, is the appellation of a religious order deduced from the name of the place where their founder resided. It was first formed into a distinct society by Jerome Emiliani, a noble Venetian, and confirmed by Paul III. and Pius IV. in 1540 and 1563. Their office was the instruction of the young and ignorant, and the relief of orphans.

FATHERS is also used for persons venerable for their age or quality, or the services they have done the public.

Thus,

Thus, at Rome the senators were called *conscript fathers*, *patres conscripti*, &c.

FATHER *Lasher*, in *Ichthyology*, an English name given to a fish, called by some authors, though improperly, *scorpena*, and *scorpius marinus*. It is properly of the cottus kind. See *COTTUS Scorpius*.

FATHIMITES, or FATHIMITES, the descendants of Mahomet by Fathima, or Fathema his daughter.

The dynasty of Fathimites, *i. e.* of princes descending in a direct line from Ali and Fathima his wife, Mahomet's daughter, commenced in Africa in the year of the Hegira 296, of Jesus Christ 908.

The Fathimites afterwards conquered Egypt, and established themselves therein in quality of caliphs.

The Fathimites of Egypt ended with Abed, in the year of the Hegira 567, 268 years after their first establishment in Africa, and 28 years after the conquest of Egypt.

FATHOM, in *Rural Economy*, is a long measure, which comprises six feet, being taken from the utmost extent of both arms, when fully stretched out into a right line. It is made use of in the measurements of mines, quarries, wells, and pits.

This measure is chiefly used at sea, or by seafaring people, for expressing depths of the sea, lengths of cables, &c. It is hardly ever used on land, except sometimes by miners.

The length of the fathom formerly differed a little, according as it was used on vessels of greater or less size. Thus in the old edition of Chambers's dictionary, the following explanation is given. "There are three kinds of fathoms accommodated to the different ranks of vessels. The first, which is that of men of war, contains six feet. The middling, or that of merchant ships, five feet and a half; and the small one, used in flays, fly-boats, and other fishing vessels, only five feet."

At present, however, the measure of a fathom is universally considered as being equal to six feet exactly.

FATHOM is also used in several countries, particularly Italy, for the common yard or ell, whereby things are ordinarily measured in commerce.

In this sense it is more commonly called *brace* or *braccio*, *q. d.* arm. In Muscovy the fathom contains seven English feet, and about one-tenth of an inch.

FATHOM-Tale, in *Mining*, is a term for work, let to workmen by the fathom measure in length, as the driving of soughs and levels generally is.

FATHOM is a measure equal to two yards, or six feet in length, in general corresponding with the French toise, whereby the scale of military measures in that country is generally regulated. The French foot being nine lines, or about $\frac{3}{4}$ parts longer than the English, requires, that in estimating the fortifications, and other buildings, &c. of that quarter, we should in general terms make an allowance of about one foot in fifteen and a half, for an excess on their part. Therefore, when we say that the line of defence of a French fortress measures 155 toises French, it will, according to our scale, give full 165 British fathoms, such as are commonly in use throughout our marine. This measure has given rise to a term now perfectly familiar among us, namely, "to fathom the depth of water," &c.; meaning, to ascertain how many fathoms it may measure from the surface to the bottom. We have likewise a derivative expression, whereby the word fathom is applied metaphorically; thus, we say, "there is no fathoming that fellow's thoughts;" meaning, that he is too deep for us to get to the bottom of his designs.

FATHABAD, in *Geography*, a town of Hindoostan, in the soubah of Agra, built in 1041 by Modoud, king of

Ghizni; 15 miles S.S.E. of Agra.—Also, a town of Hindoostan, in the near of Hissar; 57 miles W. of Hissar.

FATIAH, a town of the Arabian Irak, on the Euphrates; 15 miles S.W. of Korna.

FAT'ESS, in *Medicine*. See CORPULENCY.

FATO, in *Geography*, a small island on the east side of the gulf of Bothnia. N. lat. 63 52' E. long. 22 44'.

FATSISIO, an island of Japan, about 80 miles from the south coast of the isle of Nippon, whether the emperor banishes the grandees who have offended him, to be employed in making silk stuffs embroidered with gold. The island is barren, and almost inaccessible. N. lat. 33 40'. E. long. 140 10'.

FATTALAGUNGE, a town of Hindoostan, in Oude; 20 miles S.E. of Sumbul.

FATTAPOUR, a town of Hindoostan, in Oude; eight miles W. of Karabad.

FATTECONDA, a town of Africa, in Bornou. N. lat. 14 20'. W. long. 10 20'.

FATTENING, in *Rural Economy*, the art or process of rendering any sort of animal fat, or fit for food. It is a business in which much care and circumspection are requisite, as well as considerable knowledge of the nature of animals.

FATTENING of Cattle, the means of preparing them for the purpose of the butcher. It is a process which is capable of being accomplished in several different methods, but the most usual is that of grazing them in rich feeding pastures. It is likewise effected by keeping them in warm convenient houses, or sheds, and feeding them regularly with oats and other sorts of grain, either ground or in the sheaf; different kinds of roots, as common and Swedish turnips, carrots, parsnips, potatoes, &c. with some sort of dry food; and by the use of oil-cake in the same manner. These modes are termed stall-feeding, from the animals being kept up in the stalls; and there is much advantage in keeping the houses properly dry and warm, and the troughs for the food perfectly clean and sweet. It is also essential that the food should be given them in a regular manner, in suitable proportions, and properly varied, where different sorts are employed. See *STALL-Feeding*.

This applies equally to neat cattle and sheep; but the fattening of early lambs, and of calves, is mostly accomplished by the suckling of them. See *CALF-Suckling*, and *HOUSE-LAMB Suckling*.

FATTENING of Colours, among *Painters*, denotes a coagulation of the oil, which frequently happens on its being mixed with several kinds of pigments; whence, after being kept for some time, it is rendered of so viscid or glutinous a consistence as to be wholly incapable of being worked with either brush or pencil. This also happens sometimes after the colours have been spread or laid on the proper ground: in which case, one part of the oil will run off in small streams or drops, while the other will remain with the colour, without shewing the least tendency to dry. Oils likewise will fatten by long keeping, or by being exposed for a considerable time to the sun and air.

FATTENING of Horses. See *HORSES*.

FATTIK, in *Geography*, a town of Africa, and capital of the kingdom of Joali. N. lat. 14'. E. long. 16 48'.

FATTIKO, a town of Africa, in the kingdom of Jemmarow.

FATTIPOUR, or FATEFOUR, a town of Hindoostan, in the soubah of Agra, anciently called "Sikari," but on being rebuilt by Acbar changed its name. It was once a magnificent city, but is now in a state of decay; 28 miles W. S. W. of Agra. N. lat. 27° 10'. E. long. 78 8.—Also, a town of Hindoostan, in Oude; 35 miles W.S.W.

of Lucknow.—Also, a town of Hindoostan, in the circle of Nagore; 25 miles N.W. of Didwana.—Also, a town of Hindoostan, in Bahar, on the Gunduck; 30 miles N.N.W. of Patna.

FATTY-KAN-DURGA, a town of Hindoostan, in Moultan; 35 miles N.N.W. of Moultan

FATUARI, in *Antiquity*, were persons who, appearing inspired, foretold things to come.

The word is formed of Fatua, wife of the god Faunus, who was supposed to inspire women with the knowledge of futurity, as Faunus himself did the men. Fatua had her name from *fari*, q. d. *vaticinari*, to prophesy.

FATUUS IGNIS See *IGNIS Fatuus*.

FAVAGNANA, or FAVOGNANA, in *Geography*, an island in the Mediterranean, about 7 miles in circumference, near the W. coast of Sicily; anciently called *Egusa*, or *Capraria*. It has good anchorage in a convenient harbour, and some years yields from its fisheries 85,000 livres. N. lat. 38°. E. long. 12° 25'.

FAVALLI, in *Biography*, an Italian singer, with a soprano voice. He seems to have been the first singer of that country and kind who made any impression on French ears. He was so beloved by Louis XIV. for his fine voice, and the pleasure which his style of singing gave that monarch, that he permitted him to shoot in the royal manors, and even in the park at Versailles. He first arrived in France in 1674, and his powers seem to have been miraculous.

FAVANT, LA, in *Geography*, a river of Naples, which runs into the sea, 9 miles S.S.E. of Squillace.

FAVARA, a river of Sicily, which runs into the Mediterranean, about 5 miles S. of Modica.—Also, a town of Africa, in the country of Barca; 30 miles E.S.E. of Derina.—Also, a town of Sicily, in the valley of Noto, on a river of the same name; 10 miles W. of Noto.

FAVAROTA, a town of Sicily, in the valley of Maza; 15 miles W.N.W. of Palermo.

FAVART, CHARLES SIMON, in *Biography*, one of the most agreeable and pleasing lyric French poets of the last century. He was born at Paris in 1710, educated in the Jesuits' college, and gave very early specimens of a happy disposition for French versification. At twenty years of age he composed a poem on the Floral games, and was crowned. Many beautiful stanzas of his writing were already in circulation. Upon the merits of these juvenile pieces he was engaged at the comic opera. "La Chereheux d'Esprit, or Nicette in search of Wit," which had been preceded by many other comic operas, were so favourably received, as to fix his reputation. His "Chereheux d'Esprit" being regarded as a master-piece in its kind, the royal academy of music, or the great opera, claimed his talents, and he produced for that theatre the ballet of "Don Quixot." (See *BALLET*.) In 1744 he married the daughter of a musician in the band of Stanislaus, king of Poland, Juliana de Roncerai, who by a constant success was one of the principal supports of the comic opera. Her talents of different kinds, acting, singing, playing on the harp, and dancing, all by turns, she exhibited with equal grace and perfection. We saw her in the part of Roxalana in the "Three Sultanas," at near 60, act, look, sing, romp and dance (with her *petit nez retroussé*;) with as much seeming vivacity as if she had been only 16. Her various estimable talents and conduct justified the choice of an author as eminent for the delicacy of his taste as the decorum and propriety of his manners. He signalized his zeal on every interesting occasion for his country, and was employed by the court at different festivals, and honoured with the title of master of the revels, with a pension of 1000 livres. "At the peace of 1762 he wrote, by order of the govern-

ment, a piece of one act, for the theatre François, called "L'Anglois a Bourdeaux;" and the celebrated madame D'Angerville, who had quitted the stage, returned to play the principal part. The success of this work was crowned by his being presented to the king, who conferred on him another pension. Men of letters discovered in the "Englishmen at Bourdeaux" the agreeable author of "Nimette a la Cour," and the "Three Sultanas," and regretted that theatrical etiquette forced him to lavish on the Italian stage talents worthy of the French. The connoisseurs have never been so unjust as to attribute to him the works of others, particularly as he has always with scrupulous delicacy informed the public of any assistance he might have received from his intimate friends. He was the first who tried to teach us to listen to Italian music. In adapting it to French words, Philider assisted him, and they succeeded. The purity and elegance of his style, with the gaiety of his sentiments, are the principal characteristics of this amiable author." Laborde.

FAUCHET, CLAUDE, was born at Paris about the year 1529. He was made president of the "Cour des Monnoies," an office which he was obliged to sell to pay his debts. From Henry IV. he obtained a pension, with the title of historiographer. He was an able antiquarian, and well versed in all books relating to the subject, making himself some important additions to the stock. He died in 1601, leaving behind him (1) "Antiquités Gauloise et Françoises," in two parts: the first brings down the history of Gaul to the arrival of the Franks: the second from Pharamond to Hugh Capet. (2) "A Treatise on the Liberties of the Gallican Church." (3) "A Treatise on the Origin of Knights, Coats of Arms, and Heraldry." (4) "Origina of the Dignities and Magistrates of France." His works were collected and published in 4to. at Paris in 1610. Moreri.

FAUCIGNY, or FAUSSIGNY, *Darony of*, in *Geography*, a province of Savoy, bounded on the N. by the territory of Chablais, on the E. by the Valais, and the duchy of Aosta, and on the S. and W. by the Genevois. Wood and pasture form the principal riches of this country. It is divided into Upper and Lower; the chief towns of the former are Salauche, Samoens, Tainage, and Plumet, and those of the latter are Cluse, Bonne, and Bonne Ville. This province now belongs to France, and constitutes part of the department of the Leman.

FAUCOGNEY, a town of France, in the department of the Upper Saone, and chief place of a canton in the district of Lure; 9 miles N. of Lure. The place contains 983 and the canton 10,205 inhabitants, on a territory of 200 kilometres and in 17 communes.

FAUCON, or FALCON, in *Gunnery*, a name formerly given to a small piece of cannon, whose diameter was $2\frac{3}{4}$ inches; weight, 750 pounds; length, 7 feet; load, $2\frac{1}{2}$ pound; shot, $2\frac{1}{2}$ inches diameter; and $2\frac{1}{2}$ pounds weight. See *CANNON*.

FAUCONCOURT, in *Geography*, a town of France, in the department of the Vosges; 4 miles N.W. of Ramberviller.

FAUCONET, or FALCONET, in *Gunnery*, a very small piece of ordnance, whose diameter at the bore was $2\frac{1}{4}$ inches; weight, 400 pounds; length, 6 feet; load, $1\frac{1}{2}$ pound; shot, something more than two inches diameter; and $1\frac{1}{4}$ pound weight. See *ORDNANCE* and *GUN*.

FAUD, in *Agriculture*, a provincial term employed in some places to signify a truss of short-straw, or as much as the arms are capable of folding.

FAVELONE,

FAVELONE, in *Geography*, a river of Naples, which runs into the sea, 4 miles from Squillace.

FAVENTIA, in *Ancient Geography*, a town in the S.E. part of Gallia Cispadana. See FAENZA.

FAVERGES, in *Geography*, a town of France, in the department of Mont Blanc, and chief place of a canton in the district of Annecy. The place contains 2,156, and the canton 12,143 inhabitants, on a territory of 240 kilometres, and in 16 communes.

FAVERNEY, a town of France, in the department of the Upper Saone; 7 miles N. of Vesoul. N. lat. 47° 46'. E. long. 6° 11'.

FAVEROLLE, a town of France, in the department of the Marne; 12 miles W. of Rheims.

FAVEROLLES, a town of France, in the department of the Cote d'Or; 12 miles E. of Chatillon-sur-Seine.

FAVERSHAM, a market town in the hundred of the same name, and county of Kent, England, is situated on a navigable arm of the river Swale, and consists principally of four streets, forming an irregular cross, in the centre of which is the Guildhall and market place. Though a borough by prescription as well as charter, it does not appear ever to have been summoned to return members to parliament; it has, however, been the place of meeting of a Witanagemot, or Council of the Wise Men, assembled by king Athelstan, about the year 930, "to enact laws, and constitute methods for the future observance of them." At that time, and long before, the town formed part of the royal demesnes; and from the high value of the market and appendages, as stated in the Domesday record, it appears to have been then a place of considerable resort and traffic. In 1147, king Stephen founded an abbey here for Cluniac monks, to whom he granted large endowments and privileges, which were confirmed by successive sovereigns: the abbots sat in twelve parliaments, in the reigns of Edward I. and II.; and the abbey possessed the right of sanctuary, which appears to have been attached even to the parish church, from the time of the dissolution till the reformation. The surrender of the abbey estates was strenuously opposed by the abbot and monks; but resistance being vain, the deed was signed July 8, 1538; the gross revenues of the abbey at that time were stated to be 355*l.* 12*s.* 2*d.* annually; the nett income 86*l.* 12*s.* 6½*d.* The buildings were extensive and numerous, but most of them have been long destroyed; the two entrance gateways remained till the middle of the last century, when they were taken down on account of their ruinous state.

Faversham has been an appendage to the port of Dover from a very remote period; its customary proportion of aid was one ship for forty days annually. At the siege of Calais, however, in the time of Edward III., this town furnished two ships and fifty-three mariners. This connection with the Cinque Ports may probably account for the distinguished privileges and charters (scarcely to be equalled by any town in the kingdom) which Faversham has immemorially been favoured with by different sovereigns. The charter under which it is still governed was granted by Henry VIII., A. D. 1545; the jurisdiction is thereby vested in a mayor, twelve jurats, (the mayor being one,) twenty-four commoners, a steward or recorder, a town clerk, and two chamberlains.

"Faversham," says Leland in his Itinerary, "is included yn one parochie, but that ys very large. Ther cummeth a creeke to the towne that bareth vessels of xx tunnes; and a myle fro thens north-east, is a great key, cawled Thorn, to discharge bigge vessels. The creeke is ledde with bakke

water, that cummeth fro Ospring." In the survey of maritime places in Kent, made in the reign of Elizabeth, this town is stated as having 380 inhabited houses; 18 ships or vessels, from five to forty-five tons burthen; and 50 persons occupied in merchandize and fishing. The quay, called the Thorn, mentioned by Leland, has long been out of use; but its place has been supplied by three new quays or wharfs, formed close to the town, where all the shipping belonging to the port take in and discharge their cargoes. Since Leland's time great improvements have taken place in the navigation of the creek; and vessels of eighty and an hundred tons burthen can now come up to the town at common tides; whilst, at spring tides, the channel is deep enough for ships drawing eight feet water; the corporation are invested with the management of the navigation, the expence being defrayed by port-dues of very ancient establishment. Upwards of 40,000 quarters of corn are annually shipped here for the London markets; hops, fruit, wool, oylers, &c. are also sent in considerable quantities from this port, to which above thirty coasting vessels (exclusive of fishing smacks) belong, of from 40 to 150 tons burthen; the imports are principally coals and fir timber, iron, tar, &c. from Sweden and Norway. A branch both of the excise and of the customs is established here; the former under the direction of a collector, surveyor, and other officers; the latter under a supervisor and assistants. The oyster fishery of Faversham is a very extensive concern, and forms the principal source of its trade, affording support to upwards of an hundred families. Here, as at Milton and Rochester, the native broods fall very short of the consumption; and vast quantities of spat or eggs are annually collected from different parts of the surrounding seas, even as distant as the Land's End in Cornwall, and the coasts of Scotland and France, and placed in the beds belonging to this fishery, there to increase and fatten.

The company of the "free-fishermen and free-dredgers of the hundred and manor of Faversham" are under the immediate protection and jurisdiction of the lord of the manor, as tenants thereof; and he appoints a steward to hold two annual courts, called admiralty, or water, courts, for the necessary regulations of the fishery. No person is admitted as a free dredger unless he has served an apprenticeship of seven years to a freeman, and is married. The right of the fishery was anciently an appurtenance to the manor of Milton, but was separated from it by king John, and granted, with the property of the grounds, to Faversham abbey; in that grant the company of free-dredgers of Faversham is first mentioned, but it is generally supposed to have existed from time immemorial. Before the war, Faversham oysters, to the amount of between 30,000 and 40,000*l.* were annually exported to Holland. The only manufacture carried on in the vicinity of Faversham is that of gun-powder, which is under the superintendance of a branch of the ordnance established here, the principal officers of which are a storekeeper, a clerk of the cheque, and a master fireworker, who all have respectable houses. The various mills, storerooms, &c. are chiefly situated on the stream that flows from Ospringe, and forms several small islands in its course to the Faversham creek. This manufacture is supposed to have been established here prior to the reign of Elizabeth; but it was a private concern, and continued till about the year 1760, when the respective works were purchased by government, and soon afterwards were rebuilt in a more substantial and safe manner. Not all the care that can be excited is, however, sufficient to prevent accidents by the occasional ignition of the powder. The most dreadful explosion that has occurred took place

in April 1781, when the corning-mill and dusting-house were destroyed by the blowing up of about 7000 pounds of powder, which so impregnated the air with sulphur, for many miles round, as greatly to affect respiration. The quantity of powder annually manufactured here is computed at between 12 and 13,000 barrels: the persons employed are nearly 400.

The church of Faversham is a spacious and handsome edifice, built of flint, in the form of a cross, and coigned with stone. It consists principally of a nave, with aisles, chancel, and transept, with a light tower at the west end, ornamented with pinnacles, and terminated by an octagonal spire, 73 feet high. On the north side of the church-yard is a free grammar-school, founded in the 18th year of queen Elizabeth, and endowed with certain lands then in the possession of the crown, but which had been given in the 18th of Henry VIII. to the abbey of Faversham, by Dr. Cole, a Kentishman, warden of All Souls' college in Oxford, for the "maintenance of a school, wherein the novices of the abbey were to be instructed in grammar."

The town has been greatly improved within the last 40 years; in 1773 a spacious avenue was formed, by which it was laid open to the high London road. The contiguous roads have since been rendered more commodious. The streets also have been new paved and lighted, under an act of parliament obtained in 1780. Faversham is situated 48 miles distant from London: has two annual fairs, and two markets, well supplied with all kinds of provisions, on Wednesdays and Saturdays; and was returned under the act of parliament in 1801 as containing 570 houses, inhabited by 3364 persons.

Among the eminent natives of this town, several were surnamed de Faversham: of these Hano de Faversham was a learned Franciscan friar, who became provincial of his order, and died in Italy, at an advanced age, in the year 1244; and Simoa de Faversham was chancellor of the university of Oxford about 1304. The celebrated musician, Dr. John Wilson, was also born in this town, in 1595. Haisted's History of Kent.

FAUFEL, in *Botany*, Clus. Exot. 187. See ARECA, sp. 1.

FAUGELAI, in *Geography*, a town of Egypt, on the right bank of the Nile.

FAUGH, in *Agriculture*, a term used provincially to signify a fallow, or land lying in the state of tillage without being cropped. It likewise implies land which is repeatedly ploughed over without any intervening crops. It is mostly made use of in the more northern parts of the island, and frequently written *fauf*.

FAUGHAN, or FAHAN, in *Geography*, a river of the county of Londonderry, Ireland, which rises in the mountains separating that county from Tyrone, and winding to the west receives a considerable addition from the Glenrandle river near Clady. It afterwards takes a north-eastern direction, and being navigable for small craft scarcely one mile, runs into Lough Foyle, not far from the place where the river Foyle also runs into it. Sampson's Londonderry.

FAVIDA, an island in the gulf of Georgia, discovered by the Spaniards in the year 1791, near the W. coast of North America, from which it is separated by a channel, called "Canal del Nuestra Signora del Rosario," 30 miles in length from N.W. to S.E. and from 2 to 5 in breadth. The N.W. point is named Point Marshal, and the S.E. point, Point Upwood.

FAVILLÆ SALIS, in *Natural History*, a name given by Vitruvius, and some of the more ancient writers, to the nitrum or nitre of the ancients. Our chemical writers, who have been used to delight much in hard names, have applied

the same phrase to express our nitre; but this is a very different salt from the other.

FAVISSA, among *Antiquaries*, a hole, pit, or vault, under ground, wherein is kept something of great value.

The word seems formed of *fovissa*, a diminutive of *fovea*, a pit or ditch.

The favissa, according to A. Gellius and Varro, was much the same with what the ancient Greeks and Romans called *θησαυρος*, *thesaurus*, and what in some of the modern churches is called *archives* and *treasury*. In the Capitol there were divers favissæ. They were subterraneous places, walled and vaulted, having no entrance or light but by a hole at the top, which was usually stopped up with a huge stone.

They were chiefly destined for keeping the old worn statues and other ancient moveables formerly used in the temple; so religiously did that people respect and preserve whatever was consecrated. Catullus would have lowered the floor of the Capitol, but that the favissæ prevented him.

Fellus, however, gives us a different account of the favissæ. According to that author they were wells or pits of water near the temples, and for the use thereof, the same with what the Greeks called *ομφαλιος*, *omphalos*, as being round, &c. Gellius likewise gives them the name of cisterns, as well as Fellus; but it is apparently for no other reason than that they bore a resemblance to them in figure.

In effect, the two notions are pretty easily reconciled; it being certain that the treasuries of some of the ancient Greek temples were the cisterns or reservoirs of water wherein people used to wash themselves before they entered the temple.

FAULBACH, in *Geography*, a town of Germany, in the county of Wertheim; 3 miles W. of Wertheim.

FAULQUEMONT, a town of France, in the department of the Moselle, and chief place of a canton in the district of Metz, near the river Nied; 16 miles E. of Metz. N. lat. 49° 3'. E. long. 6 40'. The place contains 1,050, and the canton 13,555 inhabitants, on a territory of 250 kilometres and in 55 communes.

FAULT, in *Mining* and *Geology*, is a term pretty generally used for the fissures which are found dividing the measures or strata of the earth, which form one of the most curious and important facts that the crust or surface of the earth presents. The great prevalence of faults, and the important interruption which they sometimes give to mining, have occasioned them to be noticed by the practical miners of every district; and, as is too often the case, they have received from them a great number of different names, in different districts, or according to the mode in which they appear to affect the vein or seam which they are working. In the course of our reading or practice we have met with all the following names for faults; viz.

Break	Gash	Ridge
Breast	Gaw	Rut
Cleft	Gulph	Rise-dyke
Crack	Hitch	Shake
Depression	Horfe	Shift
Dip-dyke	Jump	Slip
Down-cast	Knot	Trap-down
Down-leap	Leap-up	Trap-up
Down-trap	Leap-down	Trouble
Dyke	Let-down	Up-cast
Fall	Load	Up-leap
Fault	Lum	Up-trap
Fissure	Mare	Vein
Flooding	Mear	Wam

and probably others! Doubtless there are some which we never heard or met with. The above list strongly shews the necessity for a reform in the language of mining. That faults are real breaks or mechanical fractures of the strata, no one who has ever seen and examined one can possibly doubt; and since the worn state of their surfaces, or of the edges of the strata which they separate, has been attended to, there cannot remain a doubt but most of them have had a sliding motion, or formed the vertical junction between two masses of strata which often slid or ground forcibly against each other, as Mr. Farey has observed, and which gave the first rise to a new theory on this and many other points in geology. (Philosophical Magazine, vol. xxx. p. 258.) The direction of faults seldom differs greatly from a perpendicular to the planes of the strata, which they intersect, although they are sometimes much inclined to the perpendicular to the horizon. They generally proceed in straight lines, or nearly, until they intersect into other faults, which they never fail to do. The quantity of the sink, or rise, on one side, compared with the other, is seldom the same for any great length of the same fault, but it decreases one way, until the measures on the two sides will at a certain place be found to match; and it is believed, that in some places, where the fault continues forward, that the same is reversed, and the side which before had the measures the highest, now has them the lowest, and increasingly so. On the contrary, if a fault be pursued in the direction in which it increases the derangement of the measures, a point will be found, where it either terminates by intersecting into another, or crosses fault, or should it continue its first direction, in which it will begin to decrease, and perhaps continue to do so until the measures cease to have any derangement in their levels, but are merely separated by a fissure; and where, if a cross fault occurs, the same may be said to terminate, and actually does so, against the solid face of the measures on the opposite side of the cross fault in some instances. It is believed by some, that the principal faults generally take the same direction as the strata, or natural joints, by which the rock is divided into blocks, in which case they are said by the quarrymen or miners to agree with the face of their work. In mineral districts it is certain that the faults are much influenced in their directions by the mineral veins, which are of older formation, and that the principal ones follow the veins, dividing the matters they contain into two parts, and when the fracture has happened through the rib of ore, the same is in a very curious manner polished, as Mr. Whitehurst observes, under the name of *slicker-fides*, which see. This preference of the faults for the mineral veins has occasioned most of the cliffs or facades in the denuded mineral districts of Derbyshire and Staffordshire to happen at the side or skirt of the vein; and in some instances considerable veins of ore have been worked at the foot of such cliffs, as at Middle-peak, Runtor and Yoke-cliff veins near Wirksworth. It seems surprising, that circumstances so extraordinary and important as attend the faults should have engaged so little of the attention of the writers on mining and geology as we find by their works. Mr. William Martin, though in most respects a very accurate observer, in his recent work, "Outlines of the Knowledge of Extraneous Fossils," p. 372, considers mineral veins and faults as having the same origin, and indeed almost confounds them together.

It is necessary to observe, respecting the term fault, and many others in the above list, that they not only mean the fissure or separation itself, and the derangement of the strata occasioned thereby, but also are applied to the solid and extraneous matters with which the fissure or fault is in general

filled; for it often happens that the fissure is of some width, sometimes many yards, and is wedged quite full or matter, generally clay, with some mixtures of other substances, and sometimes angular and rounded stones are among these. A large portion of the faults are water-tight, and hold up the springs of water contained in the strata on one side of them. But it is not true, we believe, that water is ever lodged in the fault itself, as Mr. Kirwan asserts (Geol. Ess. 296.), but it frequently happens, that the cutting of a fault by miners, that is, the driving a passage through it, or the bursting-in of a thin fault, lets in a great body of water to the mine, which was before pent up in the porous strata and open cracks of the rocks on the other side, which has probably occasioned his mistake. In the neighbourhood of old mines in particular, the utmost precautions are often necessary in cutting or even approaching the thin faults, for fear of drowning the miners by a sudden influx of water.

FAUNALIA, in *Antiquity*, feasts celebrated by the Romans in honour of the god Faunus.

The deity Faunus, to whom the solemnity was devoted, and from whom it was denominated, was the same among the Romans with the Pan of the Greeks.

The Faunalia were held on the day of the nones of December; *i. e.* on the fifth day of that month. The principal sacrifice was a roe-buck; or rather, according to Horace, a kid attended with libations of wine, and burning of incense.

It was properly a country festival, being performed in the fields and villages, or in the midst of woods, with peculiar joy and devotion.

Horace gives us a very gay description thereof in the eighteenth ode of his third book:

“ — Tener pleno cadit hœdus auno:
Larga nec defuit Veneris fodali
Vina crateræ: vetus ara multo.
Fumat odore.”

Struvius, in his Roman calendar, marks the feast of Faunus on the day of the ides of February, which is the thirteenth day of that month; and the Faunalia he places on the fifth of the ides of December, or the ninth of that month; and in chap. ix. he shews, that there really were two Faunalia, the one in February, mentioned by Ovid, *Fast. lib. vi. ver. 246.* the other on the ninth of December, mentioned by Horace, in the place just cited.

FAUNS, **FAÛNI**, among the ancients, were a species of demi-gods inhabiting the forests; called also Sylvans, Sylvani, and little differing from the Satyrs. They delighted more particularly in vineyards, and they generally appear as attendants of Bacchus, in the representations of Bacchanal feasts and processions. They were represented as half men, half goats, having the horns, ears, feet, and tail of a goat, a very flat nose, and the rest human.

The Roman Faunus, we have observed, was the same with the Greek Pan. Now, in the poets we find frequent mention made of Fauns and Pans in the plural number; in all probability, therefore, the Fauns were the same with the Pans.

Though the Fauns were held for demi-gods, yet they were supposed to die after a long life. Arnobius shews that their father or chief, Faunus himself, only lived 120 years.

FAVONIUM, in *Botany*, from *Favus*, a honey-comb, in allusion to the appearance of its receptacle after the seeds are fallen. *Gertn. v. 2. 431. t. 174.* Class and order, *Syngenesia Polygamia irregularis*. Nat. Ord. *Compositæ corymbifloræ*, Linn. *Corymbifloræ*, Juss.

Gen. Ch. *Common* Calyx double; the external of many unequal,

unequal, elliptical, entire, spinous leaves, the outer ones much the largest; *internal* simple, of one leaf, firmly united with the receptacle, bordered with numerous, unequal, spinous teeth. *Cor.* compound, radiant; florets of the disk androgynous, tubular, five-cleft, regular: those of the radius neuter, ligulate, three-toothed. *Stam.* Filaments five; anthers united into a tube. *Pist.* Germen obovate, crowned; style rather longer than its own corolla; stigmas two, revolute. *Peric.* none, except the permanent calyx. *Seeds* solitary, inversely pyramidal, smooth, lead-coloured; crown membranous, of one leaf, cut half-way down into numerous radiating teeth. *Recept.* broad, naked, deeply cellular, the cells irregular, with thick, even, smooth edges.

Eff. Ch. Receptacle naked, deeply cellular. Down many-toothed. Florets of the radius ligulate. Outer calyx many-leaved; inner many-toothed.

1. *F. spinosum.* (*Polyinnia spinosa*; Linn. Suppl. 384. *Choriflea spinosa*; Thunb. Prod. 163. *Didelta spinosa*; Ait. Hort. Kew. v. 3. 256. Willd. Sp. Pl. v. 3. 226.) See *DIDELTA*, where this plant is described, but from which genus we are now convinced, by Gärtner's remarks, it ought to be removed.

FÄVONIUS, among the Romans, the wind which blew directly from the west.

FAVORINUS, in *Biography*, a celebrated Platonic philosopher, who flourished under the reigns of Trajan and Adrian, was born at Arles in Gaul, and studied under Dio Chrysostom. He was himself profoundly skilled in philosophy, and wrote numerous books on the subject. He taught with much reputation at Rome, and at Athens. He was highly respected by Adrian, and frequently disputed with that prince, though not always with the decision of a philosopher. Being once reproached for having tamely given up a point in debate, he replied "are you astonished that I should submit to the superior learning of one who has thirty legions of troops at his command?" He is reported to have been an eunuch, and is said to have felt surprise at three things, *viz.* that being a Gaul, he could speak Greek so well;—that being an eunuch, he should have been accused of adultery;—that being a subject of envy and jealousy, he should be permitted to have lived so long.

FAVORINUS, *VARINUS*, who flourished in the 16th century, was born near Camerino, a ducal town of Umbria. He studied under Angelo Politian, and John Lascaris at Florence, and was patronized by Lorenzo the Magnificent. Having determined on an ecclesiastical life, he undertook the care of a congregation, and was appointed preceptor to John de Medici, afterwards pope Leo X. Favorinus was appointed keeper of the Medicean library in the year 1512, and two years afterwards his former pupil nominated him to the bishopric of Nocera; the duties of this high office he performed, so as to obtain high and very general respect, till his death, which happened in 1537. His principal work, as a literary man, was a Greek lexicon, entitled "*Magnum Dictionarium, seu Thesaurus Linguæ Græcæ,*" &c. fol. This work is wholly in Greek, and furnishes scholars with the various explications of words, which are to be found in other lexicons. It has gone through many editions, but the most beautiful and correct is said to be that of Venice in 1712. He was author of several other publications. Moreri.

FAVORITE, in *Ornithology*. See *FULICA flavirostris*.

FAVORITO, in the *Italian Music*, is an epithet given to such parts of any composition as are performed to the greatest advantage. Thus, choro favorito is a chorus in which are employed the best voices and instruments to sing

the recitativos, play the ritornellos, &c. This is otherwise called the *little chorus*, or *choro recitante*.

FAVOUR, in *Commerce*. See *DAYS of Grace*.

FAVOUR, in *Mythology*, a deified person among the ancients, of whom we merely learn, that Apelles made a fine picture of this deity.

FAVOURABLE LAKE, in *Geography*, a lake of N. America, in N. lat. 52° 50'. W. long. 92° 30', which is the source of two large rivers, at the mouth of one of which, emptying into Winnipic lake, stands the Canadian house. The other is the S. W. branch of Severn river.

FAUP, one of the Caroline or New Phillipine islands, in the Pacific ocean.

FAUQUEMBERQUES, a town of France, in the department of the strait of Calais, and chief place of a canton, in the district of St. Omer, 11 miles S. W. of St. Omer. The place contains 1,250, and the canton 14,852 inhabitants, on a territory of 182½ kilometres, and in 24 communes.

FAUQUEMONT, or *VALKENBERG*, or *Falkenberg*, a town of France, in the department of the Lower Meuse, situated on the Geule; 12 miles W. of Aix-la-Chapelle.

FAUR, *GUY DU*, *LORD DU PIERAC*, in *Biography*, an eminent lawyer and man of letters, was born of a distinguished family at Poulouise in 1528. He was educated at Paris, and then went to Italy, to perfect himself in jurisprudence. On his return he figured away with high reputation in the parliament of his native city, and was chosen a deputy to the states of Orleans in 1559, at which he had the firmness to present a memorial of grievances to the king. He was afterwards selected as ambassador from Charles IX. to the council of Trent, where he ably defended the rights of the Gallican church. In 1565, he was nominated advocate general in the parliament of Paris, and in this capacity he composed an apology in Latin, for the infamous massacre of St. Bartholomew. He next accompanied the duke of Anjou, afterwards Henry III. when he went to take possession of the crown of Poland. He was selected to other high diplomatic stations, but was at length charged with indulging an amorous passion for the queen of Navarre. Some respectable writers treat this charge as a mere calumny. He died in 1584, leaving behind him, as memorials of his literary character, "Pleadings and Harangues," "A discourse on the Soul and the Sciences," but his name is chiefly famous for a series of moral maxims in French verse, entitled "Quatrains;" they are written with elegance and spirit, were extremely popular, and have been translated into the Latin, Greek, and modern languages. Moreri.

FAURANO, in *Geography*, a town of Naples, in *Lavora*; 17 miles E. of Naples.

FAVRE, *ANTONY*, in *Biography*, was born at Bourg-en-Bresse in 1557, studied at Paris and Turin, and was raised to several important posts under the duke of Savoy, and finally was made governor of that country, and all the provinces beyond the mountains. He was also president of the council of the Genevois for the duke of Nemours. His character for professional knowledge, and strict undeviating integrity, was extremely high, and he might have attained to considerable rank in France under Lewis XIII. could he have induced him to quit Savoy. He died in 1624. His works on jurisprudence were published in ten vols. folio, of which the principal is entitled "*Codex Fabrianus.*" This has been referred to in all the parliaments of France. Moreri.

FAVRE, *CLAUDE*, lord of Vaugelas, son of the preceding, was born in 1585, and early brought up in attendance upon
the

the court. He was made gentleman in ordinary, and afterwards chamberlain to Gaston, duke of Orleans, whom he followed in all his fortunes, though to the ruin of himself and his prospects. He was a distinguished member of the French academy, and devoted his whole leisure time to the study of his native language, by which he has perpetuated his name. He published "Remarks on the French Language," and a translation of "Quintus Curtius." On the latter he is said to have spent thirty years, and it accordingly obtained for him a high reputation. Lewis XIII. had settled upon his father and family a pension, the payment of which, however, had ceased, but was renewed to Claude, with a view of inducing him to engage in the compilation of the dictionary of the academy. On this occasion Richelieu said to him, "I hope you will not forget the word *pension* in your dictionary." "No," my lord, replied Favre, "and still less the word *gratitude*," a delicate, but forcible reproof for the cardinal. Favre died insolvent in 1650. Moreri.

FAUSSE, *Fr.* in *Music*, false, out of tune, by being too high or too low. There are false voices, as there are false strings. It is supposed that this is occasioned by a bad ear, but the mischief is done before the sound arrives at the ear; and we have known persons sing out of tune, who stop perfectly well in time on the violin, and who judge very accurately of the intonation of others. It is often from defect of the organ, which is disobedient to the will of the owner, that false intonations occur; *intonationi perfidi*.

FAUSSE-BRAY, in *Fortification*, is a strong parapet, or a low rampart, formed by a continuation of the revetement of the scarp, carried up to such a height, generally about seven feet, as should enable the defenders to fire directly into the covert-way, and to obstruct the assailants not only from making any lodgment there, but from attempting the passage of the ditch. These are certainly points of importance, and it should seem that the *fausse-bray* possessed in itself the means of answering every part of its intention; and such, indeed, would probably have continued to be the case, were it not that the invention of ricochet-firing, by which the ball is made to lob along the interior of a defence, (see ENFILADE and EPAULEMENT) totally disqualifies the *fausse-bray* from being considered a place of security. Add to this most formidable objection, that, where the rampart is furnished with a revetement of masonry, the splinters occasioned by such shots as may strike thereon, prove more destructive than the open fire of many situations apparently more exposed.

In consequence of such important defects, modern engineers have totally discarded the *fausse-bray* as a defence, though it may be advantageously constructed in certain instances as the only effectual means of preventing the rubbish occasioned by the breaching-batteries of the assailants from falling into the ditch, so as to afford the means of ascent. In lieu of a *fausse-bray*, it is now the practice to plant a very strong fence, a few feet distant from the foot of the rampart, for the above purpose, as well as to conceal such persons as may have occasion to pass along the berm. The defence of the covert way, and of the passage of the ditch, is found to be more effectually supported by the construction of a low work, called a *tenaille*. (see CONSTRUCTION *Military*;) placed before the porterns in the curtains; and from which the fire is more powerful than that from the flanks; it being more horizontal, and much nearer.

FAUSSE *Chenille*, in *Natural History*, a term used by Mr. Reaumur, and other of the French writers, to express a large class of worms produced from the eggs of several species of four-winged flies. These worms have greatly

the appearance of caterpillars in their general form, so that they have deceived many writers on insects into an opinion that they were really so; but M. Reaumur has shewn that they are very different. *Hist. Inf.* vol. ix. p. 133.

FAUSSE *Quarte*, *Fr.* in *Music*, another name for the tritonus, or sharp 4th. See TRITONUS.

FAUSSET, *Fr.* is that kind of voice which sings an octave above its natural compass, to imitate a boy or a female. A voice on this occasion resembles a flute or organ pipe over-blown, or blown with a sharper current, when it breaks into the octave. See OCTAVE and FALSET.

FAUST, JOHN, in *Biography*, a goldsmith at Mentz, celebrated on account of the share which he had in the invention of the art of printing. It has never been ascertained to whom we are chiefly indebted for this admirable art. Claims have been made for persons named Guttemberg and Schæffer, and it has been asserted that Faust only furnished money to Guttemberg to enable him to bring the invention to a state of maturity, he having previously, at Strasburgh, made the attempt with carved blocks. Schæffer, who was son-in-law to Faust, invented punches and matrices. To the first work that was printed the names Faust and Schæffer are attached; this was entitled "Durandi *Rationale divinarum officiorum*," 1459. Among other works to which these names are attached are the Bible, and two editions of the Pfalter. These were executed with characters engraved on wood, and are now exceedingly rare, and considered as master-pieces of typography: the characters are cut to imitate the finest writing, and the initial letters are printed in three colours, blue, red, and purple. It has been said that Faust went to Paris to sell some copies of his bible, and having sold them at a low price, in comparison of what was given at that time for manuscript bibles, and at different rates, his customers having heard of his mode of printing them, prosecuted him on account of the overcharge. From this period Faust never appeared at Paris, and it is thought he died of the plague in the year 1466. *Nouv. Dict. Hist.* See PRINTING.

FAUSTED, in *Mining*, is a refuse sort of ore and spar, intended to be dressed over again.

FAUSTINA BORDONE, in *Biography*, a celebrated female singer at the early part of the last century; she was a Venetian, and a scholar of Michael Angelo Gasparini of Lucca. She in a manner invented a new kind of singing, by running divisions with a neatness and velocity which astonished all who heard her. She had the art of sustaining a note longer, in the opinion of the public, than any other singer, by taking her breath imperceptibly. Her beats and trills were strong and rapid; her intonation perfect; and her professional perfections were enhanced by a beautiful face, a symmetric figure, though of small stature, and a countenance and gesture on the stage, which indicated an entire intelligence and possession of the several parts she had to represent. She first appeared, as a theatrical singer, at Venice, in 1716, when she performed in the opera of "Ariodante," composed by Carl. Fran. Pollarolo. In 1719, she appeared on the same stage with Cuzzoni and Bernacchi, in an opera composed by her master Gasparini. Here she is called *Virtuosa di Camera* of the Elector Palatine. In 1721, she sung in Leo's opera of "Bajazet," at Naples; and, in 1725, we find her at Vienna, where, according to Apostolo Zeno, she received great honours, as well as presents. At the palace of prince Lichtenstein, singing to a great assembly, she was presented with a purse containing a hundred pieces of gold (*ungheri ruspi*); and near as much more at the French ambassador's. "But," says this poet, "whatever good fortune or encouragement she meets with, she merits it all by her courteous and polite man-

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ners, as well as talents, with which she has enchanted and gained the esteem and affection of the whole court." The same author speaks "della bravura di Faustina," and the "bella musica di Porfiro," in an opera by the Abate Pasquini, performed at Vienna, 1725; and of the regret expressed by the whole court at her quitting that city to go to London. She remained here but two seasons, and then returned to Venice, where, in 1732, she was married to the celebrated Saxon composer Hasse, and soon after went to Dresden, in the service of which court she remained till the year 1756. At the bombardment of that city by the late king of Prussia, Hasse, her husband, had all his manuscripts burned, which were to have been printed at the expence of his master and patron, the elector.

A late writer upon music, of considerable merit with respect to the present times, though frequently erroneous as to the past, speaking of the Faustina, says that her agility of voice has seldom been equalled; a matchless facility and rapidity in her execution; dexterity in taking her breath, exquisite shake, new and brilliant passages of embellishment, and a thousand other qualities contributed to inscribe her name among the first singers in Europe.

The Cuzzoni, an exquisite singer in a different style from that of the Faustina, being here at the same time, occasioned such fresh feuds among the nobility and gentry, subscribers to the Royal Academy, as form an era in the annals of musical contests; for so disputable were the talents of these two singers, that in Handel's opera of "Alessandro," the flames of discord were kindled to such a height among the frequenters of the opera, and patrons of the art, as to excite a greater degree of enmity than even the theological and political parties of High church and Low, or of Whig and Tory, which then raged in this country.

It was related by the Hon. Mr. Walpole (late earl of Orford) that his mother, the lady of sir Robert Walpole, had these two sirens at her house to sing in a concert, at which were all the first people of the kingdom. She was under the greatest difficulty how to settle the precedence, or prevail on either to relinquish the place, which could only be accomplished by renouncing the pleasure of hearing either of them herself: the knot could not be untied, but it was cut, by the following expedient. Lady W. finding it impossible to prevail on one to sing while the other was present, took Faustina to a remote part of the house, under the pretence of shewing her some curious china, during which time the company obtained a song from Cuzzoni, who supposed that her rival had quitted the field. A similar expedient was practised in order to get Cuzzoni out of the room, while Faustina performed.

The Faustina had a mezzo-soprano voice that was less clear than penetrating. Her compass was only from B flat to G in alt.; but after this time she extended its limits downwards. She possessed what the Italians call "un cantar granito;" her execution was articulate and brilliant. She had a fluent tongue for pronouncing words rapidly and distinctly, and a flexible throat for divisions, with so beautiful and quick a shake that she could put it in motion upon short notice, just when she would. The passages might be smooth or by leaps, or consisting of iterations of the same tone, their execution was equally easy to her as to any instrument whatever. She was doubtless the first who introduced, with success, a swift repetition of the same tone. She sung adagios with great passion and expression, but was not equally successful, if such deep sorrow were to be impressed on the hearer, as might require dragging, sliding, or notes of syncopation, and tempo rubato.

She had a very happy memory in arbitrary changes and

embellishments, and a clear and quick judgment in giving to words their full power and expression. In her action she was very happy; and as she perfectly possessed that flexibility of muscles and features, which constitutes face-playing, she succeeded equally well in furious, amorous, and tender parts: in short, she was born for singing and acting. The violence of party for these two singers, Cuzzoni and Faustina, was very great.

For, according to Tosi, their contemporary, and a most excellent judge of their several merits, their talents, and styles of singing, were so different, that the praise of one was no reproach to the other. "Indeed, their merit," says he, "is superior to all praise; for with equal force, in a different style, they help to keep up the tottering profession from immediately falling into ruin. The one is inimitable for a privileged gift of singing, and enchanting the world with a prodigious felicity in executing difficulties with a brilliancy, I know not whether from nature or art, which pleases to excess. The delightful soothing cantabile of the other, joined with the sweetness of a fine voice, a perfect intonation, strictness of time, and the rarest productions of genius in her embellishments, are qualifications as peculiar and uncommon, as they are difficult to be imitated. The pathetic of the one, and the rapidity of the other, are distinctly characteristic. What a beautiful mixture it would be, if the excellences of these two angelic beings could be united in a single individual!" (Osserv. sopra il canto fig.) Are not these reflections applicable to the two great singers (Banti and Billington) of the present time, who have each their exclusive admirers? It is a very ancient remark among musical critics, that pathetic singers have no brilliancy of execution, nor those possessed of great agility of throat, much pathos. Would it not have afforded more delight to persons of taste and discernment, to hear two great performers at the head of different styles, than the perpetual struggle of two contending sirens in the same style? Then, after taking sides, partisans have an opinion to defend, which generates disputes that seldom end short of contempt and hatred of each other.

In June, 1772, we found the old Faustina and her husband, the admirable Hasse, commonly called Sassoni by the Italians, and their two daughters at Vienna. She was then about 72, but lively, and curious after what was transacting in the world. The daughters were very fine singers in different styles. On the Faustina being asked to sing, she cried out: Ah! non posso; ho perduto tutte le miei facultà!" Alas! I am no longer able, I have lost all my faculties!" This worthy family remained at Vienna till the year 1775, then retiring to Venice, the place of the Faustina's nativity where the daughters were well married, she ended her days in 1783, at the great age of 84; and Hasse died soon after, at nearly the same age.

FAUSTINO, *St.* in *Geography*, a town of South America, in New Granada; 40 miles N. of Pamplona. N. lat. 6° 55'. W. long. 71° 34'.

FAUTAC, a town on the east coast of Madagascar. S. lat. 24°. E. long. 47° 45'.

FAUVILLE-EN-CAUX, a town of France, in the department of the Lower Seine, and chief place of a canton, in the district of Yvetot; 10 miles N. of Caudebec. The place contains 1,346, and the canton 10,956 inhabitants, on a territorial extent of 112½ kilometres, in 20 communes.

FAUX, *Fr.* in *Music*, false. See FAUSSE.

FAUX-Bourdon, *Fr.* See FALSO-BORDONE, and FABURDEN.

FAUX-Bourdon, *bastard humble bee*, in *Natural History*, a name given by Reaumur and other French naturalists to the

the bees usually called by us drones, and by the common people of that nation bourdons, confounding them with the common humble-bee under that name. See *DRONE*.

FAUX Puceron, a name given by Reaumur and others to a genus of insects much resembling the pucerons in many things, but differing in some material circumstances. The two principal kinds of these are found on the back of the leaves of the fig-trees, and in little hollow balls at the junctures of the branches of box, formed of the upper leaves vitiated by the bitings of these creatures.

FAUXVILLERS, in *Geography*, a town of France, in the department of the Forêts, and chief place of a canton in the district of Neufchâteau. The place contains 938 and the canton 5,841 inhabitants, on a territory of 255 kilometres and in 14 communes.

FAWKES, FRANCIS, in *Biography*, was born in Yorkshire about the year 1721. He received his grammar learning at Leeds, whence he was transferred to Jesus college, Cambridge. He was educated for the church, and presented to the vicarage of Orpington, with St. Mary Cray, in Kent, by archbishop Herring, whose death, in 1757, was noticed in an elegy by Mr. Fawkes. In 1761, he published a volume of poems by subscription, and took a part in some periodical publications. In 1767, he published an eclogue, addressed to the honourable Charles Yorke, on partridge shooting. He is more celebrated for translations than for original compositions. His versions of Anacreon, Sappho, Bion, Moschus, and Musæus, were popular, and are still in good repute. In 1774, he exchanged his vicarage for the rectory of Hayes, where he died in 1777. After his decease a translation from his pen of the "Argonautics," was published by subscription. "He possessed," says his biographer, "an easy flow of versification, and though his diction is not highly poetical, yet it has the merit of extraordinary clearness, which leaves no hesitation about the meaning of the original." *Gen. Biog.*

FAWN, among *Hunters*, is a buck or doe of the first year, or the young one of the buck's breed in its first year.

FAWN, in *Geography*, a township of America, in York county, Pennsylvania, on the W. bank of Susquehanna river, on the Maryland line; containing 1,214 inhabitants.

FAY, a town of France, in the department of the Indre and Loire; 13 miles S. of Chinon.

FAY-Billot, Le, a town of France, in the department of the Upper Marne, and chief place of a canton, in the district of Langres; 12 miles S. E. of Langres. The place contains 1,999, and the canton 11,453 inhabitants, on a territory of 277½ kilometres, and in 23 communes.

FAY-le-Froid, a town of France, in the department of the Upper Loire, and chief place of a canton, in the district of Le Puy; 15 miles E. S. E. of Le Puy. The place contains 525, and the canton 5,590 inhabitants, on a territory of 175 kilometres, and in 6 communes.

FAY, To, in *Ship Building*, is to set any two pieces of wood so as to join close together: the plank is said to fay to the timbers when it bears or lies close to all the timbers.

FAYAL, in *Geography*, the most western of the Azore islands. This island derives its name from the great number of beech-trees (*Faya*, in Portuguese,) which grow here; besides which it abounds with other wood. It is about 27 miles long, and 9 wide: the climate is good, the air is mild, the winter-cold is never felt, and the heat of summer is counteracted by refreshing winds. The bullocks and hogs of this island are very good, but the sheep are remarkably poor; poultry, vegetables, and fruit may be had at a reasonable price: but the chief produce of the island is wheat and

Indian corn, with which they supply Pico, and some of the other isles. Birds are numerous, and the coast affords abundance of fish. Fayal, although the most noted for wine, does not raise sufficient for its own consumption: this article is raised on Pico, and thence brought to De Horta, for foreign shipping. The chief town is called Villa de Horta, or Orta. Fayal was first peopled by Flemings, who, grudging the expence of a Portuguese garrison, undertook to defend the island. But they had reason to repent of their presumption; for the English, at different times, made descents upon the island, and took it; they destroyed the fortifications, after having seized and burnt a squadron of rich homeward bound ships that lay in the harbour. Since this time a Portuguese garrison has constantly been maintained in the island. N. lat. 38 32' 24". W. long. 28 40' 54".

FAYAL, Bay or Road of, is situated at the E. end of the isle, before Villa de Horta, and facing the W. end of Pico. It is 2 miles broad, and 3-4ths of a mile deep, being of a semi-circular form. The depth of water is from 20 to 10 and even 6 fathoms, and the bottom sandy, except near the shore, where it is rocky, and also beyond the line which joins the two parts of the bay. It is not a bad road; but the winds most to be apprehended are those which blow from between the S. S. W. and S. E. Round the S. W. point there is a cove, called Porto Piere, in which a ship or two may lie in tolerable safety.

FAYD, a town of Syria, on the frontiers of Arabia Deserta; 400 miles E. of Damascus.

FAYDIT, ANSELM, in *Biography*, a native of France, who flourished towards the close of the 12th century. He is celebrated as a Provençal poet, and for his excellent singing, by which he made himself agreeable to persons of rank. He not only composed, but represented comedies, which obtained so large a share of popular favour, as to put the author in possession of considerable wealth, which he squandered away in licentious pleasures, and vain expence. In poverty, he was fortunate enough to attract the notice and favour of Richard Cœur-de-Lion, king of England, who had a passion for poetry, and by him was once more raised to a state of affluence. After the death of Richard, Faydit returned to Aix, where he married a woman as imprudent as himself, but who died shortly after marriage. He next went to the court of the marquis of Montserrat, and afterwards to that of the lord of Saulx, where he died about 1220. He wrote a poem on the death of his patron king Richard; another, entitled "The Palace of Love," and several comedies, of which one, entitled "L'Herégia dels Preilres," *The Heresy of Priests*, was written to gratify and flatter the wishes of persons of rank, who at that period were favourers of the opinions of the Albigenics, and who he probably expected would become his friends and patrons. *Moreri.*

FAYDIT, PETER, a French priest, born at Riom, in Auvergne, about the middle of the 17th century. In 1662, he entered into the congregation of the Oratory, from which he was expelled for having published a treatise on the principles of the Cartesian philosophy. He afterwards became famous for the part which he took in the controversy between pope Innocent XI. and France, in which he compared the papantiff with pope Anicetus in his dispute with Polycarp, and with pope Victor in his difference with Polyocrates and the Asiatic bishops concerning Easter. This led to other controversies of much repute at the time, but which may now be well consigned to oblivion. In 1695, he published "Illustrations of the doctrine, and of the Ecclesiastical History of the first two centuries;" and, in the following year, "A treatise on the

the Trinity;" for which he was accused of tritheism, convicted and imprisoned at Paris. His suffering had no tendency to repress his zeal, though it probably led him to caution in his future publications. But the freedom of his language, and the want of attention and respect which he shewed to certain illustrious individuals, excited their anger so much, as to procure an order from the sovereign that he should retire to his native place, where he died in 1709. His other works are, "A Collection of Memoirs," intended to satirize "Tillemont's Ecclesiastical History," which were soon suppressed; "Remarks on Virgil, on Homer, and on the Poetic Style of the Scriptures," in 2 vols. A critique on Telemachus, entitled "Telemaco-manie." And other pieces in Latin verse, and French prose. Moreri.

FAYE, in *Geography*, a town of France, in the department of the Maine and Loire; 10 miles S. of Angers.

FAYE *le Finestre*, in the department of the Indre and Loire; 3 miles S. E. of Richelieu.

FAYENCE, a town of France, in the department of the Var, and chief place of a canton in the district of Draguignan, celebrated for its manufacture of earthen ware; 10 miles N. E. of Draguignan. The place contains 2,712 and the canton 9,488 inhabitants, on a territory of 192½ kilometres, in 6 communes.

FAYETTE, MARY-MAGDALEN PROCHE DE LA VERGNE, *Countess of*, in *Biography*, a lady in high favour at the court of Lewis XIV. She was intimately connected with the wits of that period, who were accustomed to assemble at her house, and to many of whom she was a liberal benefactress. Segrais was her particular friend, and in his name the celebrated romances entitled "Zaide," and "The Princess of Cleves," were given to the public, but he has himself testified that his part in them was only contributing to the plot and disposition, and that the filling-up and ornaments were entirely by Madame de la Fayette. These were extremely popular, and they are spoken of by Voltaire as the first in which the manners of persons of condition were painted, and natural adventures were described with ease and grace. She wrote likewise "Memoirs of the Court of France in the years 1688 and 1689;" "The Princess of Montpensier;" "The History of Henrietta of England;" and "Divers Portraits of Persons about the Court." These were all very much admired for the grace of style, and the delicacy and liveliness of description. She died in 1693. During her life she was ever most flattered with the praise of having a judgment superior to her wit, and loving the truth above all things. Moreri.

FAYETTE, in *Geography*, an American settlement in Tioga county, New York, between the Unadilla and the main branch of the Chenengo. It is laid out in 100 lots of square mile each, as nearly as the ground will permit.

FAYETTE, a county of Pennsylvania, bounded N. by Westmoreland, S. by part of Maryland and Virginia, and W. by Monongahela river; 39 miles long and 29 broad; containing 473,280 acres; divided into 17 townships, of which Union is the chief. The number of inhabitants is 20,159.

FAYETTE, a district of North Carolina, comprehending six counties, *viz.* Moore, Cumberland, Sampson, Richmond, Robeson, and Anson. It is bounded N. by Hillsborough, S. E. by Wilmington and Newbern, W. by Salisbury, and S. by the state of South Carolina. It is 120 miles in length, and 50 in breadth, and contains 41,358 inhabitants, of whom 8206 are slaves. The surface is varied with hills and dales, and is in general well watered.

FAYETTE, a county of Kentucky, 24 miles long, 20

broad, bounded N. by Scott county, N. E. by Bourbon, E. by Clark, S. by Madison and Jefferson, and W. by Woodford. The soil is excellent, though it lies on an eminence. The number of inhabitants is 12,233, of whom 3786 are slaves. The chief town is Lexington.

FAYETTE, a town in Kennebeck county and state of Maine, bounded westerly by Livermore, easterly by Mount Vernon, Wayne, and a large pond, called Great Amerskogggen pond. It has 532 inhabitants.

FAYETTEVILLE, so called in honour of the marquis La Fayette, a flourishing post town of North Carolina, pleasantly situated in Cumberland county, on the west side of the N. W. branch of Cape Fear river, nearly at the head of the navigation; 100 miles above Wilmington, and 61 southerly of Raleigh. The town is situated about a mile from the river, near the junction of Blount's and Cross creek; on both sides of the creek are about 400 houses, and handsome edifices for public use. The streets are regularly laid out, and the principal ones are 100 feet wide. Here are three mills, two considerable distilleries and breweries, and several extensive tan-yards. This town carries on a considerable trade to Wilmington in tobacco, wheat, flour, beef, pork, flax-seed, hemp, cotton, butter, lumber, slaves, naval stores, &c. The town stands in a settlement of Scots Highlanders, and has a post office, and 1656 inhabitants. N. lat. 35° 11'. W. long. 79°.

FAYORO, a town of Spain, in the province of Aragon, at the conflux of the Matarana and the Ebro; 15 miles S. of Fraga.

FAYOUM, FAIOUM, or FEIUM, a province of Egypt, on the west side of the Nile, extending from the river to the lake Berkit Caroun or Burkit-el-Kerun, the ancient lake Moeris. This was formerly the province of *Arfinoe*, (which see,) intersected by canals, which formed a communication between the river and the lake, and distinguished by its beauty and fertility, as well as the variety and value of its productions. Since that period this province has, by the oppression of the Turks, undergone a very great change; instead of flourishing cities it now presents to view cottages and hamlets built of mud, canals nearly choked up, and the sea of Moeris reduced to two-thirds of its former extent; and yet the observer will discover the same productions which Strabo has described, and the same abundance wherever the waters can penetrate. The Copts still cultivate the olive and the vine planted by their fathers. They gather an excellent grape, of which they make a white wine of very agreeable flavour. The whole country is at present covered with corn, with barley, with dourra or Indian millet, which follow one another in regular succession during seven or eight months. The superb flax, the sugar-cane, and all sorts of vegetables, spring up almost without culture. The cucumber, and various sorts of excellent melons, line the banks of the rivulets. Groves of fruit trees, amongst which are the date-tree, the fig-tree, the banana, the cassia, &c. are here and there dispersed over the plain; near the villages are groves of rose-trees, from the odoriferous flowers of which they distil the rose-water, which forms a valuable branch of commerce. The canals and the lakes abound with fish, which supplies the neighbouring provinces at a cheap rate. When winter is covering the northern countries with snow and hoar-frost, innumerable flocks of birds come to winter in lake Moeris, and the canals of Faïoum. The inhabitants take a vast number of geese, with golden plumage and of an excellent flavour; wild ducks that are fat and delicate, teals, swans, of whose skins they make furs; and pelicans. Savary's Letters on Egypt, vol. i.

FAVOUM, or *Faioum*, a town of Egypt, and capital of the province above described, which formerly possessed public baths, markets, and colleges, divided by the canal of Joseph into two parts, and surrounded by gardens. At present it is only half a league in circumference, and is situated on the eastern bank of the canal. The remainder is destroyed; the colleges no longer subsist; the houses built with brick, dried in the sun, present the dreary aspect of a heap of cottages. The inhabitants are poor, and, under oppression, destitute of energy; and all the arts are reduced to some manufactures of mats, coarse carpets, and the distillation of rose-water. This town is governed by a cacher, in the name of one of the beys of Grand Cairo. Several Arabian sheicks, who possess lands in the neighbourhood, compose his council, and they repair to the divan two or three times a week, when the governor invites them. Their chief is held in high estimation; but harmony among the members of the administration is of short continuance. The frequent successive wars at Grand Cairo disturb the tranquillity of the provinces, and the victorious party deprives the possessors of their governments and their lands; 49 miles S.S.W. of Cairo. N. lat. 29° 27'. E. long. 30° 39'. Savary.

FAYS, a town of France, in the department of Upper Marne; five miles N.W. of Joinville.

FAZILPOUR, a town of Hindoostan, in Guzerat; 12 miles N. of Brodera.

FAZULA, a town of Hindoostan, in Oude; three miles N. of Lucknow.

FAZULAPOUR, a town of Hindoostan, in Bahar; 13 miles N.W. of Bahar.

FAZZELLO, THOMAS, in *Biography*, was born at Sacca, a town of Palermo, in the year 1498. He was entered in the order of Dominican monks, and was their provincial, and might have been elected general of the order, had not his own modesty thwarted the measures taken for the purpose. He was ten times chosen prior of the monastery at Palermo, and died in possession of that office in 1570. He wrote many works, but the most considerable was a "History of Sicily," written in Latin in 20 books, which first appeared in Palermo in 1558, and which has passed through several editions, and was translated into the Italian language. Moreri.

FAZZIO, BARTHOLEMEW, was born at Spezio, on the coast of Genoa, in the beginning of the 15th century. Though of very humble descent, he became learned in the ancient languages, and translated "Arrian's History of Alexander." He likewise wrote a history of that prince in ten books; and a history of the war between the Genoese and the Venetians, which commenced in 1377. He is chiefly regarded for his work "De Viris Illustribus," which contains brief eulogies of the most famous men who were his contemporaries, with anecdotes of their lives, and an account of their principal works. This was not published till a long time after the death of the author, when Mehus annexed some MS. letters of Fazzio relating to the history of the times. We have likewise two moral treatises by Fazzio, the one entitled "De Humanae vitæ Felicitate;" and the other, "De Excellentia & præstantia Hominis;" and a Latin poem. The early part of life he passed at Genoa, whence he was invited to the court of Alphonso, king of Naples, a great patron of learned men, where he remained till his death in 1457. His style is said to be generally pure and elegant, especially in comparison with that of other writers in the same period. A great hatred prevailed between Fazzio and Lorenzo Valla, on account of their rivalry for the favour of

Alphonso, and each wrote four books of invectives against the other. Gen. Biog.

FAZZOLO, in *Geography*, a town of Naples, in the Capitanata; 13 miles S.W. of Manfredonia.

FE', SANTA, a town of Spain, in the province of Granada, near the Xenil, built by Ferdinand and Isabella in the year 1491, during the siege of Granada: it is situated in a fertile tract, and though a small town, contains about 2000 inhabitants; five miles N.W. of Granada.—Also, a town of Spain, in Aragon; five miles S. of Saragossa.

FE', Santa, a province of South America, in the vice-royalty of New Granada; and the name is sometimes given to the vice-royalty itself from that of its capital.

FE' de Bogota, Santa, the capital of the vice-royalty of New Granada, situated near the river Funza or Pati, which at the distance of 35 miles falls into the Magdalena. This city was founded in 1538 by Quesada the Conqueror. Although it lies at a considerable distance to the east of the grand chain of the Andes, which passes N. of the province of Carthagena, between the rivers Magdalena and Cauca, and though it is only four degrees from the equator, the climate is unexpectedly rather cold. It stands in a beautiful and spacious plain, called Alcazates, and the soil is sufficiently fertile. The city is large and handsome, and its streets are wide and well laid out. There are four squares, and five bridges over two little rivulets, called San Francisco, and San Augustin, which spring from the eastern mountains, and run westward both of the city and its plain, which is about 20 leagues in length and 11 in breadth, till they join the Funza, called also the river of Bogota. The whole year, such is the temperature of the climate, may here be called a perpetual spring, and the fertility of the soil produces two harvests. The cathedral is magnificent, and has 16 prebends. Here are also three parish churches and eight convents, with four nunneries, and the great hospital of San Pedro. Besides two religious colleges for education, there is the university of St. Thomas, with a large public library, established in 1772. This beautiful city presents several other churches and chapels. The population is thought to exceed 30,000 souls; and the inhabitants are generally of a good character: and though phlegmatic in their appearance, their stature and aspect are agreeable, and their wit acute. Justice is administered by two alcalds, according to the code of the Indies, with an appeal to the Royal Audiencia. The municipality is composed besides of six regidors and other officers. The inhabitants are, in general, not rich, and many of them are occupied in trade, the means of which, however, are rare and uncertain; the secular jurisdiction of this capital comprehends seven little districts in its neighbourhood, with 52 villages, and 3017 Indians, not including the people of colour, supposed to be fourfold that number. N. lat. 4° 6'. W. long. 78° 30'. For other particulars, see БОГОТА.

FE', Santa, a town, or rather a village of America, though it is the capital of New Mexico, situated 2400 miles N. of the capital city of Mexico. It is the see of a bishop and residence of a governor. It was founded, in 1682, on the skirts of a high chain of mountains, whence springs a clear river abounding in excellent trout. The river issues from a lake on the summit of the mountain, and passes through the middle of the town. The climate resembles that of Spain, having seasonable rain and snow, the spring being mild, and the summer heats maturing cotton in abundance; the population consists of 300 Spanish families, the Indians in that district not wishing to live in the same town with their masters. The surrounding territory is clear of woods, fertile and pleasant, producing wheat, maize, garden plants,

fruits, and particularly grapes, of which good wines are made. The pastures are well watered, and replenished with horses, cattle, and sheep. The Rio Bravo rises 50 leagues N.W. of the capital, diffuses fertility, and has its margins adorned with beautiful woods, and its stream abounding with excellent fish. The neighbouring mountains are clothed with tall barren pines, and with those of a smaller sort which bear large cones; the other trees are oaks of different kinds, sapes and others which form excellent timber. The animals are deer, bears, wolves, foxes, wild sheep, and stags of the size of a mule, the horns of which are not less than two yards in length, probably the moose deer. There are mines of tin, which do not defray the expense of working. N. lat. 36° 50'. W. long. 108° 48'.

FE', *Santa*, a town of South America, in the vice-royalty of La Plata, or Buenos Ayres, at the confluence of the river Salado with the Plata, built by Ferdinand V. The town is of a square form, and surrounded with walls, flanked with towers, and a deep ditch. The two streets intersect each other in the form of a cross. It contains one parish and one convent. The environs abound in silk, corn, wine, and fruit; and game is plentiful. S. lat. 31° 50'. W. long. 60°.

FE' *d' Antioquia*, *Santa*, the capital of a province so called, situated on the river Cauca, in the vice-royalty of New Granada; highly celebrated for its rich mines of gold. N. lat. 6° 48'. W. long. 74° 36'.

FE' *de Chiribique*, *Santa*, a town of South America, in New Andalusia, on the coast; 24 miles W. of Cumana. N. lat. 10° 5'. W. long. 65°.

FE', or Foy, *Santa*, a place in the middle of Veragua, a province in the Audience of Guatimala, in North America, where the king of Spain keeps officers for casting and refining gold. It stands at the source of a river which runs into the North sea.

FE', *Santa*, a city of Paraguay, in South America, 150 leagues S. by W. of the city of Assumption, seated on the river Paraguay. The inhabitants are chiefly employed in husbandry, grazing, and weaving cloth. They sell their productions and manufactures advantageously in Brazil.

FEABES, in *Rural Economy*, a term applied in some places to gooseberries; and which is sometimes written *feaberries*.

FEAGH, in *Mining*, signifies the refuse spar and rubbish of a mine.

FEAL, in *Rural Economy*, a term often used in the more northern districts to signify the turf or sward of grass land, when cut up or pared from the soil, for the purpose of forming fods. This sort of cutting or slaying off the surface of old grass lands was formerly very common, but from its being found highly prejudicial, has been lately much laid aside, and should be wholly discontinued.

FEAL-Dike, a term applied in the northern counties to a fence which is constituted either wholly or partially of fods or feal cut from the adjoining grass land.

FEAL-Manure, in *Agriculture*, is that sort of earthy manure, which is produced from the decomposition and decay of the grassy surface of land which has been cut in the manner of feal, and thrown together in a heap for the purpose. When incorporated with a little dung it forms an excellent top-dressing for hay-lands.

FEAL, was anciently used for *faithful*; hence the tenants by knights service used to swear to their lords to be *feal* and *leal*; that is, *faithful* and *loyal*.

FEALE, in *Geography*, a river of the county of Kerry, Ireland, which rises in the western part of the county of Limerick, and passes the towns of Abbyssale and Listowel;

after this it meets the river Gale, and with it forms the Cashin, a river which is navigable for eight or ten miles, and runs into the estuary of the Shannon.

FEALTY, FIDELITAS, denoted, under the feudal system, an obligation on the part of the vassal to be faithful to his lord, and to defend him against all his enemies; and by the feudal law an oath of fealty was required to be taken by all tenants to their landlord, which is couched in almost the same terms as our ancient oath of allegiance; except that in the usual oath of fealty there was frequently a saving or exception of the faith due to a superior lord by name, under whom the landlord himself was perhaps only a tenant or vassal. But when the acknowledgment was made to the absolute-superior himself, who was vassal to no man, it was no longer called the oath of fealty, but the oath of allegiance, in which the tenant swore to bear faith to his sovereign lord, without any saving or exception. See ALLEGIANCE.

Fealty is usually mentioned as synonymous with homage; but it differs from it, as homage consists in taking an oath when the tenant comes to his land, and is done but once, being an obligation which is permanent, and binds for ever, which fealty does not.

They differ also in the manner of the solemnity; for the oath of homage is taken by the tenant kneeling, but that of fealty is taken standing, and includes six things, which are comprised in the words *incolumē, tutum, utile, honestum, facile, possibile*.

Incolumē, that he do no bodily injury to the lord; *tutum*, that he do him no secret injury in any thing which is for his defence, as in his house or castle; *honestum*, that he do him no injury in his reputation; *utile*, that he do not damage him in his possessions; *facile* and *possibile*, that he make it easy and not difficult for the lord to do any good which otherwise he might do: all which is likewise comprised in Leg. Hen. I. cap. 5.

He that holds land by this only oath of fealty, holds in the freest manner; for all, even those that have fee, hold *per fidem & fiduciam*; that is, by fealty at the least.

This fealty is also used in other nations, as in Lombardy and Burgundy.

Indeed, as the very first creation of this tenure grew from the love of the lord towards his followers, so did it bind the tenant to fidelity, as appears by the whole course of the feuds, and the breach thereof is loss of the fee.

Hottoman, in his "Commentaries de Verbis Feudalibus," shews a double fealty; the one general, to be performed by every subject to his prince, answering to our oath of allegiance; and the other special, required only of such, as in respect of their fee are tied by this oath towards their lords. We read of both also in the Grand Customary of Normandy, &c.

Fealty special was with us performed either by freemen or villains. By 17 Ed. II. stat. 2. the form of this oath is appointed, and as now observed it is as follows: "I A. B. will be to you my lord C. true and faithful, and bear to you fealty and faith for the lands and tenements which I hold of you; and I will truly do and perform the customs and services that I ought to do to you. So help me God." The oath is administered by the lord or his steward; and though it is neglected in some manors, yet in copy-hold manors, where courts are kept, and copy-hold estate granted, it is generally used. Every lord, of whom tenements are holden at this day, may, and ought to call upon his tenants to take this oath in his court-baron, because if it be long neglected he may lose his feignory, and the profits arising from escheats and other contingencies.

Faalty is incident to all sorts of tenures, except from frank-almoign and tenancy at will.

FEAR, in *Ethics*, is the apprehension of some evil likely to befall us, attended with a desire of avoiding it. This passion has been found to lessen perspiration and urine.

*FEAR, in *Mythology*, was a deity among the Greeks, and afterwards adored by the Romans, together with "Palenefs," its inseparable companion. When men were struck with the view of events, of which the causes were unknown, and which infused a terror into their minds that required foreign relief, they made a divinity of the disturbing passion itself, from which they sought to be delivered, by addressing to it vows and prayers. It is not possible to determine the precise time when they began to pay adoration to these two divinities. They were known, however, to the earliest poets of Greece. Hesiod, after having told us in his *Theogony* that fear was the daughter of Mars and Venus, adds, in the description of Hercules's buckler, that this god was represented upon it in his chariot, accompanied with fear and terror. Homer (Il. l. 4.) gives these goddesses the same original. Accordingly, whenever he makes the god of war appear in battle, he gives him fear, terror, and flight for his retinue; he also places the same divinities sometimes upon the tremendous Ægis of Minerva, and sometimes upon the buckler of Agamemnon. (Il. l. 11.) A divinity, so well marked by these two poets, and so formidable in herself, could not fail to command religious worship. Accordingly they had recourse to gifts and sacrifices, in order to appease and to be delivered from her. In a battle fought by Tullus Hostilius, the Albans, who had declared for him, withdrew and joined the enemy. His men were at first dismayed, and all seemed to be lost, when that prince vowed to erect a temple to fear and palenefs; this vow produced its effects; the soldiers resumed their courage, and Tullus gained a complete victory. This event, which is the era of introducing the worship of these two goddesses into Rome, is marked upon two medals of the family of Hostilia. Upon the one is a head with the hair erect, the countenance raised towards heaven, the mouth open, and a terrible aspect, which are lively figures of the divinity whom the medal represented. The other exhibits a meagre face much lengthened, the hair laid flat, and a staring aspect. And this is the true portrait of palenefs, which is the effect of fear. According to Plutarch, the Lacedæmonians placed the temple of fear by the tribunal of the "Ephori," from a persuasion that nothing is so necessary as to inspire the wicked with fear of severe chastisement. Moreover, fear was joined in oaths with the other gods. Æschylus informs us, that in the solemn oath taken by the seven chiefs of the Theban expedition, in the midst of sacrifices, all of them holding their hands in the blood of the victims, swore by fear, by the god Mars, and by Bellona.

FEAR, *Putting in, in Law*, is the criterion that distinguishes robbery from other larcenies. For if one privately steals a sum of money from the person of another, and afterwards keeps it by putting him in fear, this is no robbery, for the fear is subsequent (1 Hal. P. C. 534.) However, it is not necessary, though usual, to lay in the indictment that the robbery was committed by *putting in fear*; it is sufficient, if laid to be done by *violence*. And when it is laid to be done by putting in fear, this does not imply any great degree of terror or affliction in the party robbed; it is enough that so much force, or threatening by word or gesture, be used, as might create an apprehension of danger, or induce a man to part with his property without or against his consent. (Foil. 128.)

FEAR, *Cape*, in *Geography*, a cape on the coast of North Carolina. N. lat. 33° 50'. W. long. 78° 11'.

FEAR *River, Cape*, a river formed by the union of two streams, which unite near Wilmington in North Carolina, and run into the sea at Cape Fear.

FEARN, a town of Scotland, in the county of Ross; four miles S. E. of Tain.

FEAST, or FESTIVAL, a church solemnity, or rejoicing in honour of God or a saint.

The word is formed of the Latin, *festum*, which some derive a *feriari*, to keep holiday; others from the Greek, *εστιασθαι*, I feast or entertain, of *εστια*, hearth, fire.

Feasts, and the ceremonies attending them, have made great part of the religion of almost all nations and sects; witness those of the Egyptians, Greeks, Romans, Hebrews, Christians, and Mahometans.

The Egyptians had six principal festivals, viz. the first, celebrated at Bubastis in honour of Diana: the second, at Busris, for the goddess Isis; the third, at Saïs, for Minerva; the fourth, at Heliopolis, in honour of the Sun; the fifth, at Buthos, was the festival of Latona; and the sixth was celebrated at Pampremis, in honour of Mars. The festival at Bubastis was peculiarly solemn. The people flocked thither from all parts, and the Nile was for several days overspread with barges, decked with ornaments, and accompanied with music. The number of spectators at this festival was computed to be 700,000; who abandoned themselves to mirth and revelling, and who consumed on this occasion more wine than they used throughout the whole year. At the festival of Busris, the sacrifices were followed with a flagellation, from which neither men nor women were exempted. The festival of Minerva at Saïs was distinguished by the great number of lamps which were kept burning during the night. The whole ceremony in the festival of Heliopolis, and that of Buthos, was to offer sacrifices upon that occasion to the Sun and to Latona. But that which they celebrated at Pampremis in honour of Mars, was attended with this singularity; the priests bore upon a four-wheeled chariot the statue of that god, inclosed in a small chapel of gilt wood; and while they endeavoured to force the chariot and statue into the temple of that divinity, men armed with clubs stood in the way to hinder it, and as the priests likewise had arms, an engagement ensued, in which it must naturally be supposed many people lost their lives; though the Egyptians maintained that no person died of the wounds which were received on that occasion.

The first feasts among the Greeks were celebrated in solemn assemblies of the whole nation, on occasion of their games, as the Olympic, the Pythian, the Isthmian, and Nemean; in process of time they had many others, the principal of which are enumerated in the course of this work. See Potter's Arch. vol. i. cap. 19, 20.

The Romans also had abundance of stated feasts in honour of their deities and heroes: such were the Saturnalia, Cerealia, Lupercalia, Liberalia, Neptunalia, Consualia, Portunalia, Vulcanalia, Palilia, Divalia, &c. See SATURNALIA, &c.

They had also feasts instituted occasionally; as Carmentalia, Quirinalia, Terminalia, Floralia, Compitalia, Lemuria, Vernalia, beside other moveable and occasional ones; as to give thanks to the gods for benefits received; to implore their assistance, or to appease their wrath, &c. as the Paganalia, Feralia, Bacchanalia, Ambarvalia, Ambrubalia, Suovetaurilia, and divers others, particularly denominated *ferie*; as Sementina, Latina, &c. See each of these feasts and *ferie* in its proper place.

The feasts were divided into days of sacrifice, and days of banqueting and feasting; days of games, and days of rest, or *feriæ*.

There being but little history wrote, or at least published in those days; one end of feasts was to keep up the remembrance of past occurrences.

The principal feasts of the Jews were the feasts of trumpets, that of the expiation, of tabernacles, or the dedication, of the passover, of pentecost, and that of purification. The modern Jews have other feasts marked in their calendar of modern institution.

The Mahometans, besides their weekly feast, or sabbath, which is kept on Friday, have two solemn feasts, the first of which is called the Feast of Victims, and celebrated on the tenth day of the last month of their year; and the second, called Bairam. The Chinese have two solemn feasts in the year, in memory of Confucius, besides others of less note on other days of the year.

FEASTS among us are either *immovable* or *moveable*.

FEASTS, *Immovable*, are those constantly celebrated on the same day of the year; the principal of these are Christmas-day, or the Nativity; the Circumcision, Epiphany, Candlemas, or the Purification; Lady-day, or the Annunciation, called also the Incarnation and Conception; All Saints, and All Souls; besides the days of the several apostles, St. Thomas, St. Paul, &c. which with us are feasts, though not *feriæ*. See each feast under its proper article.

FEASTS, *Moveable*, are those which are not confined to the same day of the year. Of these the principal is Easter, which gives law to all the rest, all of them following, and keeping their proper distances from it; such are Palm-Sunday, Good-Friday, Ash-Wednesday, Sexagesima, Ascension-day, Pentecost, and Trinity-Sunday. See EASTER, SEXAGESIMA, PENTECOST, TRINITY, &c.

The four feasts which our laws take special notice of are, the Annunciation of the blessed Virgin Mary, or Lady-day, the 25th of March; the Nativity of St. John the Baptist, held on the 24th of June; the feast of St. Michael the Archangel, on the 29th of September; and that of St. Thomas the Apostle, on the 21st of December: on which quarterly days rent on leases is usually reserved to be paid, 5 and 6 Ed. VI. cap. 3. 3 Jac. I. cap. 1. 12 Car. II. cap. 30.

Beside these feasts, which are general, and enjoined by the church, there are others local and occasional, enjoined by the magistrate, or voluntarily set on foot by the people; such are the days of thanksgiving for delivery from wars, plagues, &c. Such also are the vigils or wakes in commemoration of the dedications of particular churches. See VIGIL, &c.

The prodigious increase of feast-days in the Christian church commenced towards the close of the fourth century, and was occasioned by the discovery that was then made of the remains of martyrs and other holy men, for the commemoration of whom they were established. These, instead of being set apart for pious exercises, were abused in indolence, voluptuousness, and criminal practices. Many of them were instituted on a pagan model, and perverted to similar purposes.

FEAST of the Dead, is a solemn religious ceremony in use among the savages of America, some of whom thus testify their respect for the deceased every eight years; and others, as the Hurons and Iroquois, every ten years.

FEAST is also used for a banquet, or a sumptuous meal, without any immediate view to religion.

The use of the word, in this sense, arises hence; that a part of the ceremony of many of the ancient festivals, both those of the Heathens and the *agapæ* of the Christians, was good eating; though Mr. Huet chooses to derive the word from *festinare*, which in an ancient Latin version of Origen's Comment on Matthew, signifies *to feast*: "Ut veniens illus Jesus festinet cum discipulis suis." In all antiquity, both sacred and profane, sacrifices were little more than religious feasts.

It has been often observed by authors, that there is no nation in the world comes near the English in the magnificence of their feasts. Those made at our coronations, installments, consecrations, &c. transcend the belief of all foreigners; and yet it is doubted whether those now in use are comparable to those of our forefathers.

The Persians never discourse and deliberate of their most important affairs but in the middle of their feasts.

FEATHARD, in *Geography*, a post town of the county of Wexford, Ireland, which was formerly flourishing, and sent two members to parliament, but which has now fallen to decay, and has lost its privilege as a borough by the union. It is a seaport, separated by a small neck of land from Waterford harbour, 81 Irish miles S. by W. from Dublin, and 14 S. from New Ross. See FETHARD.

FEATHERS, in *Comparative Anatomy*, constitute the peculiar covering of the class of birds. In no other tribe of animals are they met with; for the plumes which belong to some of the lepidopterous insects are different from the feathers of birds, both with respect to their structure and mode of growth. No bird is entirely deprived of feathers, although some species want them on certain parts of the body. The turkey and vulture have the head and part of the neck uncovered. The ostrich and the wading birds have bare thighs: those birds which have crests, combs, or pieces of flesh on the head, have those parts without feathers, as in the bald coot, several gallinæ, &c. The aptenodytes want feathers even on the wings. Many birds have patches or spots about the side of the head, upon which there are no feathers.

The feathers which make the proper clothing of the bird are of two kinds, the *down* and *common short feathers*; the former is placed under the common feathers: it gives an entire covering to some water birds at a very early age; of this the young goose is a familiar example. The down is designed to defend the bird against cold and wet; and hence it is so abundant upon the lower surface of those birds that frequent the water.

Although the common feathers cover the whole body, they do not grow from every part of the skin: they are thickest upon the shoulders and loins, along the under part of the neck and breast, and do not exist upon the lateral lines of the neck or breast, or about the umbilicus. This arrangement, and their being directed downwards and backwards, allows them to cover the body more neatly, and to remain unruddled during the motion of the bird.

The *large feathers*, or *quills*, situated upon the wings and tail, should rather be considered as instruments of motion than as an integument: thus we find them strong and unyielding in their texture in birds of flight, more especially those that have heavy bodies, as the swan, goose, turkey, &c. while they are wanting in the wings of those birds that do not fly, as the ostrich, aptenodytes, &c.

There are other long feathers that differ both from the quills and common feathers, with respect to their structure and position. Of these we may mention those of the crest of the peacock, and some of the crane kind, the hypochondriac feathers of the birds of paradise, the rump feathers

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of the peacock, &c. these seem designed for ornament alone.

There are many other varieties of feathers, but as these are more the concern of the naturalist than of the anatomist, we shall not dwell upon them at present, and hereafter only notice such peculiarities in the external appearance of feathers as illustrate the structure of these parts.

The anatomy and mode of growth are essentially the same in all kinds of feathers; but we shall take our description chiefly from the large feathers, or quills, as being the most convenient for the purpose.

Previous to the appearance of the first feathers, the skin of birds is in a degree covered with hairs, except under the belly: these grow in tufts, or fasciculi, each containing about ten or twelve hairs. Cuvier states these tufts to be implanted in a bulb or follicle, which, as he conceives, contains the rudiments or sheath of the feather. When the sheath is protruded from the skin, it carries with it the fasciculus of hairs, which then appears to arise from its extremity. In general, the hair very soon falls off from the feather, but in some of the accipitrine birds it is found attached for a considerable time to the end of the feather, resembling fine down.

All feathers are originally contained in *tubular sheaths*; these penetrate the skin, and become apparent, usually a few days after the bird leaves the shell. The quills are first observed; after these, the down makes its appearance, and then the common feathers. These last are found to be arranged in a quincunx order.

The structure of the sheath is exceedingly curious: it is round, or tubular; the extremity, which is affixed in the skin, is blunt and perforated, in order to give passage to the bulb or vascular part of the feather; the external end is originally close, and of a pointed shape. The parietes of this tube appear to be of an horny nature, although they are thin and extremely fragile: it readily splits into lamina, more especially at the external extremity; it is thicker, softer, and less brittle towards the end connected with the skin.

The root of each sheath is accommodated in a corresponding excavation of the integuments: this is lined by a reflection of the cuticle, which appears, after reaching the bottom of the *cell*, to return outwards, by passing on the proper sheath of the feather, in which situation it is extremely thin and delicate. The cells which enclose the sheaths of the feathers are usually very deep in the wings and tail; their internal lining is also strong in that situation, and they adhere to the periosteum.

If the sheath of the feather be opened at a very early period, it will be found to contain a *vascular pulp*, (of which more hereafter); and around this may be seen some colouring matter, in a soft and almost liquid state, which, if examined, will be found composed of a number of little thin processes, or laminae, already possessing the form of the *barbs* of the future feather; these are therefore the first parts which are produced; they soon acquire more strength and firmness, and become attached to the *shaft* or *stalk* of the feather, which is the part next secreted.

As soon as the point of the feather is completely formed, it perforates the external end of the sheath, which is easily ruptured. The feather in this way gradually increases, to accommodate which the sheath also enlarges, and becomes on the feathers of the wing and tail a considerable tube.

In proportion as the feather is formed it passes out of the torn end of the sheath, which becomes further lacerated by this means, and dries from exposure to the air, and falls off

in shagreened plates or scales, shewing its original structure to have been laminated.

The barbs, while enclosed in the sheath, are coiled round, in order to gain room; but on passing out unfold and take their proper figure.

After the shaft and barbs of the feather are entirely formed, the tubular part, or that which in quills is called the *barrel*, is produced. Cuvier describes this part as being formed by the consolidation and drying of the sheath in which the shaft grew; but it appears to us to be secreted, like the other parts of the feather, by the vascular pulp. The tube, in a full-grown feather, always appears to be the continuation of the back part of the shaft. The sheath, however, adheres more closely to the tube than the rest of the shaft, and hence that shagreened membrane which is observable on the barrel of a quill before it is cleaned.

The *vascular substance*, or *pulp*, so often already alluded to, possesses a very singular structure. Cuvier calls it a gelatinous cylinder; but although almost so soft and pulpy as to merit that name, it is an organized body, consisting of numerous cells, and provided with a large supply of blood. An injection of a coloured fluid from any of the neighbouring arteries renders the pulp of the feather entirely red, and seems to pervade every part of it, as if it was shed into it, or extravasated in its substance.

We have failed to trace any branches of nerves into the pulp, although they can be easily dissected as far as its origin or root: in this circumstance it resembles the vascular bulbs of hair and spines, and the pulps of the teeth, into the substance of which, we believe, no person has yet clearly pursued the branches of nerves.

The pulp, after fulfilling its purpose, *viz.* the secretion of the feather, undergoes a singular change of structure: it loses all vascularity, becomes perfectly dry and transparent, and puts on the appearance of a number of empty membranous cones, or funnels, inserted the one into the other. This change has been ascribed to the part being dried by exposure to the air; but, that it is effected by a process of absorption, and by the cessation of vascular action in the arterial branches, is fully proved by the cleanness and the disappearance of all colour in the degenerated pulp. The above change goes on gradually, beginning at the extremity of the pulp, farthest from the root of the feather, and keeps regular pace with the growth of the feathers. As the pulp dries or degenerates along the grooved side of the shaft, it is rubbed off; but in the tube of the feather it is preserved, and makes that well-known jointed membranous body which we take out of the barrel of the quill in making a pen.

The conversion of the vascular pulp into dry membranous cells necessarily produces a considerable vacancy in the tubular portion of the feather, which is supplied by air. The means by which this air is obtained, and its chemical composition, have not heretofore been known. In making some experiments, with the view of analysing the air contained in quills, we discovered how it is admitted into the tube. Some quills, plucked from a living goose, being introduced into a quicksilver bath, and their ends being cut off while in the bath, a sufficient quantity of air was obtained by turning their open ends up into an inverted jar. While this was doing, it was observed, that if the open end of the quill was pushed downwards into the bath, the quicksilver rose in the barrel, as in a thermometer. This led to the conclusion, that there must be an opening through which air could pass out, and of course also into the barrel of the quill: some further examination detected a foramen situated at the upper part of the barrel, just where the groove

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groove of the shaft terminates. This opening is extremely small, while the quill is fixed in the wing, and becomes almost entirely closed by the drying of the feather after it is plucked: it is the remnant of the passage in which the portion of the vascular pulp that went to the inner, or grooved side of the shafts, was originally situated: for the pulp is divided at its external extremity into two branches, one of which goes on in the continuation of the tube in the back of the shaft, and the other belongs to the grooved, or inner side of the shaft.

The above observations put it beyond all doubt that the hollow portions of feathers are supplied with air from the atmosphere, instead of being secreted, as some have supposed. As this air cannot be expelled and removed; and as it is in a degree exposed to the influence of the blood of the vascular pulp, it was to be presumed, that it underwent the same change as air which had passed through the organs of respiration. With the view of ascertaining the fact, the following experiments were made upon a considerable portion of air collected under quicksilver, in the manner already mentioned, from the quills of a living goose.

Some nitrous gas was first admitted into the inverted jar, containing the air of the quills, and produced a very slight diminution of the column of air. Some weak solution of ammonia was next introduced, which diminished the quantity of air very considerably: this was supposed to proceed from a solution of some nitrate of mercury, which had formed on the surface.

A second quantity of air was collected in a glass tube in a similar manner. On admitting a portion of lime water, and shaking the tube, the water became slightly turbid, and no material diminution of the column of air was observed. Nitrous gas was next introduced, when the red fumes were instantly formed: in order to get rid of the superfluous nitrous gas, a quantity of the solution of sulphat of iron was passed up into the tube; a diminution in the bulk of the original air was now evident, and amounting, as was supposed, to about the one-sixth of the whole. It was calculated that this portion of air contained carbonic acid gas in the proportion of about one-fifteenth part. These experiments were made with the assistance of the best chemist of the present age. We have since repeated them nearly in the same manner, and have obtained similar results. The air admitted into feathers loses a portion of its oxygen, and acquires a certain quantity of fixed air; but it is not spoiled in the same degree as if it had passed through the lungs, nor to the same extent that, from reasoning on the subject, we had been prepared to expect.

Feathers, when fully formed, besides the *degenerated pulp* upon which they grew, usually consist of three parts, the *tube* or *barrel*, the *shaft* or *stalk*, and the *barbs*, with their *barbules*.

The *tube* is a cylinder of a horny substance; it is transparent, on account of its only containing air, and the dry membranous cells which remain from the vascular pulp; its size is in general small in proportion to that of the whole feather, except in the quills, where it is of a considerable size. It is largest in the large auferine and gallinaceous birds, as the turkey, swan, goose, &c.; and hence the quills of these birds are the fittest to be made into pens. The tube, when minutely examined, appears to consist of two layers, or laminae; the external is a circular plate, and exhibits some slight linear impressions running round the barrel in a transverse direction; it is likewise more dense and transparent than the internal, which has its parts disposed in a longitudinal direction, and is smooth on the internal surface.

The cavity of the barrel is continued a little way into the back part of the shaft, in which it is gradually lost, and in some birds of flight, as the eagle, hawk, hawk, &c. it is continued for a very considerable distance into the shaft. No part can be better contrived for uniting the advantages of strength and levity than the barrel of quills.

The *shaft* is likewise composed of a circular and a longitudinal layer, or plate; it, however, appears opaque, in consequence of being filled with a pithy substance. This last is often of a white colour; it resembles very much the medulla of vegetables in a dried state, but is more compact and close in its structure. The shaft is the principal part of most feathers. The back, or external side of the shaft, is smooth; the opposite, or inner surface, presents a groove, which runs along the middle of the shaft for its whole length, giving it the appearance of having been originally composed of two pieces. The two sides, or intermediate surfaces, of the shaft, are lighter in their texture than the external and internal surfaces.

The *barbs* are implanted along the two edges of the external surface, or back of the shaft. Upon the existence, size, colour, and form of these, chiefly depend the character and appearance of the feather.

The barbs, when minutely examined, are seen to send off *processes* from the edge of their posterior surface, exactly in the same manner as they arise themselves from the shaft: every barb, therefore, may be properly considered as a shaft in miniature.

Sometimes both the barbs and *barbules* are wanting, as in the quills of the callowary, of which the shafts are long, smooth, and pointed, resembling the spines of the porcupine.

In loose floating feathers, as those of the ostrich, &c. the barbs are not closely applied to each other, and give off usually barbules on each side, which have no immediate connection with one another. In general, however, the barbules of one barb are inserted or interwoven with those of the next barb, so that the feather presents a continuous surface to the air or water. When the feathers are ruffled, the connection of the barbules is destroyed, and the adjustment of the feathers consists in laying the barbs neatly the one beside the other, by which the barbules fall into each other's interstices.

The adhesion between the barbs of the wing-feathers in many birds of flight and water-birds is rendered very firm. In the goose, for instance, the barbs of the quills are plates or laminae, which have each a concave and convex surface. The barbs, therefore, are received the one into the other, and are besides united by a row of barbules along their upper or posterior edge. A degree of the same structure is found in the wings of all birds that fly. The intention of the barbs adhering together is the same as the feathers being laid one upon another; by both these circumstances the bird is enabled to present an unbroken surface to the impulse of the air during flight, and defend its body from being wet. The quills of the wing and tail appear to have, in general, but one row of barbules, which being placed obliquely upon the posterior edge of the barbs, are enabled to pass across and touch each other.

The feathers that form the crest of the peacock have no barbules in their middle and inferior part. The feathers of the crest of the balearic crane are twisted in a spiral manner, and their barbs are only fine hairs. The crest of the little egret (*ardea garzetta*) is composed of similar feathers. The tuft of feathers at the bottom of the neck of the male turkey may be also regarded as barbules.

The barbules are long, distinct, and unattached to each other

FEATHERS.

other in the hypochondriac feathers of the birds of paradise, the rump feathers of the peacock, those on the thighs of the mycæria and balearic crane, the feathers of the toucan, and those placed around the ears of the owl, &c.

The feathers of the nocturnal birds of prey have the barbs covered with long silky down, from which arises the slow and silent flight of those birds so necessary to their habits of life.

The feathers of the bulfinch, the purple throated fly-catcher (*Muscicapa rubricollis*), the *Tanagra septicolor*, those of the head of the red-headed manakin, and of the rhamphalles momota, &c. have the barbs fine and silky.

The rump-feathers of the golden thrush, those of the tail of the jay, and of the neck of the common duck, have the barbs set close, and furnished with long, fine, soft barbules, disposed upon the surface in such a manner as to resemble satin.

In some foreign birds, as the humming-birds, the galbula and trogons, *paradisca aurea*, &c. the barbs of the feathers are broad and smooth upon the surface, and being of a brilliant colour, produce the appearance of polished metals.

In the ruby necked humming-bird the feathers of the head and throat, and those of the head and belly of the amethystine humming-bird, are so extremely brilliant as to resemble precious stones, as the names of these birds imply. This effect is produced by the barbs which terminate the shaft being so very dense and highly polished. The barbs of the tail-feathers in the wood-pecker are singularly strong, it being by the tail that these birds sustain themselves in a great measure when taking their prey.

The appearance of sealing-wax on the wings of the waxen chattering (*ampelis garrulus*) arises from the end of the shaft being without barbs, and formed into a solid round disk.

In the down of all birds the shafts are extremely fine and delicate, and often imperceptible. The barbs are long, distinct, and floating; and the barbules are long, loose, and silky.

The chemical composition of feathers agrees so nearly with that of hairs, that we need not enter into particulars upon this part of the subject. Feathers, however, contain a less proportion of mucilage, and receive less moisture from the body; but although feathers are so dry, even when attached to the living bird, they lose much of their pliancy and freshness after being some time plucked.

In the *Plate* designed to illustrate the *anatomy and mode of growth of feathers*, *fig. 1.* represents a portion of skin of a bird recently hatched, upon which the hairs are seen that precede the appearance of the feathers. *Fig. 2.* shews one of the young sheaths, bearing on its extremity some of these hairs. *Fig. 3.* is a portion of the wing on which the sheaths of the quills are shewn of different sizes. The cells are laid open, to expose the roots of the feathers and the vascular pulps passing into them; *a* the substance of the wing; *bbbb* the feather-sheaths; *ccc* the pulps penetrating the base of the sheaths; *ddd* the lining of the cells turned back. *Fig. 4.* is the end of a sheath, shewing the foramen by which the pulp enters the feather. *Fig. 5.* exhibits the sheath ruptured at its external extremity, through which the end of the feather is seen to protrude; *a* the sheath, shewing the appearance of being composed of circular fibres; *b* the feather. *Fig. 6.* shews the same feather removed from the sheath; *a* the vane or shaft, with the barbs imperfectly unfolded; *b* a part of the tubular portion of the shaft. *Fig. 7.* represents the pulp taken out of the sheath, and that part which had formed the shaft and barbs decayed and dry; *a* the pulp still soft and vascular; *b* the part which having

done its office is degenerated; *c* the feather. *Fig. 8.* is a magnified view of the pulp, separated from all its connections. *Fig. 9.* is a view of the pulp laid open, in order to expose the blood-vessels. *Fig. 10.* exhibits the pulp as it exists when completely degenerated. *Fig. 11.* is the lower portion of a quill, to shew the foramen for admitting air into the barrel; *a* the groove of the inner side of the shaft leading to the opening; *b* indicates a speck, which marks the situation of the foramen. *Fig. 12.* is the quill of a stork laid open at the back part, in order to expose the continuation of the tube into the shaft. *Fig. 13.* is given as an example of a loose floating barb, with the barbules on each side, and not intended for attachment to the adjoining ones: this view is magnified. *Fig. 14.* is a magnified representation of a barb of a goose's quill; *a* the convex surface which lies in the corresponding convexity of the next barb; *b* the single row of stiff oblique barbules.

FEATHERS. The chemical composition of feathers appears, by Mr. Hatchett's excellent experiments (*Phil. Trans.* vol. xc.), to be nearly the same as that of hair, nail, and cuticle, and consists of inspissated albumen mixed with a very minute portion of gelatin, and a little animal oil. The proportion of inspissated albumen is so large, that feathers may be boiled for many days in water with scarcely any loss, the albumen being insoluble in this liquid, and the gelatin being so small that the liquor gives no precipitate with tan, and very little with nitro-muriat of tin.

FEATHERS, in *Commerce*, make a considerable article, particularly those of the ostrich, heron, swan, peacock, goose, &c. for plumes, ornaments of the head, filling of beds, writing pens, &c.

Geese are plucked in some parts of Great Britain five times in the year; the first plucking is at Lady-day for feathers and quills; and the same is renewed for feathers only four times more between that and Michaelmas. (See *FEN* and *GOOSE*.) In cold seasons many geese die by this barbarous custom. Those feathers that are brought from Somersetshire are esteemed the best, and those from Ireland the worst. Eider down is imported into this country from Denmark, and is furnished by those ducks that are inhabitants of Hudson's bay, Greenland, Iceland, and Norway: Hudson's bay also affords a very fine feather, supposed to be of the goose-kind. The down of the swan is brought from Dantzick, whence we have also a great quantity of cock and hen feathers. The best method of curing feathers is to lay them in a room in an exposure to the sun, and when dried to put them in bags, and beat them well with poles to discharge the dust.

FEATHER-bed,
FEATHERS, dry-pulled, } See BED.
FEATHERS, scalded, }

FEATHERS, in *Agriculture*, are sometimes employed as manure, where they can be collected in any quantity; but, when used in this way, the pens, stumps, and other refuse of them are chiefly the parts had recourse to, being procured from the shops of the poulterers, &c. in large towns.

FEATHER, in the *Manege*, a sort of natural frizzling of the hair found in many parts of a horse's body, but more commonly between the eyes. In some cases it resembles an ear of barley, and in others an oilet-hole. Many are of opinion, that when the feather is lower than the eyes it is a sign of a weak eye-sight; but this remark is not certain.

FEATHER-edged Boards, in *Rural Economy*, are such boards as are sawn thinner on one edge than the other, in order

order to lay over each other, being much employed in building small farm-sheds, &c. where great expence is to be avoided.

FEATHER, *Prince's*, in *Gardening*, a common name of a species of the *amaranthus*. See *AMARANTHUS*.

FEATHER, *Roman*, called in French *et de Romaine*, is a feather upon a horse's neck, being a row of hair turned back and raised, which forms a mark like a sword-blade just by the mane.

FEATHER, *Mid*, in the *English Salt-works*. See *MID*.

FEATHER, *Sea*. See *GORGONIA*.

FEATHERS, *Fossil*, in *Natural History*. Different writers have described organic remains, or reliquia, found in the strata, under the name of feathers, or *ortholithi*, &c. Most of the drawings of pretended fossil feathers which we have seen, have had a considerable resemblance to the iron-stone fossil which Mr. Parkinson has figured in the fifth plate, (fig. 5.) of the first volume of his *Organic Remains*, and he considers it as a kind of leaf or vegetable production, and we think with good reason.

FEATHER-OUT, in *Geology*, is a term which has been of late used by Mr. W. Smith and others, in describing such strata as do not end abruptly, or in the face of a sudden hill, but whose lower beds advance so far beyond the superior ones, as to end by imperceptible degrees; a case which frequently occurs with some particular strata, and gives much trouble to a mineralogical surveyor in tracing their superior and inferior edges, and describing the surface they include on a map. In denudated districts, it is very common to find strata, which are of pretty uniform hardness, feathering-out so far, that it is difficult to trace their limits, except by the slight and almost imperceptible tablets which the harder beds occasion, as mentioned by Mr. Farey, *Philosophical Magazine*, vol. xxxiii. p. 262.

FEATHERED COLUMBINE. See *THALICTRUM*.

FEATLY, DANIEL, in *Biography*, was born at Charlton in Oxfordshire, in 1582. In 1594 he was admitted a scholar of Corpus Christi college, where he took his degree of B. A. in 1602. He pursued his theological studies with great ardour; and on account of his learning and polished manners was appointed chaplain to the embassy sent to the court of France, where he resided three years, and obtained a distinguished reputation as a preacher. Upon his return, in 1613, he took his degree of B. D. and was presented with the rectory of Northill in Cornwall, and immediately after was appointed domestic chaplain to Dr. Abbot, archbishop of Canterbury, who in a short time presented him with the rectory of Lambeth. This was followed by other preferments of considerable worth. In 1625 he married, and quitted the palace at Lambeth for a house at Kennington, of which he became possessed in right of his wife. During the civil wars he had nearly lost his life by some enthusiastical soldiers who had conceived the opinion of his holding popish principles. Though he twice escaped their fury, his property was very much deteriorated by their ravages. In 1643 he was nominated one of the assembly of divines, not only on account of his learning, but because he was zealously attached to the Calvinistic doctrines. This latter circumstance induced the assembly not only to treat him with great respect, but to permit him to speak freely his own opinions in favour of "episcopacy," and against the "covenant." He was by his own friends deemed orthodox and loyal; but lord Clarendon and others will not allow him that praise, on account of his attending against archbishop Laud when on trial. Lord Clarendon asserts that the king sent him a letter commanding him to follow the example of the other episco-

pal divines who had quitted the assembly, which occasioned his writing to archbishop Usher, assigning reasons why he could not obey the royal mandate. This correspondence was by some means laid before parliament, and was the ruin of Featly; who was found guilty of a breach of an ordinance which prohibited the members of the assembly from divulging their opinions without consent of one or both houses. He was accordingly deemed a betrayer of the parliamentary cause, imprisoned, stripped of his preferments, and expelled the assembly. His spirits were not broken by this usage, but his health began rapidly to decline; he supplicated parliament to be permitted to exchange his prison for apartments in Chelsea college, for the sake of change of air: this favour he obtained, but it was then too late; he died in 1644. His character is given in few words by Wood, who says that "he was most seriously and soundly pious and devout." Neal's *Hist. of Puritans* by Toulmin.

FEAZING, at *Sea*, is the ravelling out of the cable or any great rope at the ends.

FEBABO, in *Geography*, a town of Africa, and capital of a district in the Libyan desert, inhabited by the Tibboo; 160 miles S. of Augela. N. lat. 26° 50'. E. long. 22° 5'.

FEBRICULA, in *Medicine*, the diminutive of *febris*, signifying a slight fever, has been sometimes applied to the hectic fever, and sometimes to the low nervous fever, so denominated by Dr. Huxham. In the latter acceptation principally we have a treatise on the "Febricula, or Little Fever," by sir Richard Manningham. See *NERVOUS Fever*.

FEBRIFUGE, from *febris*, fever, and *fugo*, I drive away, a term which is applicable to every remedy for fever, but was originally employed to denote the quality of those medicines which were believed to have some peculiar or specific power in arresting febrile diseases. The word, however, is now seldom employed; because no remedy possessed of any specific anti-febrile power is known. Antimonial medicines, indeed, and the neutral salts, in consequence of their diaphoretic quality, are sometimes called febrifuges; but the term is not applied to them with more propriety than to the purgatives which are given, or even to the gruel which the patients drink. If there be a remedy, which can be said directly to suppress febrile action, it is, we believe, *cold water*, freely applied to the surface, and taken internally. (See *COLD*.) Hence the term "febrifugum magnum," used a century ago by the reverend Dr. Handcock, although it called forth the raillery and ridicule of the faculty, was, perhaps, not less just than emphatical. (See his treatise, entitled "Febrifugum Magnum, or Common Water the best Cure for Fevers," London, 1723.) The cinchona, or Peruvian bark, has been termed the greatest febrifuge, probably on account of its efficacy in the cure of intermittent fevers, or agues, but, strictly speaking, it is a *preventive* in these cases; since its efficacy consists in preventing the return of the fever, by strengthening the body in the interval; and not in allaying the fever itself, over which it has no power. The secret preparation of antimony, which Dr. James employed, and which was sufficiently popular for many years, as a febrifuge, to enrich the inventor and his family, possesses no other power in allaying fever, than its operation as a purgative and diaphoretic. See *FEVER*.

FEBRIS. See *FEVER*.

FEBRIS *Amphemerina*, from *εμψι* and *ἡμέρα*, a day, an appellation given by some of the moderns to that form of remittent fever, in which similar remissions and exacerbations occur daily, in order to distinguish it from the daily inter-

mittent, which is called febris quotidiana. (See Sauvages, Nosol. Method. class ii. order ii. genus 6.) It has been also denominated by Latin writers quotidiana continua. (See Senertus de Febris, lib. ii. cap. xiv.) "Est febris perpetuo quidem durans," says this author, "et nunquam ad *ἀπαρξία* deveniens, singulis tamen diebus exacerbationes suas habens a pituitâ sanguini permixta." It is the synecdoche or continens fever of Morton, erroneously so called: and the febris latica of some writers in barbarous Latin. The terms *ἀμφημερινα*, *amphemerina*, as well as *cathemerina*, and *methemerina*, derived from the lame root, with the addition of the prepositions *κατα* and *μετα*, were applied by the Greeks to this fever, as well as the quotidian intermittent. See REMITTENT.

FEBRIS *Anginosa*, a term applied to fevers accompanied by a sore throat, or angina. See CYNANCHE.

FEBRIS *Defecatoria*, the same with *depuratoria*, a term used by Sydenham, Quesnay, and other humoral pathologists, to denote such a fever as terminates by a critical discharge, which was supposed to rid the system of morbid humours. See DEPURATORIA.

FEBRIS *Elodes*. See ELODES.

FEBRIS *Ephemera*. See EPHEMERA.

FEBRIS *Epiolos*. See EPIALOS.

FEBRIS *Gastrica*, an appellation applied to those modifications of fever in which the stomach and bowels are more particularly affected; as with pain, diarrhœa, especially when the stools are of a morbid appearance, or fetid, &c. (See Burserius, Inst. Med. Pract. vol. i.) The same variety of fever has also been denominated febris stercoralis, and by Quesnay *fièvre excrementeuse*. (Traite des Fievres, tom. ii.)

FEBRIS *Hemitritæa*, *ἡμιτριταία*, the same with semi-tertian. See FEVER, *Semi-tertian*.

FEBRIS *Lypiria*. See LYPYRIA.

FEBRIS *Phricodes*, from *φρίξω*, *febrile chill*, called also febris horrida and horrifica, a variety of fever in which the rigors or chills are frequent. See PHRICODES.

FEBRIS *Synochus*, also *Synocha*, different modifications of continued fever, the former term being applied to the milder, the latter to the more violent, inflammatory or ardent species. See those words.

FEBRIS *Tritæophia*, a remittent fever with the remissions and exacerbations occurring only on the alternate days; it differs from the tertian intermittent, as the febris amphimerina differs from the quotidian. See REMITTENT.

FEBRIS *Tetartophia*, a remittent fever, with the remissions and exacerbations on the fourth day from the commencement, that is, with an interval of two days between each remission; and differing from the quartan, as the preceding article from the tertian intermittent. The tritæophia and tetartophia have also been denominated tertiana continua, and quartana continua. See REMITTENT.

FEBRIS *Typhodes*. See TYPHUS.

FEBRUA, or FEBRUATA, in *Mythology*, an appellation given to Juno as the goddess of purification, and as presiding over women in the pains of labour and childbirth. She was so denominated, because the pontiffs paid her a peculiar worship on the first day of February.

FEBRU, in *Antiquity*, a feast held by the Romans in the month of February, in behalf of the manes of the deceased.

Macrobius tells us that sacrifices were here performed, and the last offices paid to the shades of the deceased. (Saturn. lib. i. cap. 13.) And from this feast it was that the month of February took its name.

The design of these sacrifices is somewhat controverted: Pliny says they were performed to render the infernal gods

propitious to the deceased; though some of the moderns have imagined that they were intended to appease the deceased themselves, and were offered immediately to them as a sort of deities. What confirms the former sentiment is, that Pluto himself is furnished Februus. They lasted twelve days.

The word is of an ancient standing in the Latin tongue; from the very foundation of the city we meet with *februa* for purifications, and *februare*, to purge or purify. Varro, (De Ling. lib. v.) derives it from the Sabines; Vossius and others from *ferreo*, I am hot, because purifications were chiefly performed with fire and hot water. Some go higher, and even deduce the words from *פֶּבַר*, *phur*, or *phavar*, which in the Syriac and Arabic has the same signification with *feruit*, or *effervuit*, and might probably likewise signify to purify; for *plazar*, in Arabic, denotes a preparation given to women in child-bed to bring away the after-birth, and other impurities remaining after delivery, much as among the Romans, who gave the name Februa to the goddesses supposed to preside over the delivery of women. Ovid. Fast.

FEBRUARY, FEBRUARIUS, in the *Roman Chronology*, the second month of their year, so called from *februa*, a feast held therein.

In the first ages of Rome, February was the last month of the year, and preceded January, till the decemviri made an order that February should be the second month of the year, and come after January. See BISSEXTILE.

FECAMP, in *Geography*, a town of France, in the department of the Lower Seine, and chief place of a canton, in the district of Le Havre, nine miles S W. of Dieppe. The place contains 7000, and the canton 14,981 inhabitants, on a territorial extent of 82½ kilometres, in 13 communes. The principal commerce consists of linen, serges, lace, leather, and hats: the herring fishery employs many vessels: and smaller boats fish along the coast. N. lat. 49 46'. E. long. 0° 28'.

FECES. See FÆCES.

FECIALES, or FOCIALES, an order of priests or officers consisting of twenty persons, among the ancient Romans, appointed to proclaim war, negotiate peace, &c.

Festus derives the word from *ferio*, I strike, as *ferire fœdus* signifies to conclude a treaty; and accordingly, instead of *feciales*, he would have it wrote *feriales*. Others derive it from *fœdus*, which was anciently written *fedus*; or from *fides*, *faith*; others from *facio*, *feci*, I make, &c. because they made war and peace. Vossius chooses to derive it from *fatu*, of the verb *fari*, to speak: in which sense the *feciales* should be the same with *oratores*; which sentiment is also confirmed by the authority of Varro, who says they were called indifferently, *feciales* and *oratores*. De Vit. Popul. Roman. lib. ii.

The *feciales* were a sort of heralds or kings at arms, who, when the Romans had any dispute with their neighbours, were sent first to demand the thing pretended to be usurped, or require satisfaction for the injury alleged to be done. If an answer was not returned by them that was satisfactory to the people and the senate, they were dispatched again to declare war, and the like in treating of peace, the *feciales* being the only persons appointed to negotiate between the senate, &c. and the enemy.

Plutarch, in the Life of Numa, and Halicarnassens, lib. ii. observe, that they were first instituted by that prince. The latter adds, that they were chosen out of the best families in Rome; that their office, which was reputed a sort of sacerdotium, or priesthood, only ended with their life; that their persons were sacred and inviolable, as those of other

priests; that they were even charged to see the republic did not declare war unjustly; that they were to receive the complaints and remonstrances of nations who pretended to have been any way injured by the Romans; that if those complaints were found just, they were to seize the criminals, and deliver them up to those they had offended; that they were invested with the rights and privileges of ambassadors; that they concluded treaties of peace and alliance, and took care they were executed; and, lastly, abolished them if they were found not to be equitable. Livy, lib. i. cap. 24. ascribes their institution to Ancus Martius, in the year of Rome 114. See also Aul. Gell. lib. xvi. cap. 4.

But Varro assures us, that in his time most of these functions of the *seciales* were set aside; as those of the ancient heralds at arms are among us at present; and though Plutarch observes, that they had still some authority in his time.

The *seciales* were crowned with *verbena*, *vervain*, when they went to declare war; their head was covered with a veil, over which the crown was applied; in this equipage they proceeded to the frontiers of the new enemy's country, and threw a bloody dart or javelin into the ground within the same. In Livy, and other ancient authors, we have the formula used in such declarations.

FECKENHAM, JOHN DE, in *Biography*, the last mitred abbot who sat in the house of peers, was born of poor parents, who resided in a mere cottage on Feckenham forest, in Worcestershire, from which place he derived his name, that of his family being "Howman." His natural abilities induced the parish priest to educate him, and then to obtain for him an admission into the monastery at Evesham. When he was eighteen years of age, he was sent to Gloucester college, Oxford; where he resided a sufficient time to improve himself in academical learning, and then he was recalled to his abbey. Upon the dissolution of this place, in 1536, he had a yearly pension of one hundred florins allowed him during his life. He now returned to Oxford, and in a short time took his degree, and was appointed chaplain to Dr. Bell, bishop of Worcester. He was afterwards chaplain to Bonner, bishop of London, and, in 1549, when Bonner was deprived of his bishopric, his chaplain was committed to the Tower of London. The cause of his imprisonment was first promising, and then refusing, to administer the sacraments after the Protestant manner. He was afterwards, to use his own expression, "borrowed from prison to take part in different disputations on the points at issue between the Protestants and Papists," which were held at the houses of some persons of high rank, and was carried into Worcestershire, where he still held a benefice to maintain solemn public debates with Hooper, the bishop of that diocese. These disputations producing no change in his religious opinions, he was most shamefully remanded to the Tower, where he was kept till the accession of queen Mary, in 1553. He was now made chaplain to the queen; and also chaplain to Bonner, by whom he was presented to the prebend of Kentish Town, in St. Paul's cathedral. He was deputed to lady Jane Grey, to attempt her conversion two days before she was executed, but his mission proved to be entirely fruitless. From the prebendary of St. Paul's, he was, in the year 1554, raised to the deanery; and received other valuable preferment. In the same year he was appointed to dispute against Cranmer, Ridley, and Latimer, before those exemplary characters were committed to the flames by order of the bloody queen, and her still more infamous prelates. Feckenham, it is believed, was no party in these horrible crimes, and abhorred even the office of attempting to change the opinions of men, whom in his heart he could not but respect. He was kind and humane, and distinguished

himself in performing a thousand good offices for the afflicted and persecuted Protestants. He went so far in this cause as to offend his bigoted mistress, who probably began to be suspicious of his principles. In 1556 he was created D.D. out of respect to his learning, piety, benevolence, and other virtues, without being called on to perform the accustomed exercises. In the same year, queen Mary restored the monastic foundation of Westminster Abbey, and appointed Feckenham abbot of the same, with episcopal power over the monks. When Elizabeth came to the crown in 1558, she did not require to be reminded of her obligations to this worthy man, who had pleaded for her liberty when imprisoned by her sister, but offered him the highest promotion in the church, provided he could conform to the changes then in contemplation. This his conscience obliged him to refuse: he went much farther; he thought it his duty to oppose the reformation in the house of peers, where he sat as a mitred abbot in the lowest place on the bishop's form. For his steady attachment to his own principles, and for the eloquence with which he pleaded against the innovations of the times, he was committed to the Tower in 1560, and continued in that prison till 1663, when he was removed to the custody of Dr. Horne, bishop of Winchester, who probably engaged to convert him from his errors: a task much too difficult for the prelate, who, it appears, in a few months, sent him back to the Tower. Shortly after, at the solicitation of his friends, he was removed to the Marshalsea, from which he soon obtained a complete discharge. In 1574, he was again imprisoned, and released upon giving bond for his appearance when called on. It must be observed, that this mode of giving and taking bond is often resorted to as an apology for the government, when they know that they have stretched the limits of their power, and by submitting to give bond or bail for appearance, the aggrieved and injured person, in truth, justifies the conduct of those who have inflicted the injury. Feckenham, at length, wearied with frequent prosecutions, acknowledged the queen's supremacy, but could be persuaded to go no farther, and he was again imprisoned at the castle of Wisbeach, where he spent the remainder of his days, and died in 1585. Camden calls him "a learned and good man, that lived long, did a great deal of good, and always solicited the minds of his adversaries to benevolence." Fuller styles him a man cruel to none, courteous and charitable to all who needed his help. Burnet and others bear their testimony likewise to the excellence of his character. *Biog. Brit.*

FECULA, in *Chemistry*. This term is usually applied to any pulverulent matter extracted from any part of a vegetable, simply by breaking down its texture, washing with water, and sublimence. It is therefore a most minutely divided substance, capable of being suspended in cold water, but not dissolved.

The most important of these is the *amylaceous fecula*, a nutritive insipid substance contained abundantly in grains, seeds, and roots, and which, when extracted, purified, and dried, forms the common *Starch*, the manufacture of which will be described under that article.

Most parts of vegetables will furnish this fecula, but it is particularly found in grains, seeds, and roots, united with an extractive and saccharine matter, sometimes with gluten and vegetable albumen, with mucilage, and oil. Of roots, the tuberous and bulbous are those which contain the most fecula; the medullary part of trees and plants also abound with it.

The extraction of the fecula is very simple, but it cannot always be obtained free from colour and taste. The root

or grain must first be broken down into a pulp by rasping or other mechanical means, and then washed with cold water, which becomes immediately turbid. This is to be hastily poured off from the fibrous part of the pulp through a coarse sieve, and allowed to remain at rest for a few minutes, during which the fecula subsides to the bottom in the form of a very fine close-grained powder, but without any tenacity or cohesion, and of the consistence of very fine wetted sand: The supernatant liquor always remains somewhat turbid, and generally coloured with mucilage or extract. The fecula should be washed repeatedly with abundance of cold water, till this comes from it quite insipid and colourless.

It should be observed, however, that it is only from a few of the grains and roots of plants that the extraction of the fecula is thus easily effected; for where this substance is intimately united with oil and mucilage, as in the almond, and many other kernel seeds, the whole is rendered uniformly diffusible in water nearly in an equal degree, and the fecula will not be deposited pure by mere subsidence, nor indeed is there any way by which it can be obtained very pure when in this combination.

The chemical properties of pure fecula (taking fine starch as an example), are the following:

It is a white powder, nearly, if not entirely, insipid, somewhat adhering to the tongue, but not soluble in the mouth. When examined with a lens in a good light it appears composed of small semi-transparent grains, with a satiny gloss, and somewhat of a crystalline arrangement. It is not easily moistened with cold water, but when rubbed with this fluid it makes an incohesive mass, which, on drying, cracks into small pieces. When wetted and kept in a moderate warmth, the mixture slightly ferments and turns sour.

Boiling water, however, acts very differently on fecula, for it dissolves that substance speedily and totally into a thick, tenacious, transparent jelly, which becomes still more tenacious by long boiling, as is seen in the ordinary domestic use of starch. When liquid starch is slowly dried, it shrinks in every direction as the water evaporates, and finally becomes a transparent brittle substance, exactly resembling gum-mucilage.

Most of the acids dissolve fecula with ease, especially when assisted with heat, and with nearly the same products and appearances that attend the action of the same acids on mucilage.

The alkalies also dissolve fecula readily, but the precise chemical effects of these agents have not been much examined.

When starch is heated strongly in the open air, it first becomes yellow, then brown, and red, softens, puffs up, exhales a white pungent acid smoke, and leaves a bulky soft coal. The products of its distillation *per se* are, a water loaded with pyromucous acid, some drops of a red-brown oil, much carbonic acid, and hydrocarbonous gas. The ashes of the coal, when fully calcined, contain a little potash and phosphat of lime.

Starch, when kept dry, and secluded from the air, will remain long unaltered, though at last it runs into clots, and acquires a sour musty smell.

In chemical properties the amylaceous fecula bears the strongest resemblance to mucilage.

Of the green Fecula of Plants.—This substance, which has been the subject of much curious investigation, must be carefully distinguished from the amylaceous fecula last described, to which indeed it has no other resemblance than in the mere circumstance of being sometimes obtained in a fine pulverulent form by spontaneous subsidence.

Many of the green succulent vegetables, when pressed mo-

derately, afford a turbid green juice, which, when filtered, gives a clear but tenacious juice, that passes through the filter, whilst there remains behind a green pulp, which is the species of fecula in question. Rouellé was the first who pointed out the nature of this fecula, shewing that it was totally different from the amylaceous fecula, but bore a strong resemblance to the gluten of wheat, mixed, however, with a kind of resinous substance soluble in alcohol, to which the green colour is chiefly owing.

Proust has also given some valuable observations on this subject (*Journal de Physique*, tom. 56.) of which the following is an abstract.

When any of the green turbid juice of plants, (such as of hemlock, cress, cabbage, &c.) is heated, it becomesropy, and soon coagulates in part, forming a tough, green, glutinous mass, that separates from the liquor, which last now loses its colour and remains limpid. The heat of 145° is sufficient to separate all this fecula, which is less than what is required to coagulate albumen, one circumstance that establishes some difference between this fecula and albumen, to which it has been likened by Fourcroy. If the coagulated fecula is gently dried, it hardens into an elastic horny substance, which will not again unite with water. If this fecula, either before or after coagulation, be kept under water in warm weather, it becomes offensive in a day's time, and has the nauseous smell and other circumstances attending the putrefaction of animal matter. The water in which this fecula has long been kept contains sulphuretted hydrogen, and carbonat of ammonia.

This fecula is precipitated from the native juice by almost any neutral salt, which, probably, is merely owing to the superior affinity of the salt for the water in which the fecula is held dissolved.

When the entire green feculous precipitate, formed by heating the recent juice, is treated with alcohol, a portion only dissolves therein, leaving about 80 *per cent.* of the whole precipitate untouched. The alcoholic solution, evaporated to dryness, leaves a soft green substance, somewhat resembling a resin, but differing from it in not being separated from the alcoholic solution on addition of water. Alcohol, added to the entire juice of the plant recently expressed, produces a white precipitate, and leaves a green resinous solution. Oxymuriatic acid destroys the green colour, both of the entire juice and of the alcoholic solution.

On the whole, it seems probable that the green fecula of the herbaceous vegetables consists of two parts, namely, of a green substance, soluble in alcohol, and very similar to the resin; and of another principle, coagulable by a very gentle heat, susceptible of putrefaction, like animal matter, producing much ammonia when heated, soluble in alkalies, and which bears a very strong analogy with animal gluten.

FECULENT, or FACULENT, is applied to the blood and other humours, where they abound in feces or dregs, or have not the proper and usual degree of purity.

FECUNDATION of PLANTS, in *Vegetable Physiology*, is now generally believed to be accomplished by the action of the pollen of the anthers upon the stigma. (See ANTHROPE.) This doctrine, having been previously asserted by several physiologists towards the end of the seventeenth century, was variously illustrated and finally established by Linnæus towards the year 1732. His subsequent publications all tend to confirm it, especially his prize dissertation, published by the Imperial Academy at Petersburg in 1760, translated into English, with notes, by the author of the present article in 1786. Whether the hypothesis advanced in that work, that the stamens, or male organs, derive their origin from the cortical part of the plant, and the pistils, or female

female ones, from the medullary substance, be founded in truth, is not to our present purpose. There are many facts and analogies which support that theory; and what theory, in the hands of an ingenious man, is destitute of such supports? The idea is altogether speculative; and the doctrine of vegetable impregnation, which we shall now briefly explain, is entirely independent of it.

As far as the flowers of any plant have been clearly ascertained and dissected, they are found to consist of two essential kinds of organs, the stamens and pistils. The essential part of the former is the anther, a capsular body containing the pollen; which last, even after it is dislodged from the anther, is found to be also in general capsular, though in some instances of a glutinous substance. In either case the pollen finally discharges something, in the form of a vapour or essence, by which its final purpose is answered. The essential part of the pistil or pistils, on the other hand, is the stigma belonging to each. This is formed so as to receive and retain the pollen, being either downy or concave, often irritable, and especially furnished with a peculiar viscid moisture of its own, which causes the pollen, when of a dry nature, to explode, and when otherwise, to give out its essential substance, so as to be communicated through the medium of the said peculiar moisture, to the rudiments of the seeds, which by that means alone are enabled to bring to perfection the latent embryo of the future plant within them, or, in other words, to become prolific. It has been ascertained that seeds, however apparently perfect in all their other parts, have no embryo unless the pollen has acted upon them as above-mentioned. (See EMBRYO and CORCULUM.) That the pollen is not of an excrementitious nature, and has functions to perform after it has left the anther, is evident from its elaborate structure, and highly elastic, and apparently active, contents, which are subsequently discharged. That its functions, whatever they may be, are not performed by any clandestine communication with the infant seeds, through the other parts of the flower, is demonstrated by the great numbers of flowers which have the stamens in one individual, and the pistils in another, of the same species, growing on different stalks or even distinct roots. That the stigma is no less important an agent than the pollen, appears from its vitality being retained till it has received that stimulus, and no longer, while the parts immediately connected with the stigma, destined to contain, protect, or hereafter to transport, the growing seeds or fruit, remain in full vigour till their destination is accomplished. Thus the styles of many umbelliferous plants, and various others, after their stigmas are entirely withered, become lengthened, hardened, or recurved, so as to form hooks by which the ripe seeds stick to the coats of animals, and are by that means widely dispersed. Other styles become feathery crowns or wings, through whose support the seeds are waisted away by the wind, as in most compound flowers. In every case the stigma, however elaborate an organ originally, will be found to have long since disappeared, its "fountains of life" having been dried up as soon as the ends of its creation were accomplished. That the female organs of a flower are, during their growth, before fecundation, independent of the male ones, or stamens, is proved by removing the latter, and impregnating their appropriate pistils with pollen from another blossom of the same species, which will then as effectually perfect their seeds as if they had received pollen from the anthers which naturally belong to them. This last experiment is most satisfactorily performed on flowers that last but one day, as the various species of *Glaucium* or Horned-poppy.

Innumerable collateral circumstances confirm the doctrine

of vegetable fecundation here advanced. If the pollen be caused to explode prematurely by adventitious moisture, before it reaches its final destination at the stigma, its purpose is defeated, and the appropriate pistils prove barren. This happens to corn and fruit-trees occasionally, from superabundant and uninterrupted rain. Cold also is hurtful, as benumbing the vital energy of the stigma and its concomitant parts. Excessive, irregular, or unhealthy nourishment sometimes changes the nature of the stamens and pistils, so effectually as to transform them into other parts of a flower, chiefly petals, thereby entirely defeating their natural purpose, and producing those beautiful monsters called double flowers, which generally return to a natural state, if restored to their natural soils and situations. Accidental or artificial cross fecundation, by application of the pollen of one flower to the stigma of another nearly akin, thereby producing a male offspring, more or less resembling both its parents, but, like animal mules, only transiently, imperfectly or not at all, prolific, is perhaps the most conclusive proof of the truth of this doctrine. Linnæus performed such an experiment on the *Tragopogon pratensis*, whose flowers are yellow, by sprinkling its stigmas with pollen taken from *Tragopogon porrifolius*, whose flowers are dark purple. The offspring bore purple flowers, yellow at their base, than which nothing could be more conclusive; and the many varieties, or seemingly new species, of Cape Geraniums, which come up spontaneously from seed ripened in our gardens, and sooner or later decline and disappear, afford no less evident confirmation of the sexes and fecundation of vegetables. S.

FECUNDITY, or FOECUNDITY, *Fertility*, or that quality of a thing which denominates it fruitful.

The fecundity of divers plants is very extraordinary. M. Dodart has an express discourse on this subject, in the Memoirs of the Academy of Science; wherein he shews, that, at a moderate computation, an elm, one year with another, yields 329,000 grains or seeds, each of which, if properly lodged, would grow up into a tree: now an elm ordinarily lives 100 years, consequently, in the course of its life, it produces near 33,000,000 seeds, all which arise from one single seed.

He shews farther, that the same elm, by frequently cutting off its head, &c. might be brought to produce 15,840,000,000 seeds, and, consequently, that there are so many actually contained in it.

FECUNDITY of Fish. See FISH.

FECUNSUM, in *Geography*, a town of Japan, on the N. coast of Nippon; 28 miles N. of Noto.

FECURI, a town of Japan, in the island of Nippon, on the gulf of Jedo; 65 miles S. of Jedo.

FECYUS Moxs, in *Ancient Geography*, a mountain of Gallia Narbonensis, situated on the bank of a lake, near the sea, at the mouth of the Rhône, in the country of the Velfei Arceonici.

FEDALA, in *Geography*, a sea-port town of Africa, in Morocco, on a bay of the Atlantic, forming the road belonging to this town, scarcely sufficient to shelter a few small vessels; 8 leagues S. of Monfooria. The above-mentioned bay is partly formed by a little point of land which projects into the sea, and which has been improperly denominated an island. In the year 1773 the reigning emperor, having permitted a great quantity of corn to be brought out of the matadores contiguous to this road, determined to avail himself of the opportunity thus offered for building a city, by obliging the merchants, who wished to have any part of the corn, to build some houses; and thus the town of Fedala was begun in a very advantageous situation; but no sooner was the corn disposed of than the town was abandoned;

doned; so that it was ruined before it was finished. The road of Fedala being defended by the coast, which, on the southern side, perceptibly extends to the west, ships may safely anchor here in winter; but, in summer, when the winds blow strong from the N.N.W., the swell of the sea is very incommodious.

FEDER SEA, a lake of Germany, in the circle of Swabia, about 12 miles in circumference; communicating with the Danube by a river called Krantzach; the lake is a little to the east of Buchau.

FEDERATION, or CONFEDERATION, applies principally to a certain coalition among powers, generally adjunctly situated, and nearly equal in power, for the purpose of maintaining their independence, or for the conquest of some obnoxious people, with whom none of the parties could cope unless aided by the forces of his neighbours. This excellent policy has been on many occasions resorted to as the means of self-defence, and, when duly maintained, has rarely failed to accomplish its intent; but, unhappily, we experience in this branch of politics all those evils inseparably attendant upon every combination of persons whose views and interests are not strictly in unison; jealousy, ambition, and resentment for supposed slights, rarely fail to banish that harmony, on which alone the safety of all must depend. Of this, we have a lamentable instance in the late dismemberment of the German empire, of which the several members allowed themselves to be swayed by hopes and expectations, such as must ultimately prove illusive; in the mean time they enable him, who should have been considered their common enemy, to destroy the very foundation of their safety, both general and individual, and to extend that power, which had already proved itself too extensive, to admit that Europe should repose in peace, or even preserve its independence.

In like manner we see that immense federation, formed in the heart of Hindoostan by the Mahrattas, proceeding with hasty strides towards its dissolution. There the several princes allowed themselves to be actuated by ambition; each wanted to become the head of a formidable empire; each viewed his neighbour's dominions with a longing eye, and viewed his every act with suspicion and doubt. Hence it was no difficult task to set the whole at variance, and to sow discord so abundantly among them, as to raise an impenetrable barrier against reconciliation, and future co-operation.

Though not so evidently marked, a certain characteristic of this description may be traced in the conduct of those Indian tribes inhabiting the interior of North America. Formerly, to insult one, was to challenge the whole; but since they have become familiarized to the use of spirituous liquors, and been taught to look forward to their own separate interests, each tribe has been, to a certain degree, estranged from the federation, and all have consequently been, more or less, bereft of both property and power. In this case, however, we are induced to throw a veil over the privations, and the sufferings of a people who have contributed so little, if at all, to the welfare of the world at large; viewing them as ferocious, sanguinary, and treacherous, we may be permitted rather to exult in, than to condemn those encroachments which carry with them civilization and improvement; we therefore feel no disposition to become their partizans.

With respect to that federation or league which has been so often attempted, and so invariably baffled, for the narrowing our maritime influence, little need be said. So long as our ministers remain faithful to their trust, we may confide to the British navy the charge of supporting that

exalted character for which it is not indebted to empty panegyric, but to its own substantial merits.

The British empire, while its three component parts, *viz.* England (including Wales), Scotland, and Ireland, though governed by one king, had their respective parliaments, and consequently separate establishments and different laws; could be considered only as a federation. A very cursory review of past events in those several portions of the united kingdom must satisfy every reflecting mind, that human wisdom could not have devised a more prudent, or a more necessary measure, than the abolition of those distinct forms of legislation, upon which our enemies ever depended for support. It is true the minds of all are not as yet reconciled to the combination, but we may safely venture to predict, that posterity will do justice to the sagacity and integrity of that minister who bound our whole population to each other, by mutual advantage; a much stronger tie than could possibly be effected by *federation*.

FEDIA, in *Botany*, a name which originated with Adanson, and seems to be derived from *Fedus*, an ancient word for *Hædus*, a kid. This derivation might at least be probable, if the *Fedia* of Adanson, like that of subsequent authors, included the Lamb's Lettuce, but it consists of *Valeriana sibirica* only, to which the name is not in that sense appropriate, except by a very lax concatenation of ideas. Still less surely can it be deduced from *fædus*, filthy, fætid, or mean.—Adanson Fam. des Pl. v. 2. 152. Gærtn. t. 86. Vahl. Enum. v. 2. 18. Michaux Boreali-Amer. v. 1. 18. (*Valeriana*; Linn. Gen. 22. Schreb. 29. Willd. Sp. Pl. v. 1. 175. Sm. Fl. Brit. 37. Juss. 195. *Valerianella*; Tourn. t. 52. Rivin. Monop. Irr. t. 5. *Locusta*; *ibid.* t. 6. *Polypremum*; Adans. loc. cit.) Class and order, *Triandria Monogynia*. Nat. Ord. *Aggregate*, Linn. *Dipsacæ*, Juss.

Gen. Ch. Cal. Perianth superior, very small, with three or four teeth, at length variously dilated, permanent. Cor. of one petal, funnel-shaped; tube gibbous; border five-cleft, regular or irregular, bluntish. Stam. Filaments three, sometimes four, five, or six, inserted into the corolla, awl-shaped, erect, nearly as long as the border; anthers roundish. *Pist.* Germen inferior, of three cells; style thread-shaped, the length of the stamens; stigma notched. *Peric.* Capsule coriaceous or membranous, not bursting, crowned with the calyx, of two abortive cells and one fertile. *Seed* solitary, ovate, smooth.

Ess. Ch. Calyx superior, with three or four teeth. Corolla of one petal, five-cleft. Capsule crowned, without valves, with one fertile cell. Seed solitary.

Perhaps this genus may properly be separated from *Valeriana*, but it is a question of some difficulty, their natural affinity being very great, and the structure of the parts of fructification in both extremely various. *Telesia* consists of 12 species in Vahl's *Enumeratio Plantarum*, that author raising to the rank of species, several heretofore esteemed varieties of *Valeriana Locusta*, Linn. Sp. Pl. 47. Engl. Bot. t. 811. Among these are *V. dentata*, Sm. Fl. Brit. 135. Engl. Bot. t. 1370.

F. cornucopia (*Valeriana cornucopia*; Linn. Sp. Pl. 44. Sm. Fl. Græc. Sic. t. 32.) is one of the handsomest, but it is one that most betrays a strict relationship to *Telesia*, and perhaps ought to combine the two genera. If every *Valeriana* had that feathery crown to the fruit, of which no traces are found in the flower, and which makes so striking a character in most of the species, the distinction would be obvious and certain, and when they are all properly examined, in flower and in fruit, it may be found to hold good. If not, we presume *Fedia* can scarcely be supported.

FEDOA, in *Ornithology*, the great Godwit, a species of *Scelopax*, which see.

FEDOA, is also a name given by Willughby and Ray to the Stone-Curlew or thick-kneed bunting, the *CHARADRIUS Oedicnemus*.

FEE, FEUD, *Feudum*, *Feodum*, or *Fief*, an estate, land, tenement, lordship, or the like, held of a superior lord, on condition of fealty, homage, or other acknowledgment.

The word is derived by some authors from *fidus*, as arising from a treaty or alliance made with the lord; but the opinion of Selden seems the best authorized, who deduces it from the Saxon, *feob*, *stipendium*, the fee being a kind of prebend to live upon; and accordingly we find, that in ancient times it was used for the wages and appointments of officers. It is observed by Pontopiddan, in his History of Norway, that in the northern languages *odh* signifies property, and therefore *feedoh*, or *feudum*, will denote *stipendiary property*.

The term fee is properly applied to lands and tenements, which we hold in perpetual right, on condition of an acknowledgment of superiority in a higher lord. See *TENURE*.

The writers on this subject divide all land and tenements wherein a man has a perpetual estate to him and his heirs into allodium and feudum.

Allodium is defined to be a man's own land, which he possesses merely in his own right, without acknowledgment of any service or payment of any rent to another; and this is property in the highest degree.

Feudum, or fee, is that which we hold by the benefit of another, and for which we do service or pay rent, or both, to the chief lord; in which superior the ultimate property of the land resides. And therefore Sir Henry Spelman defines a feud or fee to be the right which the vassal or tenant hath in lands, to use the same, and take the profits to him and his heirs, rendering to the lord his due services: the mere allodial property of the soil always remaining in the lord. This allodial property no subject in England has; it being a received, and now undeniable, principle in the law, that all the lands in England are holden mediately or immediately of the king.

Originally a feud was only an estate for life; and those to whom it was granted were called *vassalli*, who by such means were brought to a stricter discipline and obedience to the princes, and were bound to serve them in wars.

The origin of fees or feuds is one of the darkest and most intricate points in modern history. Some attribute the invention to the Lombards. Sir Thomas Craig inclines to this opinion, and says, that the Lombards, after they were subdued by Charlemagne, not only retained their ancient customs, but at the return of that emperor into France transmitted them with him into the remotest parts of that kingdom. In reality, the constitution of feuds had its original from the military policy of the Northern or Celtic nations, the Goths, Huns, Franks, Vandals, and Lombards, who spread themselves over Europe at the declension of the Roman empire. This is rendered probable by the demand which the Cimbric and Teutonic nations of the same original, are recorded to have made on the Romans on their first irruption into Italy, about a century before the Christian era. They demanded of the Romans, "Ut martius populus aliquid sibi terræ daret, quasi stipendium: cæterum, ut vellet, manibus atque armis suis uteretur;" i. e. they desired feuds to be allowed them, which they were to hold by military and other personal services. (L. Florus, lib. iii. cap. 3.) Having brought this constitu-

tion from their own countries, they continued it in their respective colonies as the most likely means to secure their new acquisitions; and for this purpose the victorious general allotted large districts of land to the superior officers of the army; and these again distributed smaller parcels to the inferior officers and more deserving soldiers. However, the feudal policy was only brought by degrees into that state, which we find established in the empire under Conrade the Salic, who was the first emperor that rendered fiefs hereditary, and in France under Hugh Capet. Sir Thomas Craig has distinguished four states of the feudal law; its infancy, comprehending the period between the first overflowing of the northern nations and the year 650; its childhood, the time in which fiefs, which were before annual, or at most for life, were extended to the sons of the vassal, and no farther, viz. from the year 650 to the year 800, when Charlemagne was crowned emperor; its adolescence, from the times of Charlemagne to those of Conrade II. or the Salic, who began his reign in the year 1024, and not only confirmed the inheritance of fiefs to the sons and grandsons of the vassals, but permitted one brother to succeed another in his paternal estate: but even after the alteration made by Conrade, it was not uncommon in Germany to grant fiefs only for life; a charter of this kind occurs as late as the year 1376; and its maturity from this period forward, when feuds were permitted to descend to collaterals as far as the seventh degree. Others find some appearance of the duties of a vassal to his lord, in the ancient relations between the patron and his client; and others look for its rise in the Roman *Beneficia*.

The emperors, it seems, distributed lands among the ancient legions on condition of their holding themselves ready at all times to take up arms in defence of the frontiers of the empire, which affords us a good image enough of feuds, though in all probability their first origin should be traced higher; but in process of time their nature was changed, and duties were annexed to them which originally were not.

Du-Moulin makes no doubt, but that those distributions of land called *benefices*, were the first matter of fees; for which reason he uses the terms *benefice* and *feud* promiscuously, as if they were the same thing; and yet there was a good deal of difference between them, as there was neither fealty nor homage, nor the other feudal rights annexed to the benefice; and that the benefice was not hereditary.

Probably benefices, (see *BENEFICE*,) began then to be called feuds, when they became hereditary; and when those of whom the benefices were held began to demand faith or fealty from them. This fealty seems to constitute the *fee*; the word fee itself signifying, in the ancient Norman language, *faith*.

There is no fixing the precise era when these changes commenced; for fees, such as they now are, were not established all at once; but in different countries they took place at different times, and in different manners.

The great lords, after the destruction of the Roman empire, having in several parts usurped the property of their benefices, laid likewise hold of the jurisdiction, and made their vassals their subjects; so that each became a sort of petty sovereign in his own territory.

Mezeray observes, that the donation of fees to the nobles of France commenced under the reign of Charles Martel.

Hugh Capet, when he came to the crown, was himself so little established that he durst not oppose those usurpations, and was forced to suffer what he could not redress.

redrefs. See Le Fevre, De l'Origine des Fiefs, and Alfaferra's Origines Feudorum primoribus Gallæ. See FEUDUM.

The origin of fees in England, Camden carries as far back as the time of Alexander Severus. That prince having built a wall in the north of England to prevent the incursions of the Picts, he some time after began to neglect the defence thereof, and gave, as Lampridius, in Vita Alex. Severi, assures us, the lands conquered from the enemy to those of his captains and soldiers, whom that author calls "limitarios duces, & milites;" *i. e.* captains and soldiers of the frontiers; but it was on this condition, that their heirs should continue in the service, and that the lands should never descend to private persons; *i. e.* to such as did not bear arms. That prince's reason was, that people, who in serving, defended their own, would serve with a great deal more zeal than any others. Such, according to Camden, was the rise of fees in our nation. Britan. p. 651.

However, the feudal polity originally derived from the Northern nations, and gradually established on the continent of Europe, was not universally received in England, though some traces of it may be discerned in the times of the Saxons, who were firmly settled in this island as early as the year 600, and incorporated with the national constitution, till the reign of William the Norman; and this was done not by the mere arbitrary will and power of the conqueror, but by the universal consent of the common council of the kingdom, on the same principle of self security which had before induced the other nations of Europe to adopt it. The era of formally introducing the feudal tenures by law was probably the latter end of the year 1086, when the king was attended by all his nobility at Sarum, and all the principal land-holders submitted their lands to the yoke of military tenure, became the king's vassals, and did homage and fealty to his person. This ingraftment of the feudal tenures and other customs of Normandy upon the ancient Saxon laws of Edward the Confessor, produced a different political system in this country, and changed both power and property in many respects; for those hereditary estates of the Saxon nobility and gentry which were allodial, and not subject to any feudal service, were converted into feuds, and other lands which were of a feudal nature, and holden by military service, having been granted only at will, or for a certain number of years, or at most for life or lives, and the grants of which were called benefices, were made hereditary fiefs. The feudal rights claimed in consequence of this establishment by the king over his tenants, and by them over their's, were considerably mitigated by the charter of Henry I. But, notwithstanding this charter, former grievances were revived and aggravated by Henry and his successors, till in the reign of king John, they became so intolerable, that they occasioned his barons, or principal feudatories, to rise up in arms against him; which at length produced the famous great charter, (see MAGNA CHARTA,) at Runningmead, which, with some alterations, was confirmed by his son Henry III. Upon the whole it appears from the history of feudal tenures, and the alterations that have taken place with regard to them, in the successive reigns of Henry I., John, Henry III., and Charles, that the liberties of Englishmen are not (as some arbitrary writers would represent them) mere infringements, of the king's prerogative, extorted from our princes, by taking advantage of their weakness; but a restoration of that ancient constitution, of which our ancestors had been defrauded by the art and finess of the Norman lawyers, rather than deprived by the force of the Norman arms. See CONQUEST.

Although the barbarous nations, which framed the feudal

system, and from which it seems to have originated, settled in their new territories at different times, came from different countries, spoke various languages, and were under the command of separate leaders, the feudal policy and laws were established, with little variation, in every kingdom of Europe. Hence some have concluded, that all these nations, notwithstanding so many apparent circumstances of distinction, were originally the same people. It may, however, with greater probability, be ascribed to the similar state of society and of manners to which they were accustomed in their native countries, and to the similar situation in which they found themselves on taking possession of their new domains. As the conquerors of Europe had their acquisitions to maintain, not only against such of the ancient inhabitants as they had spared, but against the more formidable inroads of new invaders, self-defence was their chief care, and seems to have been the sole object of their first institutions and policy. Instead of those loose associations, which, without diminishing their personal independence, had been sufficient for their security, while they remained in their original countries, they saw the necessity of confederating more closely together, and of relinquishing some of their private rights in order to obtain public security. Every freeman, therefore, upon receiving a portion of the lands which were divided, bound himself to appear in arms against the enemies of the community. This military service was the condition upon which he received and held his lands; and as they were exempted from every other burden, that tenure, among a warlike people, was deemed both easy and honourable. The king, or general, who led them to conquest, had the largest portion allotted to him; and he parcelled it out among those who entered into an obligation to bear arms in his defence. His chief officers imitated his example, in distributing portions of lands among their dependants, upon the same condition. Thus, a feudal kingdom resembled a military establishment rather than a civil institution. The names of a soldier and a freeman were synonymous. Every proprietor of land, girt with a sword, was ready to march at the summons of his superior, and to take the field against the common enemy. The feudal government, however, though admirably calculated for defence against the assaults of any foreign power, was defective in its provisions for the interior order of society. The bond of political union was extremely feeble; and the sources of anarchy were innumerable. The powerful vassals of the crown soon extorted a confirmation for life of those grants of land which, being at first purely gratuitous, had been bestowed only during pleasure. They then succeeded in having them converted into hereditary possessions; and at length in rendering them unalienable. The crown vassals, after having secured the possession of their lands and dignities, were led by the feudal institutions to new, and still more dangerous encroachments on the prerogatives of the sovereign. They obtained the power of supreme jurisdiction, both civil and criminal, within their own territories; the right of coining money; together with the privilege of carrying on war against their private enemies in their own name, and by their own authority. Subordination was almost lost, and persons of superior rank aspired at independence. Hence a kingdom, considerable in name and extent, was broken into as many separate principalities as it contained powerful barons. A thousand causes of jealousy and discord sprang up among them, and gave rise to as many wars. Every country in Europe, wasted or kept in continual alarm during these endless contests, was filled with castles and places of strength, erected for the security of the inhabitants, not against foreign force, but against internal hostilities. Indeed an almost universal anarchy prevailed. The gentry
 escaped

escaped punishment, and the innocent could not find protection. Such was the state of Europe with respect to the interior administration of government from the 7th to the 11th century. This system likewise prevented nations from acting with vigour in their external operations. Besides, the feudal anarchy had a fatal influence on the character and improvement of the human mind. Without the protection of regular government, and the certainty of personal security, it cannot be expected that men will make any progress in the arts and sciences, or aim at attaining refinement in taste or manners. In less than a century after the barbarous nations settled in their new conquests, almost all the effects of the knowledge and civility which the Romans had spread through Europe disappeared. The human mind, neglected, uncultivated, and depressed, sunk into the most profound ignorance. The inhabitants of Europe during this period were not only strangers to the arts which embellish a polished age, but destitute of the virtues which abound among people who continue in a simple state.

Having cursorily mentioned several of the disadvantages and pernicious effects of the feudal system, and they were sufficiently great, we ought not to omit some few circumstances that may be alleged in its favour. This system, in its very nature, stood opposed to the arbitrary power of the crown, and provided for the political liberty of all those who possessed any portion of landed property. This system also nourished a manly and vigorous spirit, which, however hurtful in some of its immediate effects, has been eminently serviceable in the progress of society. We must add, that the feudal system caused even the clergy, too frequently the tools of absolute monarchs, to be the great asserters and promoters of freedom. This fact is ascertained by various instances that occur in our own history. The bishops, in consequence of the feudal tenures, found it their interest to unite with the barons and great landholders in resisting the encroachments of our princes; and they did it, in several cases, with distinguished ability and success. The bishops were particularly instrumental in obtaining the famous *MAGNA CHARTA* (which see.) The most important and valuable articles of that instrument were probably owing to Stephen Langton, archbishop of Canterbury. With respect to the clergy in general, notwithstanding the ignorance and bad conduct of too many of them, and the absurdity of their tenets, they were very useful in moderating and restraining the disorderly spirit of the feudal times. They often interfered in the cause of humanity and justice. They were the only depositaries of the knowledge and literature that remained in the world; and the monastic institutions, in particular, were the chief preservers of agriculture, and of both the necessary and elegant arts.

But to return from this digression. The disorders in the feudal system, together with the corruption of taste and manners consequent upon these, which had gone on increasing during a long course of years, seem to have attained their utmost point of excess towards the close of the 11th century. From that era we may date the return of government and manners in a contrary direction; and it is not difficult to trace a succession of causes and events which contributed to abolish confusion and barbarism, and to introduce order, regularity, and refinement. Among the principal of these we recount the Crusades, the formation of cities into communities, corporations, or bodies politic, and granting them the privilege of municipal jurisdiction; for when the inhabitants of cities obtained personal freedom and municipal jurisdiction, they soon acquired civil liberty and political power. The feudal system, however, did not decline with equal gradations in all parts of Europe. It

did not decline so fast in Scotland as in England; nor, while it was a separate kingdom, did their commons ever acquire the same power. This was owing to the low state of commerce, industry, and arts, among the Scots.

We may observe that there are considerable remains of the feudal system at this day in Europe. In Germany it subsists, in many respects, as much as ever. The husbandmen of Poland are confined to the glebe; as they are also in Bohemia, in Swabia, and in other parts of Germany; and even in France, in some provinces remote from the capital: we see, said Voltaire in his time, some remains of this slavery. The most visible traces of this system in England are in the forms of law; almost all the remains of the feudal system in England, except these forms, having been abolished in the reign of Charles II. by act of parliament. The feudal law carried with it a system of private rights, which swallowed up all others wherever it came, and involved likewise, in giving effect to these rights, a system of "forms," which remain even where the original rights are no more. It is particularly worthy of notice, with respect to the feudal system, that a form of government so uniform in its principles should have branched out, as it were, under different circumstances, into other forms so totally different from one another as are the constitutions of the several European states; which were almost all, originally, equally feudal, and, therefore, necessarily similar to one another. But what is most of all remarkable with respect to the feudal system is, that a form of government, so ill calculated to secure the most valuable ends of society, a constitution so totally inconsistent with security and liberty, and so unfriendly to commerce and science, should, in several instances, have terminated, by the natural course of things, in governments under which men enjoy the greatest security, together with all desirable liberty; and where the utmost scope is given to the genius of man in the extension of arts, manufactures, commerce, and science. Lord Lyttelton's *Hist. of King Henry II.* vol. i. p. 59, &c. vol. iii. p. 97, &c. Blackstone's *Comm.* vol. ii. cap. 4. Robertson's *Ch. V.* vol. i.

All our lands in England (the crown-land, which is in the king's own hand, the right of his crown, excepted) are of the nature of feud or fee. For though many have land by descent from their ancestors, and others have bought lands, yet land cannot come to any, either by descent or purchase, but with the burden that was laid on him who had the novel fee, or who first received it as a benefice from his lord to him, and such as should descend from him, or to him it should be otherwise conveyed and transferred; so that no man has *directum dominium*; i. e. the very property or domain in any land but the prince in right of his crown. (*Camd. Britan.* p. 93.) Though he who has fee has *jus perpetuum*, and *utile dominium*, yet he owes a duty for it; so that it is not strictly his own. Indeed, as much is imported by the terms in which we express our highest right in lands, &c. the most a man can say is, "I am seised of this land in my domain or demesne as of fee."

The grand and fundamental maxim of all feudal tenure is this; that all lands were originally granted out by the sovereign, and are therefore holden, either mediately or immediately, of the crown. The grantor was called the proprietor, or *lord*, who retained the dominion or ultimate property of the feud or fee; and the grantee, who had only the use and possession, according to the terms of the grant, was styled the feudatory, or *vassal*, another name for the tenant or holder of the lands. The manner of the grant was by words of gratuitous and pure donation, "*dedi et concessi*," which are still the operative words in our modern deeds of feoffment. This was perfected by the ceremony of corpora-

ral investiture, or open and notorious delivery of possession in the presence of the other vassals, which perpetuated among them the era of the new acquisition, at a time when the art of writing was little known; and therefore the evidence of property was reposed in the memory of the neighbourhood; who, in case of a disputed title, were afterwards called upon to decide the difference, not only according to external proofs adduced by the litigant parties, but also by the internal testimony of their own private knowledge. The vassal or tenant took an oath of fealty (see FEALTY), and upon investiture did homage to his lord; (see HOMAGE.) This was followed by the service which he engaged to perform to his superior or lord, in recompence for the land which he held. In pure, proper, and original feuds, this service was two-fold; to follow, or do *suit* to the lord in his courts in time of peace; and in his armies or warlike retinue, when necessity called him to the field. At the first introduction of feuds, which were gratuitous, they were precarious, and held at the *will* of the lord; who was then the sole judge whether his vassal performed his services faithfully. Then they became certain, for one or more years. Among the ancient Germans they continued only from year to year; as an annual distribution of lands was made by their leaders in their general councils or assemblies. (See Tacit. de Mor. Germ. c. 26. and Cæsar de Bell. Gall. l. 6. c. 21.) In process of time, feuds began to be granted for the life of the feudatory. But they were not yet hereditary, though occasionally granted by the favour of the lord to the children of the former possessor, on payment of a fine or acknowledgment to the lord, which was called a relief. Afterwards feuds were by degrees universally extended beyond the life of the first vassal to his sons, or to such of them as the lord should name; but as the sons died off, their shares reverted to the lord, without descending to their children, or to their surviving brothers. But when a feud was given to a man and his *heirs*, in general terms, a more extended rule of succession took place; and when the feudatory died, his male descendants *in infinitum* were admitted to the succession, and in defect of them, such of his male collateral kindred as were of the blood or lineage of the first feudatory, and no others. The descent being confined to males, originally extended to all the males alike; but this being found inconvenient, and *honorary* feuds (or titles of nobility) being introduced, which could only be inherited by the eldest son; in imitation of these, *military* feuds (or those now described) began in most countries to descend according to the same rule of primogeniture, to the eldest son in exclusion of all the rest. The feudatory could not alienate or dispose of his feud, nor could he exchange, nor mortgage, nor devise it by will, without the consent of the lord. When feuds ceased to be military, they began to be bought and sold, and deviations were made from the old fundamental rules of tenure and succession. See TENURE.

It should be observed, that our English lawyers do very rarely (of late years especially) use the word *fee* in this its primary original sense, in contradistinction to *allodium* or absolute property, but generally use it to express the continuance or quantity of an estate; so that a *fee* in general signifies an estate of inheritance, being the highest and most extensive interest that a man can have in a feud; and in that sense of the term it is applicable to, and may be had in, any kind of hereditaments, either corporeal or incorporeal; with this distinction, that of a corporeal inheritance a man shall be said to be seized *in his demesne, as of fee*; of an incorporeal one, he shall only be said to be

seized *as of fee*, and not in his demesne. (Litt. § 10.) Blackstone's Comm. vol. ii. p. 106.

In the stat. 37 Hen. VIII. cap. 16. *fee* is also used for lands vested in the crown; but it is from ignorance of the import of the word; for *fee* cannot be without *fealty* sworn to a superior; but the king owns *fealty* to no superior but God alone.

Fee is divided in our laws into *fee-absolute*, called also *fee-simple*; and *fee-conditional*, also called *fee-tail*. See FEUD.

FEE, Frank. See FRANK.

Fee-simple, feudum simplex, is that whereof we are seized to us and our heirs for ever. Or it denominates an absolute inheritance, clear of any condition, limitation, or restriction to particular heirs, but descendable to the heirs general, whether male or female, lineal or collateral. It is a general rule, that the word *heirs* is necessary in the grant or donation, in order to make a *fee* or inheritance; but this rule does not extend to devises by will, nor to fines and recoveries considered as a species of conveyance, nor to creation of nobility by writ, though in creations by patent, the word *heirs* must be inserted; nor to grants of lands to sole corporations and their successors; nor finally, to the case of the king, in whom a *fee-simple* will vest, without the words *heirs* or *successors* in the grant.

Fee-tail, feudum taliatum, is that whereof we are seized with limitation to us and the heirs of our body. See TAIL.

Fee-tail is of two kinds, general and special.

Fee-tail general, is where lands and tenements are given to a man and the heirs of his body begotten. So that if a man seized of such land by such gift marry one or more wives, and have no issue by them, and at length marry another, by whom he hath issue, this issue shall inherit the land.

Fee-tail special, is where a man and his wife are seized of lands to them and the heirs of their two bodies; where, in case the wife die without issue, and he marry another by whom he have issue, this issue cannot inherit the land, and therefore it is called *special tail*.

This *fee-tail special* has its origin from the stat. of Westm. 2. 13 Edw. 1. cap. 1. Before that statute, all land given to a man and his heirs, either general or special, was reputed in the nature of a *fee*; and therefore so firmly held to him, that, any limitation notwithstanding, he might alienate it at pleasure: for redress of which inconvenience the statute provides, that if a man gives lands in *fee*, limiting the heirs to whom it should descend, with a reversion to himself and his heirs for default of such former heirs, the form and meaning of the gift shall be observed.

Estates, in general and special tail, are farther diversified by the distinction of sexes in such entails; for both of them may be in tail male or female; as if lands be given to a man and his heirs male of his body begotten, this is an estate in tail male general; but if to a man and the heirs female of his body or his present wife begotten, this is an estate in tail female special; and in case of an entail male, the heirs female shall never inherit, nor any derived from them; nor *conversely*, the heirs male, in case of a gift in tail female. (Litt. § 21. 22.) As the word *heirs* is necessary to create a *fee*, so the word *body*, or some other words of procreation, are necessary to make it a *fee-tail*, and to ascertain to what heirs in particular the *fee* is limited; though in wills and testaments greater indulgence is allowed. The incidents to a tenancy in tail, under the statute Westm. 2. are chiefly these (Co. Litt. 224.): 1. That a tenant in tail may commit

waste on the estate-tail by felling timber, pulling down houses, or the like, without being impeached or called to account for the same. 2. That the wife of the tenant in tail shall have her dower or thirds of the estate-tail. 3. That the husband of a female tenant in tail may be tenant by the courtesy of the estate-tail. 4. That an estate-tail may be barred or destroyed by a fine, by a common recovery, or by lineal warranty descending with assets to the heir. By subsequent statutes, estates-tail may be aliened, are liable to forfeiture for high treason, and are chargeable with reasonable leases, and with such debts as are due to the crown on specialties, or have been contracted with fellow subjects in a course of commerce.

FEE, Base, or qualified, is a conditional fee that has a qualification subjoined to it, and which must be determined whenever this qualification is at an end; as in the case of a grant to A. and his heirs, *tenants of the manor of Dale*; whenever the heirs of A. cease to be tenants of that manor, the grant is entirely defeated. Blackstone's Comm. vol. ii. chap. 7. See **ENTAIL**.

FEE-expectant, feudum expectativum. See **ESTATE**, and **EXPECTANT**.

FEE-farm, or ferm, feudi-firma, or feo-firma, is a tenure of lands by which they are holden to a person and his heirs forever, under a certain annual rent.

Fee farm takes place upon the creation of a tenancy, when the lord reserves to himself and his heirs either the rent for which it was before let to farm, or at least a fourth part of the rent, and that without homage, fealty, or other services, more than are especially comprised in the feoffment. Yet it would appear by Fitzherbert, that the third part of the value may be appointed for the rent, or the finding of a chaplain to say divine service, &c. And the nature of it is this; that if the rent be behind, and unpaid for the space of two years, then the feoffee or his heirs have action to recover the lands as their demesnes.

FEE-farm rents of the Crown, are such rents as issue to the kings of England from their ancient demesnes, many of which were alienated from the crown in the reign of Charles II.

FEE is also used for the compass or circuit of a manor or lordship. Thus Bracton, "in eadem villa, & de eodem feodo."

FEE is also used for a perpetual right incorporeal: as to have the keeping of the persons in fee, rent granted in fee, and office held in fee, &c.

FEE, Knight's. See **KNIGHT'S FEE**.

FEE also signifies a reward or ordinary due given a person for the execution of his office, or the performance of his part in his respective art or science.

Thus, the lawyer, barrister, and physician, are said to have their fees; *i. e.* considerations for the pains taken with the client or patient. If a person refuse to pay an officer his due fees, the court will grant an attachment against him, to be committed till the fees are paid; and an attorney may bring an action of the case for his fees against the client that retained him in his cause. With us, some have said that a counsel can maintain no action for his fees, which are given not as *locutio vel conductio*, but as *quiddam honorarium*; not as a salary or hire, but as a mere gratuity, which a counsellor cannot demand without injury to his reputation. This, however, has been held otherwise. F.N.B. 121. 1 Brownl. 73. 31 H. VI. c. 9.

FEES also denote several perquisites or allowances paid to public officers by persons who have business with them. The fees due to the officers of the Custom-house are expressly mentioned in a schedule or table, which is hung

up to view in the said office, and in all other places where the fees are to be paid; and if any officer shall offend, by acting contrary to the regulations therein contained, he shall forfeit his office and place, and be for ever after incapable of any office in the Custom-house.

The smallness of the salaries of divers of the king's servants is compensated by the perquisites or fees of honour. The fees paid to the several officers by every person upon his being knighted amount to 78*l.* 13*s.* 4*d.* And if it be done within the verge of the court, there is 3*l.* more to the six pages of the bed-chamber, which brings it to 81*l.* Every knight of the most noble order of the garter pays, upon his installment, if Prince of Wales, 66*l.* 13*s.* 4*d.*; if a duke 20*l.*; if a marquis 16*l.* 18*s.* 4*d.*; if an earl 12*l.* 13*s.* 4*d.* The fees due for the entrance into the house of lords are as follows:

	£.	s.	d.
Prince of Wales	-	30	0 0
An Archbishop	-	27	0 0
A Duke	-	27	0 0
A Marquis	-	19	6 8
An Earl	-	14	0 0
A Viscount	-	12	0 0
A Bishop	-	14	0 0
A Baron	-	9	0 0

These fees are paid by every peer on his first introduction to the house, both on his original accession to a title, and his advancement to a higher one, and by every bishop upon his first consecration, and upon any future promotion.

The homage-fees due on the accession of a peer are,

	£.	s.	d.
Prince of Wales	-	703	6 8
Ditto, as Earl of Chester	-	203	3 4
A Duke	-	350	3 4
A Marquis	-	272	10 7
An Earl	-	203	3 4
A Viscount	-	159	7 4
A Baron	-	150	5 4

Besides the sum charged in the king's books, every bishop pays, on his consecration or promotion, as homage-fees, 112*l.* 10*s.* 4*d.* and an archbishop double this sum.

FEED, in *Rural Economy*, the portion or quantity of oats or other sort of grain or provender, which is given to a horse or other animal at one time. The term also implies the fattening of different sorts of live stock, as neat cattle, sheep, &c.

FEEDER, in *Engineering*, is a cut or channel, sometimes called a carriage or catch-drain, by which a stream or supply of water is brought into a canal; sometimes the stream of water itself, which is so supplied to a canal, is called a feeder. See **CANAL**.

FEEDERS, in *Rural Economy*, signify by graziers those neat cattle which are bought in expressly for the purpose of being fed off.

FEEDERS of a Vein, in *Mining*, are the short cross veins which appear to branch from it in some instances, and are so called from the vulgar notion that these feed or supply the vein with ore: *strings* and *leadings* are sometimes used as terms for these small cross veins.

FEEDING, in *Rural Economy*, the act or process of fattening any sort of live stock on a farm.

FEEDING of Cattle, the process of rendering them in a state proper for the butcher. It likewise signifies the foddering of them.

FEEDING House, or Shed, is that sort of farm-building which is constructed for the purpose of fattening neat cattle. It should have a dry warm situation, be capable of

free ventilation, and be well supplied with proper conveniences for the reception of food and water. See *CATTLE Sheds*.

FEEDING Grounds, such lands as are set apart for the fattening of different sorts of live stock. They are chiefly those of the rich deep pasture kinds.

FEEDING-Piece, a field or portion of grass land which is employed for the purpose of grazing animals. It is advantageous to have such a piece near to the house.

FEEDING-Down, the practice of eating down grass lands with different sorts of live stock. In *new lays* some prefer mowing the few first years, from the supposition that grazing is more injurious to them; but the superiority of these different practices has not yet been fully ascertained. See *LAYING down to Grass*, and *PASTURE*.

FEEDING-Grounds, in *Mining*, is used by some miners to denote certain kinds of soil or rock, which are supposed to feed or to supply ore to veins in their vicinity: it is a certain fact, that some beds of limestone in Derbyshire, called *bearing-measures*, have generally ore in the veins which intersect them, when often the same veins contain little or no ore between the measures above or below these bearing measures.

FEEDING, *Foul*, in the *Manege*. See *FOUL*.

FEEJEE, in *Geography*, an island in the Southern Pacific ocean, about three days' sail from Tongataboo, in the direction of N. W. by W. It is represented as a high but very fruitful island; abounding with hogs, dogs, and fowls, and all the kinds of fruits and roots that are found in any of the others, and as being much larger than Tongataboo, to the dominion of which it seems to be subject, as the other islands of the Archipelago are; although, on the other hand, Feejee and Tongataboo frequently make war upon each other; and the inhabitants of the latter appear to be much afraid of those of the former, who were really formidable on account of their peculiar dexterity in the use of bows and slings, and also on account of the savage practice prevalent among them of eating the enemies whom they killed in battle. The more northerly part of this numerous group was discovered by Tasman in 1643; and it is the same cluster of islands and reefs that was explored by the Duff Missionary ship, and where she experienced the greatest dangers that attended her voyage. These islands were named by Tasman "Prince William's Island," and "Heemskirk's shoals." They extend northward to the latitude of $15^{\circ} 33'$. Captain Bligh fell in with the easternmost of them in W. long. 178° , and pursuing a north-western course he found the group to extend 4° westward from the first islands. He saw several of them that had from 30 to 40 leagues of coast, which appeared fertile and pleasantly variegated with hills and vallies. In 1792 he passed to the north of the first islands discovered by him in 1789; and having crossed his former tracks, he doubled the southernmost island of the group in S. lat. $19^{\circ} 15'$. E. long. 178° . The canoes of the islanders attempted to overtake him, seemingly with hostile designs. The most western part of this group was discovered by captain Barber in 1794, in his passage from Port Jackson to the N.W. coast of America. He saw six of the islands, the largest of which he placed in E. long. $175^{\circ} 15'$. The natives, who seemed unaccustomed to trade, exhibited hostile appearances; and actually attempted to board his ship. It is not certain whether all these islands are connected with, or independent of, each other; but they are thought to be subject to Tongataboo. The inhabitants, however, are of a distinct race, speak a different language, and, besides spears and clubs, make use of bows and arrows in battle. In this

respect they resemble most of the islanders who inhabit the larger countries to the westward, and differ from all that have yet been discovered to the eastward of the group. The natives of the Friendly islands regard the people of Feejee as superior to themselves both in military prowess and mechanical ingenuity; their weapons and clothing being wrought in a more masterly style; and some manufactures, especially that of earthen vessels, being carried on at Feejee, which are not attempted at Tongataboo. They had also dogs at Feejee, when there were none in the Friendly islands. The stature of the Feejeeans is superior, their complexions are darker, and their hair approaches to wool. They moreover retain the practice of eating the bodies of enemies whom they have killed, which is now abhorred by all the lighter race, except the inhabitants of New Zealand.

FEEL, in the *Manege*, they say to feel a horse in the hand; that is, to observe that the will of the horse is in the rider's hand, that he tastes the bridle, and has a good *appui* in obeying the bit.

To feel a horse upon the haunches, is to observe that he plies or bends them, which is contrary to leaning or throwing upon the shoulders.

FEELERS, *ANTENNÆ*, in *Natural History*, are the horns, as they are usually called, upon the heads of insects. See *ENTOMOLOGY*.

FEELING, in *Physiology*, the power in any organ of receiving the impressions of external objects, and of conveying these to the brain, so as to cause sensation; or of exhibiting the same phenomena from alterations in the state of the organ itself. In this explanation the word is equivalent to *sensibility*, and denotes the capacity of being acted upon, and of acting again on the sentient principle: thus we say that any part has much or little feeling, &c. In a more confined sense, this word signifies the sense of touching, which is the particular mode of sensibility belonging to the surface of the body. The subject is explained under the articles *BRAIN*, *SENSIBILITY*, and *SKIN*.

FEESURA, in *Geography*, a town of Africa, in the kingdom of Kaarta; 28 miles W. of Kemmoo.

FEET, a town of Norway, in the government of Aggerhuus; 36 miles N. N. E. of Frederickstad.

FERT Presentation, in *Midwifery*, a species of preternatural or cross birth, in which, on the bursting of the membranes, during labour, one or both the feet of the child come down into the vagina, instead of the head. In this case, the pains usually cease, and do not recur again, until nearly the whole of the liquor amnii is drained away, which frequently is not completed in less than three, four, or more hours. This suspension of the pains is apt to excite uneasiness in the patient, or her attendants, and the accoucheur is often pressed to give assistance, which he must however avoid doing, until, by the recurrence of the pains, he is satisfied that the uterus is contracted, so as to come again into contact with the body of the child. He may then gradually, and moderately assist, during the pains, in drawing down the legs of the child; still keeping in mind the rule to be observed in all cases, where delivery is to be performed by art, not to empty the uterus too hastily.

When the breech is delivered, the accoucheur will attend to the position of the child, and if the belly be placed towards the pubes of the mother, turn it towards the sacrum, and then complete the delivery in the manner directed under the article *LABOUR*, *preternatural*.

FEG, in *Agriculture*, a term used provincially to signify the tough dead grass which remains in pastures after they have been eaten down by stock.

FEGALLE, or **FAGALO**, *Cape*, in *Geography*, a cape on the coast of Algiers, called by the Moors "Ras Azintoure." N. lat. 35° 40'. E. long. 0° 54'.

FEGARI, a town of Japan, in the island of Nippon; 70 miles S. E. of Meaco.

FEGESAK, or **VEGESAK**, a town of Germany, in the duchy of Bremen; eight miles N. N. W. of Bremen.

F EGLINA, a town of Naples, in Calabria Citra; seven miles S. E. of Cosenza.

FEHRABAD. See **FARABAT**.

FEHRENBACH, a town of Germany, in the lordship of Furstenberg; 16 miles E. of Friburg.

FEHRNBELLIN, a town of Germany, in the Middle Mark of Brandenburg, on the Rhine; 28 miles N. W. of Berlin. N. lat. 52° 53'. E. long. 12° 50'.

FEI, a town of China, of the third rank, in Chang-tong.—Also, a river of Persia, which runs into the Mes, eight miles S. E. of Suc Sambil, in Chusistan.

FEID. See **FAID**.

FEIDERSDORF, in *Geography*, a town of Germany, in the principality of Culmbach; eight miles S. W. of Culmbach's.

FEIGNED ACTION, in *Laws*. See **FAINT action**.

FEIGNED ISSUE. See **FEIGNED ISSUE**.

FEILITSCH, in *Geography*, a town of Germany, in the principality of Culmbach; three miles N. E. of Hof.

FEINT, in *Fencing*, a false attack, or a shew of making a stroke or thrust, in one part, with design to induce the adversary to form a parade for guarding that part, and leaving some other part unguarded where the thrust is really intended.

Feints are either single or double, high or low, without or within, &c. in prime, in tierce, in quart, in demi, and in the whole circle; of one, two, or three measures.

The simple feint is a mere motion of the wrist, without stirring the foot, &c.

FEINT, in *Rhetoric*, a figure whereby the speaker touches on something, in making a shew of passing it over in silence. The Latins call this *praetermissio*.

FEINT-Attack, in the *Military Art*, is a manœuvre resorted to on a variety of occasions, but especially when the defences of a town, &c. are to be carried by storm. However easy it may appear to distract the attention of the defenders, or to attract it to a wrong direction, such is not actually the case in general. This ruse de guerre has been so very frequently practised, that none but the most unguarded commanders are to be deceived by the mere display of an armed force in a quarter where the works are not absolutely insignificant, or reduced to a defenceless state. A feint-attack, it is to be recollected, must assume such a form as should give a most imposing air; it should carry with it such evident power, as at the least should rescue it from destruction in the event of the garrison seeing through the device, and either allowing the assailants to advance, under the idea of complete success, into a snare, or making a sally, such as should leave no room for boasting of the effect of the enterprize; in either case, ruin will generally follow.

The immense variety of cases, and of situations, that could be adduced, would, if individually treated in this work, trespass far beyond the ordinary importance of the article among our readers in general; the subject might swell an ample octavo. We must therefore confine ourselves to observing, that feint-attacks generally succeed best in the dark, and ought in every instance, where cavalry is at hand, to be supported by such a force of that description as should suffice to cover a retreat. If it is known that the

place is well-manned, the feint-attack should not be confined to one part; several shews of storming parties should be made, under the previous caution of having a body of cavalry between two such indications, ready to aid either that may be pursued. When a garrison is weak, there may arise much benefit by changing the feint-attack into a feint-retreat; thereby inducing the defenders to quit their works, and to advance within the reach of some latent force. Where it is accurately ascertained that a *feint*, and not a *real* attack is made, the best policy is for the defenders either to remain perfectly quiet behind their walls, if the situation be secure; or to keep up a thin fire, from riflemen, so as to make each shot take effect, yet at the same time reserving the disposable force under cover, as much as possible concealed, so as to fall suddenly on the assailants; who may be expected to push forward, under the idea of meeting but little resistance.

Where equal forces are opposed, the feint-attack is extremely hazardous; and, even under certain advantages, in point of numbers, cannot be too cautiously adopted. If the main assault should not be successful, the worst of consequences may ordinarily be expected; as not only will much loss be sustained in that quarter, but the means of rescuing the smaller party be completely superseded by that necessity which self-preservation ever imposes. We do not mean to deny that the most brilliant results may attend the measure when favourably circumstanced, but to caution those who, from adventitious reading of the few successful issues, entertain such sanguine expectations, as to cause their banishing all ideas of defeat, from giving too great scope to expectation; and, at all events, from indulging in the speculation without the best intelligence, the best means of approach, and the certainty of being able to effect their retreat. It is to be carried in mind, that in all probability, information of the intended assaults will reach the besieged, so as to give ample scope for preparation accordingly; or, to say the least, that they may be competent to form a correct opinion, regarding the intentions of their opponents; in either case much may be apprehended.

FEINTE, an old French musical term, to express the alteration of any note or interval, by a sharp or a flat. It is properly the generical term for diesis and accidental flats. Rousseau says, "this word is no longer in use; but no other is substituted in its room. The fear of using superannuated words daily enervates and impoverishes our language; its greatest enemies are the purists. The short, or chromatic keys on a harpsichord, now denominated sharps and flats, used to be called feintes. The keys which are white used to be black, because our coarse and vulgar artists never thought of making the clavier black to set off the ladies hands. Short eighths in organs and old instruments are likewise called feintes coupé, or cut keys."

FEIRA, in *Geography*, a town of Portugal, in the province of Beira; 10 miles S. of Oporto.

FEISOUN, a town of Asiatic Turkey, in the government of Diarbekir; 40 miles N. of Diarbekir.

FEISTRITZ, a town of the duchy of Stiria, four miles N. of Muehrau.—Also, a river of the duchy of Stiria, which runs into the Save, nine miles N. E. of Laybach.—Also, a town of the duchy of Carinthia; 10 miles N. E. of Saxenburg.

FEITCHIN, a town of China, of the third rank, in Chang-tong; 25 miles S. S. W. of Tei-nan.

FEITKINGE, a town of Sweden, in the province of Schonen; six miles E. of Chrilliansfad.

FEIUM. See **FAYOUM**.

FEKE.

FEKETEBANJA, a town of Hungary; 28 miles N. E. of Zatmar.

FEKETELO, a town of Transylvania; 23 miles S. W. of Colofvar.

FEKETEPAK, a town of Transylvania; 25 miles S. W. of Colofvar.

FEKETE-PATOR, a town of Hungary, 18 miles S. S. E. of Grof-Wardein.

FEL, *MAD.* in *Biography*, a singer in the French opera at Paris, of high renown, and durable favour. She was the daughter of an able organist at Bourdeaux, born 1716, and received at the great opera in 1733. Her sweet, pure, and silver-toned voice delighted the public 20 years, and would have continued in favour twenty years more, if bad health, and a feeble chest, had not obliged her to quit the stage in 1759. Mad. Fel sung equally well in French and Latin, and was one of the French who had best succeeded in Italian. Her voice was always as young and astonishing as ever, to the small number of friends to whom she devoted the last years of her life, and who cherished her personal qualities as much as they did her vocal talents. *Laborde*.

FEL, in the *Materia Medica of the Ancients*, the name of a fruit much used by them in stomachic medicines, but very badly described to us. All that we know of the matter is, that there were three fruits brought from the Indies at that time, and called bel, fel, and sel; they were all of the same virtues, and seemed nearly allied to each other in all respects. Serapio tells us, that the fruit fel was about the size of the pistachia nut, and somewhat resembled it in shape; and Avicenna observes, that it was an Indian medicine, bitter, and hot, like ginger; and that it was used as a stomachic. He also says the same thing of the two other fruits; whence it appears they were nearly the same thing.

FEL, in *Medicine*. See *GALL*.

FEL Terra, *gall of the earth*, a name by which some authors have called the small centaury, because of its great bitterness.

FELAGUS, in our *Law Books*, was used for a companion or friend, who was bound in the decennary for the good behaviour of another. In the laws of king Ina, it is said, if a murderer could not be found, the parents of the person slain should have six marks, and the king forty; if he had no parents, then the lord should have it; "et si dominus non habet, felagus ejus." *Leg. Ine*, cap. 15.

Felagus is said to be "quasi fide cum eo ligatus."

FELAPTON, in *Logic*, one of the moods of syllogisms.

In a syllogism in felapton, the first proposition is an universal negative; the second an universal affirmative; and the third a particular negative.

FELDBACH, in *Geography*, a town in the duchy of Stiria; 14 miles N. of Rakelburg.

FELDER, a river of Germany, which rises in Henneberg, and runs into the Werra, 2 miles N. E. of Vacha.

FELDES, a town of the duchy of Carniola; 14 miles N. W. of Crauburg.

FELDES-SEE, a lake of the duchy of Carniola; 2 miles S. W. of Felde.

FELDKIRCH, COUNTY OF, a small country of Germany, formerly in the circle of Swabia, but now a part of the Tyrolse, bounded on the north by the county of Montford, on the east by Pludentz, on the south by the Grisons, and on the west by the Rhine.

FELDKIRCH, the capital of the above-mentioned county, well built, and situated on the Ill, near the Rhine. The inhabitants enjoy the privilege of choosing their own magistrates, and of refusing to surrender any who are under

the law of the empire, and of not being summoned by any provincial judges; 28 miles N. N. E. of Coire. N. lat. 47° 12'. E. long. 9° 48'.

FELDKIRCHEN, a town of the duchy of Carinthia; 13 miles N. W. of Clagenfurt.

FELDSBACH, a river of Austria, which runs into the Danube, 3 miles below Grein.

FELDSBERG, a town of Germany, in Carinthia, belonging to the archbishop of Salzburg; 4 miles N. E. of Saxenburg.

FELDSBURG, a town of Austria; 28 miles N. N. E. of Vienna. N. lat. 48° 42'. E. long. 16° 43'.

FELD-SEE, a lake in the duchy of Carinthia; 8 miles N. W. of Velach.

FELDUAR, a town of Hungary, near the Danube, supported by fishing in this river; 12 miles S. E. of Symontornya.

FELE, ST. a town of Naples, in Basilicata; 7 miles N. N. E. of Muro.

FELE Homagers, was anciently used for the faithful subjects. But it seems the word should be written feal homagers.

FELLENBRUNN (Ober), in *Geography*, a town of Austria; 3 miles N. W. of Sonneberg.

FELLENBRUNN (Unt.), a town of Austria; 8 miles N. of Korn-Neuburg.

FELENGA, a small island in the gulf of Venice, near the coast of Istria. N. lat. 45° 52'. E. long. 14° 4'.

FELETINO, a town of Italy, in the Campagna di Roma; 8 miles N. of Aletri.

FELETZ, a town or district of Russia, in the government of Orel, on the left side of the river Soffia.

FELIBIEN, MICHAEL, in *Biography*, was born in 1665, and brought up to the church. He joined at an early age the congregation of Benedictine monks, and is author of many books on practical piety; but is more particularly known for his "History of the Abbey of St. Denis," adorned with figures, and illustrated with learned dissertations. Through the fame which he acquired by this work, he was chosen by the magistrates of Paris to write the history of that capital. In 1713 he published his prospectus of the intended work, and proceeded in the labour till he was arrested in his progress by the hand of death in 1719. It was afterwards completed in five volumes folio, and published in 1725. *Moreri*.

FELIBIEN, JAMES, was born, in 1636, at Chartres, and by intense application became a proficient in biblical knowledge. He obtained considerable preferment in the church, and in 1695 was promoted to the archdeaconry of Vendôme, in which city he died, in 1716, at the age of 80. His principal work as an author was entitled "Pentateuchus Historicus, five quinque libri historici. Josue, Judices. Ruth, primus et secundus Regum, cum Commentariis ex fere Hebraico, versione 70 interpretum, et variis auctoribus collectis," 4to. 1703. This was intended as a continuation of Jansenius's commentary on the Old Testament. It was written with so much freedom and boldness, that it was suppressed by a decree of council. The author obtained leave to republish it, having first pruned away its objectionable passages. The copies of the original publication are now extremely scarce, and objects of great curiosity. *Moreri*.

FELICE, ST. in *Geography*, a town of Italy; 17 miles N. N. E. of Modena.—Also, a town of Spain, in the province of Leon.

FELICIEN, ST. a town of France, in the department of the Ardeche, and chief place of a canton in the district

of Tournon; 9 miles W. of Tournon. The place contains 1,589, and the canton 8,079 inhabitants, on a territory of 147½ kilometres, and in 9 communes.

FELICITA, or **FELICE**, **ST.** a town of Italy, in the Campagna, near the coast of the Mediterranean, at the foot of mount Circelli, supposed to be built on or near the site of the ancient Circæi, but not well inhabited; 10 miles S.W. of Terracina.

FELICITY, in *Mythology*, a deity both among the Romans and the Greeks. The Romans had multiplied their divinities to a great number before they elevated Felicity to this rank. It was above 600 years after the building of Rome, that Lucullus, upon his return from the war with Mithridates and Tigranes, built a temple to her. Pliny adds (l. 35. c. 12.), that this general enjoined the statuary Archefilaus to make the statue of that goddess; but that they both died before it was finished. Lepidus, general of the cavalry, had also, according to Dion (l. 44.) dedicated a temple to that goddess. The Greeks, likewise, honoured the same goddess under the name of Eudaimonia and Macaria. Felicity is often represented upon the Roman medals, either under the figure of a woman holding in her hand the cornucopia, or under some other symbol, with the legend "Felicitas Publica," or "Felicitas Ang. Felicitas Temporum."

FELICUDA, in *Geography*, one of the Lipari islands, anciently called *Phenicusa*. N. lat. 38° 34'. W. long. 14° 2'. This island, as well as Alicuda, which are the two extreme Liparian islands towards the west, display proofs of their having anciently contained volcanoes. In Felicuda there is a spacious cavern, called the Grotto of the Sea-ox, which, from an aperture of 40 feet high, opens into a hall near 200 feet long, 120 broad, and 65 high. This cavern is formed of lava, and is only accessible by sea. Spallanzani (vol. iii. p. 99.) supposes, that it was occasioned by the action of the gases in the lava, when fluid; as there are examples in Ætna of caverns, much deeper, produced by a similar cause.

FELIPE, **ST.** a town of Mexico, in New Biscay; 36 miles N.W. of Parrel.—Also, a town of Mexico, in the province of Mechoacan; 100 miles N. of Mechoacan.—Also, a town of Spain, in the province of Valencia, situated on the declivity of a mountain, at the foot of two castles; which form an amphitheatre. It was formerly called *Xativa*, and was once one of the most beautiful towns in Spain; but as it took part with Charles III. in 1707, Philip V. ordered it to be demolished, and caused a new town to be built, which he called St. Felipe; 29 miles S.S.W. of Valencia. N. lat. 39°. W. long. 0° 46'.—Also, a town of South America, in the province of Venezuela; 70 miles S. of Venezuela.—Also, a town of New Mexico, in New Navarre; 85 miles W. of Casa Grande.—Also, a bay called St. Jago, on the N. coast of Terra Australis del Espíritu Santo, discovered by Quiros in 1666. S. lat. 14° 55'. E. long. 167° 8'.—Also, a town of New Mexico, on the Bravo; 40 miles S. of Santa Fé.—Also, a town of Brazil, formerly called "St. Luis de Marignon," capital of the jurisdiction of Maranhao. S. lat. 2° 30'. W. long. 45° 36'.—Also, a town of Brazil, in the jurisdiction of St. Paul.—Also, a town of the island of Cuba; 55 miles S.E. of Havana.

FELIS, in *Zoology*, a genus of quadrupeds in the order **FERÆ**, the essential character of which consists in having fore teeth, the intermediate ones equal; grinders three on each side; tongue beset with bristles backwards; and the claws retractile.

This ferocious tribe, consisting altogether of about 23 species, besides an amazing number of varieties, is distinguished by their sharp and formidable claws, which are

lodged in a sheath, and are capable of being extended or drawn in at pleasure. They lead a solitary and ravenous life, and never unite for mutual defence or support like those of the herbivorous kinds of animals, but seek their food alone, and are frequently enemies to each other. Though differing greatly in size and colour, they are allied to each other in disposition, being fierce, rapacious, and artful, and are endued also with considerable strength. They run with speed, easily climb trees, and when falling from a height alight on the feet. They are carnivorous, and refuse vegetables, unless extremely pressed by hunger. When in sight of their prey, they wave their tails, and seize it by a sudden spring. The females bring forth several young at a birth, and have eight teats, four of which are pectoral, and four abdominal.

Species.

LEO. Tail long; body pale tawny. *Felis leo*, Linn. *Felis cauda elongata, corpore belveolo*, Schreb. *Felis cauda in floccum desinente*, Briff. *Leo*, Gesner, &c. *Lion*.

The form of the lion is strikingly bold and majestic, corresponding with the generosity of his nature; and from the magnitude of his size, his strength, agility, and courage, he reigns the superior of all other quadrupeds. A lion of the largest dimensions measures about eight or nine feet in length, from the nose to the base of the tail, and the latter itself nearly four feet. Those of smaller size, when full grown, are about five feet long, independently of the tail. The aspect of the lion, when he presents his front full to the view of the observer, is impressively grand; his head large and rounded, his forehead square, his shaggy flowing mane, which he can erect at pleasure, surrounding his awful front, his huge eye-brows, his round and fiery eye-balls, his pendulous lips, and formidable armament of his teeth, conspire altogether to render his appearance terrific. The ears of the lion are small, and of a rounded form; his face covered with short and close hair, of a pale tawny colour; the mane, descending from the upper part of the head, falls over the shoulders, and hangs down almost to the knees; the belly and breast are covered likewise with long hair. The rest of the body is covered with very short hair, excepting the point of the tail, which is furnished with a bushy tuft. The hinder parts of the lion are rather disproportionate to the front, his posterior limbs being comparatively longer, and the latter have besides a naked appearance when contrasted with the shagginess of its anterior aspect. The legs are fleshy and muscular; the length of the claws is about an inch and a quarter, very hooked, and of a whitish colour; the claws being retractile, can be extended or withdrawn into the membranaceous sheath at pleasure, and their points are generally acute, as they are never extended, except when the animal seizes on its prey.

The lioness is smaller than the lion, being scarcely three-fourths the size of the latter; she is also destitute of the mane, and her fur is of a whiter cast on the sides and belly.

It has been observed generally, by some writers, that in warm climates quadrupeds usually attain to a far more considerable size, and are naturally stronger than in the cold or temperate climates, and that they are likewise more fierce and hardy, as their natural qualities seem to correspond with the ardour of the climate. This remark can apply only to certain tribes, or at least admits of many exceptions; but with regard to the lion in particular is strictly true. The lions, naturally the inhabitants of the hotter regions of the earth, thrive best in the burning wastes of the torrid zone; in those deserts whence mankind are driven by the rigorous heat

heat of the climate, the lion reigns sole master; its disposition seems to partake of the ardour of its native soil, and under the influence of a scorching sun it becomes larger, more powerful, fierce, and terrible than in other parts of the globe. It is thus that the lions of mount Atlas, whose summits are oftentimes covered with snows, are neither so strong nor so ferocious as those of Biledulgerid or Zaara, or the deserts in the interior of the vast continent of Africa. In those barren wastes the lion is the dread of travellers, and the scourge of the neighbouring provinces. Happily the species is not numerous, and is said to be diminishing in number; for if we may credit the testimony of those who have traversed these regions within the space of the last century, the number of lions is not near so considerable as they were formerly, and their number indeed appears to decrease daily. The Romans brought many more lions out of Libya in one year for their public spectacles than could be found at this time in the country. Scylla, the dictator, for example, exhibited during his prætorship a hundred lions; but in this respect he was far excelled by Pompey the Great, who brought together in the grand Circus no less than six hundred animals of this species, three hundred and fifteen of which were males: and it is recorded also of Cæsar the dictator, that he collected altogether no less than four hundred for the same purpose, that of public exhibition. It is remarked by modern writers, that the lions of Turkey, Persia, and the Indies are less numerous than formerly; and indeed we are assured by the best of the late French travellers, that there are at present no lions throughout Turkey.

As this formidable and courageous animal makes a prey of most other animals, and is himself the prey of none, this diminution in the number of the species can be attributed only to the increased population of mankind: and it is also well observed, that the courage of this animal diminishes, and its caution and timidity become greater as it approaches the habitations of the human race. The quality of his courage, though natural, is exalted or depressed according to the success with which he is accustomed to employ his force. In those regions, the exclusive empire of which has been resigned to him by man, the lion is alone formidable. Accustomed to measure his strength by that of all other animals which he encounters, the habit of conquest renders him haughty and intrepid. Having never experienced the strength of man, or the power of his arms, instead of betraying fear at his approach, the lion disdains and sets him at defiance. Wounds irritate but do not terrify him; neither is he dismayed at the sight of numbers. A single lion of the desert has been known to attack a whole caravan; and if, after a violent and obstinate engagement, he found himself weakened, he retreats fighting, and always keeping his face to the enemy. But acquainted with man, and the power of his arms, or ingenuity, he loses his natural fortitude, and feels sensible of his inferiority; and hence the lion, in the neighbourhood of the villages of the Indians and Africans, has been known to fly before women, and even children, and suffer itself to be driven by them from its lurking-place.

This alteration in the disposition of the lion sufficiently demonstrates that it will admit of a certain degree of education. The page of history informs us of lions yoked in triumphal chariots; that of Mark Antony, when he appeared in the streets of Rome, accompanied by his mistresses Cytheris, was drawn by lions; and other instances of a similar nature might also be adduced. Lions have been occasionally trained to the arts of war, or the chase, by the ancients, and it is affirmed of these, that they never employed their strength or courage but against their enemies. The lion (says

Buffon) when taken young, and brought up amongst domestic animals, is easily accustomed to live, and even sports innocently with them. He is gentle and careless to his master, and if he sometimes refuses his natural ferocity, he seldom turns his rage against his benefactors. He has also been known to disdain the insults, and pardon the offensive liberties of weaker animals. When led into captivity, he discovers symptoms of uneasiness, without anger or peevishness; on the contrary, he assumes the habits of gentleness, obeys his master, caresses the hand that feeds him, and sometimes spares the animals that are thrown to him for prey. By this act of generosity he seems to consider himself as forever bound to protect them; he lives peaceably with them, allows them a part of his food, and will rather submit to the inconveniences of hunger than destroy the fruits of his own beneficence.

Notwithstanding this generosity and placability of disposition, it should however be remembered, that the passions of the lion are impetuous and vehement, and it is not to be expected, that on all occasions the impressions of education will be sufficient to counterpoise them. We are well assured, from ocular observation, that the keepers of these animals frequently play with them, and with a degree of familiarity, little short of temerity, put their hands in their mouths, pull out their tongue, or hold them by the teeth, or even beat them, all which the animal seems to bear with fullen composure. But it is nevertheless dangerous to let the lion suffer from hunger, or provoke him by ill-timed teazings; the mildness of his temper is liable to irritation, and has been known to resent the imprudent chastisements of his keeper. Labat informs us of a gentleman who kept a lion in his chamber, and employed a servant to attend it, and who as usual mixed his caresses with blows. This was borne by the lion for some time. One morning, however, the gentleman was awakened by an unusual noise in his room, and drawing his curtains aside he perceived it to proceed from the lion, which was growling over the body of the unhappy man, whom it had just killed, and had separated his head from his body. The terror and consternation of the gentleman may be easily conceived; he flew out of the room, and fortunately obtained sufficient assistance to secure the animal from committing further mischief.

The appearance of the lion is truly expressive of the magnanimous qualities of his nature, his gait is stately, his look determined, his eyes glowing with peculiar lustre, inspire terror, and his voice is tremendous. The force of his muscular strength is apparent from his prodigious leaps and bounds, which often exceed twenty feet; by the lively motion of his tail, a single sweep of which is sufficient to throw a man to the ground; by the facility with which he moves the skin of his face, and the faculty of erecting and agitating the hair of his mane when irritated.

Lions are very ardent in their amours; when the female is in season, she is often followed by eight or ten males, who roar incessantly, and enter into furious engagements till one completely overcomes the rest, takes peaceable possession of her, and carries her off to some secret recess. All the passions of the lion, the soft passion of love not excepted, are excessive. From the reports of the French naturalists, the amours of these animals differ in no respect from those of the common cat, and frequent opportunities have occurred of late years in the menagerie of the museum of natural history in Paris to verify the truth of this observation; they are not on those occasions more cordial than the cat, and like that animal growl and wrangle as though offended with each other, the female especially. The lioness is naturally weaker and more timid than the lion, but such is
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the strength of her attachment for her young, that for their support she becomes more ferocious and terrible than the lion himself, makes her excursions with more boldness, attacks and destroys without distinction all other animals, and carries them reeking to her cubs, whom she thus instructs to suck their blood, and tear their flesh. She brings forth her young in the most secret and inaccessible places, and when afraid that her retreat will be discovered, endeavours to conceal the traces of her feet, by returning frequently on her steps, or effacing them by brushing the ground with her tail. When the danger is great, she will sometimes transport her young from one place to another in her mouth, or if obstructed in this attempt to save them she becomes furious, and defends them to the last extremity.

The length of time the lioness goes with young is variously stated by different writers; Ælian says two months, and Philostratus six months; among the moderns the period of gestation is said to be five months, and the best authors seem to agree in this conclusion. From very recent observation, it nevertheless appears that neither of the above statements is correct; it has been clearly ascertained by La Cépède, that the lioness goes with young one hundred and eight days, or rather more than three months and a half. The number of young brought forth by the lioness at a time is also generally misrepresented. Aristotle believed that at the first birth the lioness constantly produced either five or six young; most commonly only five; and at each succeeding litter progressively one less, till she brought forth but a single whelp, and after that she became barren. This early naturalist was deceived, but his information is nevertheless more just than that of other ancient writers before his time, who supposed the lioness never produced but a single litter, the young, instead of being brought forth as in other animals, tearing an opening through the side of their mother, and thus effecting their escape, at the expence of her life. Among the writers of later times it is usually admitted that the lioness has several litters in her life, and at each birth produces about three or four whelps. The lioness occasionally breeds in a state of confinement in Europe, instances of which are known in Britain; but whether the time of gestation in these animals has been well determined by the observation of English naturalists seems rather doubtful. A lioness in the menagerie at Paris, about two months gone with young, produced an abortive birth of two foetuses, the skin of which was perfectly smooth, the hair not having at that period began to grow. Twenty-one days after this the female was in heat, and was known to receive the embraces of the lion five several times in the same day. From that time every symptom of pregnancy appeared; and on the 108th day after, at seven in the morning, the pains of birth commenced; at five in the evening, the usual hour of repast, the lioness in vain attempted to eat the food presented to her, the pains, almost every instant repeated, compelling her to abandon it. The keeper, observing this, entered the den, and made the animal swallow some olive oil, which seemed rather to relieve her; about ten o'clock she brought forth a living whelp; in half an hour after another, and a third at a quarter past eleven. The above were all males. This occurred in November 1801. About the end of March following the male was again admitted to the same lioness, and on the 15th of July 1802, she had a litter of two female whelps, so that the period of gestation in the latter instance was much the same as in the former.

The lions, when first born, are rather larger than a half-grown kitten; at least three or four we have seen that were brought forth in the Tower did not exceed that size, or

about a foot in length from the back of the head to the origin of the tail. Their colour is a mixture of reddish and grey, with a number of small brown bands, which are most distinct on the dorsal spine, and near the origin of the tail; and these stripes scarcely disappear in the whelps a twelve-month old, and they continue at the teat about the same time. The mane of the male begins to make its appearance when the animal is about three years, or three years and a half old: the age of maturity is said to be about the sixth or seventh year, in the female at the sixth year.

Naturalists are not agreed as to the ordinary period of life in this animal, which is variously stated, at from about 20 to 50 years or more. Buffon, reasoning from the size and constitution of the lion, and the time required for his arriving at his full growth, concludes that it ought to be about 25 years, or seven times the space of three or four years, as it has been asserted of the lion that he acquired maturity in three or four years after his birth. It is, however, ascertained, that in some instances the lion lives much beyond that time. The great lion called Pompey, which died in the Tower, is recorded to have lived in captivity above 70 years; and one brought from the river Gambia died there a few years since at the age of 63.

The lion seldom quits his den, or goes abroad in the middle of the day, but commences his depredations at twilight, and returns before the morning. The roaring of the lion, when in quest of prey, is said by Buffon to resemble the sound of distant thunder, and, being echoed by the rocks and mountains, appals the whole race of animals, and puts them to sudden flight; but he frequently varies his voice into a hideous scream, or yell. The lion, when hungry, will attack any animal that presents itself; but he is so formidable that all endeavour to avoid him, and this circumstance often obliges him to conceal himself, and lie in wait, that he may take his prey by surprise. For this purpose he crunches on his belly in some thicket till his prey approaches, and then with a prodigious leap he seizes it at the first bound. Should he miss the object, we are told he descends from farther pursuit, and, turning back towards the place of his ambush, measures the ground step by step, and again lies in wait for another opportunity.

The lurking place of the lion is generally chosen near a spring, or by the side of a river, where he has an opportunity of surprising such animals as resort to the water to quench their thirst. In burning deserts, where rivers and fountains are denied, they live in a perpetual fever, a sort of madness fatal to every animal they meet with. The lion is supposed to be destitute of scent in that superior degree which most animals of prey possess, and to hunt by the eye alone. Many historians have even represented him as incapable of finding his prey except by accident, and that he is obliged to the jackal, a quadruped of excellent scent, for the discovery of it. This is an erroneous supposition; the jackal does not attend the lion to provide for him, but, being a small and feeble creature, follows his track to pick up the refuse of such animals as the lion destroys, and does not condescend entirely to devour. The strength of the lion is so prodigious, that it is even affirmed a single stroke of his paw is sufficient to break the back of a horse, and that he carries off a middle-sized ox, or buffalo, with ease. The lion is said to devour as much food at once as will serve him for two or three days, and when satiated to remain in a state of rest or retirement in his den, till impelled again by hunger to leave it, and prow in search of prey. The reversed bristles with which his tongue is beset are so large and strong, that he readily lacerates the skin of other animals; and his teeth so powerful, that he breaks and crushes the bones

bones with perfect facility, and often swallows them with the flesh. It is estimated that about fifteen pounds of raw flesh is sufficient for the ordinary subsistence of each lion daily. He endures hunger better than thirst, and laps in drinking like a dog.

The roaring of the lion is strong and loud, but when he is irritated his cry is shorter, repeated more suddenly, and is still more terrible than the roaring; besides which, at such times he beats his sides with his tail, stamps with his feet, erects and agitates the hair of his head and mane, moves the skin of his face, shews his teeth, and lolls out his tongue. According to Dr. Sparman, "the roaring of the lion consists in a hoarse inarticulate sound, which at the same time seems to have a hollowness in it, something like that proceeding from a speaking trumpet. The sound is between the German *u* and an *o*, being drawn to a greater length, and appearing as if it came from out of the earth; at the same time, that after listening with the greatest attention, I could not exactly hear from what quarter it came. The sound of the lion's voice does not bear the least resemblance to thunder, as M. de Buffon, tom. ix. p. 22. from the voyage of Boullaye de Goux, affirms it does. In fact, it appeared to me neither peculiarly piercing nor tremendous; yet, from its slow prolonged note, joined with nocturnal darkness, and the terrible idea one is apt to form to one's self of this animal, it made me shudder, even in such places as I had an opportunity of hearing it in with more satisfaction, and without having the least occasion for fear. We could plainly perceive by our cattle when the lions, whether they roared or not, were reconnoitering us at a small distance. For in that case the hounds did not dare to bark in the least, but crept quite close to the Hottentots; and our oxen and horses sighed deeply, frequently hanging back, and pulling slowly with all their might at the strong straps with which they were tied up to the waggon. They likewise laid themselves down on the ground and stood up alternately, appearing as if they did not know what to do with themselves; or rather, just as if they were in the agonies of death. It is indeed a wonderful circumstance that the brute creation should have been taught merely by nature to be in dread of the lion; for our horses and oxen were all from places where I am certain they could have no knowledge of this dreadful adversary of theirs; so that in this we must admire the bounty of providence, which, while it has sent such a tyrant as the lion amongst the animal creation, has likewise taught them to discern and distinguish it with trembling and horror."

We might naturally conclude that the roaring of the lion would prove serviceable to the other animals, by operating as a warning for them to betake themselves to flight; but as he puts his mouth to the ground when he roars, the sound is diffused equally to a considerable surrounding distance, and it is hence impossible to distinguish the precise spot from whence it issues. This increases the alarm; the intimidated animals fly backwards and forwards in all directions, and being dark, very often run to the very place from whence the sound proceeds, and which they meant to avoid. When the lion walks, his gait is stately, grave, and slow, though in an oblique direction. His movements are not, however, equal, but consist of leaps and bounds, which prevent him from stopping suddenly, and make him often overleap his mark. Should he chance to miss his prey, the Hottentots affirm that he turns slowly round towards the place where he lay in ambush, proceeding thither step by step, and, as it were, measuring the exact length between the two points, in order to find how much he exceeded or fell short of the mark to which his leap had been directed.

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The character of the lion for courage and generosity is to be admitted, according to Dr. Sparman, with considerable abatement. "It is not in magnanimity, says this writer, as many will have it to be, but in an insidious and cowardly disposition, blended with a certain degree of pride, that the general character of the lion consists; though hunger must naturally have the effect of now and then inspiring so strong and nimble an animal with uncommon intrepidity and courage. Moreover, being accustomed always itself to kill its own food, and that with the greatest ease, as meeting with no resistance, and even frequently to devour it reeking and weltering in its blood, it cannot but be easily provoked, and acquire a greater turn for cruelty than generosity; but, on the other hand, not being accustomed to meet with any resistance, it is no wonder that, when it does, it should sometimes be saint-hearted and crest-fallen. A yeoman, a man of veracity (Jacob Kok, of Keehoe river), related to me an adventure he had, in these words: "One day walking over his lands with his loaded gun, he unexpectedly met with a lion. Being an excellent shot, he thought himself pretty certain, in the position he was in, of killing it, and therefore fired his piece. Unfortunately he did not recollect that the charge had been in it for some time, and consequently was damp, so that his piece hung fire, and the ball, falling short, entered the ground close to the lion. In consequence of this he was seized with a panic, and took directly to his feet; but being soon out of breath, and closely pursued by the lion, he jumped up on a little heap of stones, and there made a stand, presenting the butt end of his gun to his adversary, fully resolved to defend his life as well as he could to the utmost. My friend did not take upon him to determine whether this position and manner of his intimidated the lion or not: it had, however, such an effect upon the creature, that it likewise made a stand, and, what was still more singular, laid itself down at the distance of a few paces from the heap of stones, seemingly quite unconcerned. The sportsman in the mean while did not dare to stir a step from the spot; besides, in his flight, he had the misfortune to lose his powder-horn. At length, after waiting a good half hour, the lion rose up, and at first went very slowly; and step by step, as if he had a mind to steal off, but as soon as it got to a greater distance it began to bound away at a great rate."

The same author relates also another occurrence to the same effect, but which, being attended with circumstances more remarkable than the former, has been more frequently repeated. "An elderly Hottentot, says this writer, in the service of a Christian, near the upper part of Sunday river, on the Cambdebo side, perceived a lion following him at a great distance for two hours together. Thence he naturally concluded that the lion only waited for the approach of darkness in order to make him his prey, and in the mean time could not expect any other than to serve for this fierce animal's supper, inasmuch as he had no other weapon of defence than a stick, and knew that he could not get home before it was dark. But as he was well acquainted with the nature of the lion, and the manner of its seizing upon its prey, and at the same time had leisure between whiles to ruminate on the ways and means in which it was most likely that his existence would be put an end to, he at length hit upon a method of saving his life. For this purpose, instead of making the best of his way home, he looked out for a *kilp-trans* (so they generally call a rocky place, level and plain at the top, and having a perpendicular precipice on one side of it), and sitting himself down on the edge of one of these precipices, he found, to his great joy, that the lion likewise

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made a halt, and kept the same distance as before. As soon as it grew dark, the Hottentot, sliding a little forwards, let himself down below the upper edge of the precipice upon some projecting part or cleft of the rock, where he could just keep himself from falling. But in order to cheat the lion still more, he set his hat and cloak on the stick, making with it, at the same time, a gentle motion just over his head, and a little way from the edge of the mountain. This crafty expedient had the desired success. He did not stay long in this situation before the lion came creeping softly towards him like a cat, and mistaking the skin cloak for the Hottentot himself, took his leap with such exactness and precision, as to fall headlong down the precipice directly close to the snare which had been set up for him."

This is not the only instance of the lion being ensnared by a stratagem of this kind. In the out-houses and waste grounds about farms, where a lion has been upon the watch for some animal and missed it, or where they have reason to expect one, they set up the figure of a man, close by the side of several loaded guns; so that these discharge themselves into the body of the beast at the very instant that he springs, or throws himself upon the dressed figure. This is done with so much ease and success, that they scarcely ever think it worth the trouble in Africa to take the lions alive, nor are they often at the pains to construct pit-falls for their capture.

Dr. Sparrman remarks, as a singular trait in the history of the lion, that though, according to many, it always kills his prey immediately if it belongs to the brute creation, it contents itself, however provoked, with merely wounding the human species in the first moment of seizure; or at least to wait some time before he gives the fatal blow to the unhappy victim. In several places through which the traveller passed, the natives mentioned to him by name a father and two sons, who were said to be still living, and who, being on foot near a river on their estate in search of a lion, were unexpectedly surprised by him; the foremost was thrown down by him, but the other two had just time to shoot the lion dead on the spot, after it had lain almost across the youth so nearly and dearly related to them, without having done him any particular injury. He also saw, near the upper part of Duyven-hoek river, an elderly Hottentot, who at that time had under one eye, and beneath the cheek-bone, the ghastly marks of the bite of a lion, which did not condescend to give him any other chastisement for having, in company with his master, hunted him with intrepidity, though without success. It was related likewise of a farmer and captain in the militia named Bota, who had lain for some time under a lion, and had received several bruises from the beast, besides being bitten very much in one arm, but who in a manner had his life given him by this noble animal. "I do not rightly," says Dr. Sparrman, "know how to account for this merciful disposition towards mankind. Does it proceed from the lion's greater respect and veneration for man, as being an equal to, or even a mightier tyrant than, himself among the animal creation? Or is it merely from the same caprice which has sometimes induced him not only to spare the lives of men or brute creatures, who have been given up to him for prey, but even to care for them and treat them with the greatest kindness? Whims and freaks of this kind have, perhaps, in a great measure, acquired the lion the reputation it has for generosity; but I cannot allow the specious name, sacred only to virtue, to be lavished on a wild beast. Slaves, indeed, and wretches of servile minds, are wont with this attribute to flatter their greatest tyrants; but with what show of reason can this attribute be bestowed upon the most powerful tyrant among quadr-

ped, because it does not exercise an equal degree of cruelty upon all occasions? That the lion does not, like the wolf, tiger, or some other beasts of prey, kill a great deal of game or cattle at one time, perhaps proceeds from this, that while he is employed in attacking one or two of them, the remainder fly farther than it accords with the natural indolence of this beast to follow them. If this be called generosity, a cat may be styled generous with regard to rats; as I have seen this creature in the fields, among a great number of the latter, where she could have made a great havoc at once, seize on a single one, and run off with it. The lion, and the cat likewise, very much resemble each other, in partly sleeping out, and partly passing away, in a quiet inactive state, a great part of their time in which hunger does not urge them to go in quest of their prey."

The strength of the lion, according to the same interesting traveller, is very considerable. He was informed that this animal was once seen at the Cape to take an heifer in his mouth, and though the legs of the latter dragged on the ground, yet he seemed to carry her off with the same ease that a cat does a rat; and it had likewise in its course to leap a broad dyke, which it accomplished without difficulty. This happened near Boshiesman river; the lion was perceived by a hunting party of Hottentots dragging his prey from the plain to a neighbouring woody hill; they however pursued, and forcing the lion to leave it, made a prize of it themselves. The lion is however said to be not sufficiently powerful to overcome an animal of such strength and size as the buffalo, without having recourse both to agility and stratagem. With this view it steals on the buffalo, and fastens with both its paws upon the mouth and nostrils of the beast, and keeps squeezing them close together, till at length the creature is strangled, wearied out, and dies. Attacks of this kind have been witnessed by the colonists, and the buffaloes have sometimes escaped, bearing at the same time the marks of the lion's claws about their mouth and nose. The lion on such occasions ventures, however, to assail the buffalo at great peril; for if another buffalo should approach, he would not fail to attack the lion, and the strength of the two buffaloes would be more than sufficient to overpower their assailant. The lion, it is said, unless pressed with hunger, will not always attack the buffalo; a traveller had once an opportunity of seeing a female buffalo with her calf, defended by a river at her back, keep for a long time at bay five lions which partly surrounded her; but did not, at least as long as the traveller looked on, dare to attack her. There is an instance also recorded of a lion being trampled to death by a herd of cattle, which he was urged to attack (probably by hunger) in the broad day light.

At the Cape the lion is frequently hunted by the colonists both for the sake of the flesh, which, though possessing a strong and disagreeable flavour, is eaten by the negroes; and also for the skin, which those people use as a mantle, or a bed. In the day time, and on the open plain, from ten to sixteen dogs will easily overcome a lion of the largest size. Nor is there any necessity that the dogs with which the lion is hunted should be very large, and trained up to the sport, as Buffon thinks they ought to be, the object being perfectly well accomplished with the common farmhouse dogs. As the lion is less swift than the dogs, the latter easily approach him, when, from a greatness of soul, and a fullen degree of magnanimity, the lion turns round, and waits for the attack, shaking his mane, and roaring with a short and sharp tone, or sits down to face them. The hounds then surround him, and, rushing upon him, all

at once, are thus, by their united efforts, able to subdue, or tear him in pieces: he has seldom time to give more than two or three slight strokes with his paws, each of which is attended with the death of one of his assailants.

Buffon asserts that the lion may be hunted on horseback, but that the horses must be trained to it, which, however, Dr. Sparrman assures us, is not the case, as the colonists hunt the lion with common hunting horses; the latter he describes to be as eager in pursuit of this formidable animal as in that of the antelope. "Our horses," says he, "the very same as had several times, in the manner above-mentioned, shewn their disquietude when the lion happened to be in the vicinity of them, and which were not in the least trained to the chase, once exhibited a spirit in the pursuit of two large lions equal to that which they had shewn at other times in chasing the timid gazels; though in fact hunting horses seem to partake much more of their master's pleasure in the chase. I remember in particular, at Agter Bruntjes Hoogtee, I rode a horse, which, by a tremulous sound issuing from its chest, cocking up its ears, and prancing and capering, discovered, in an unequivocal manner, its ardour in the chase, whenever it came in sight of the larger kind of game. There have even been instances of hunting horses, who, when the hunter has jumped off their backs in order to discharge his piece, but has missed his mark, have, in their eagerness for the chase, not allowed him time sufficient to mount again, but followed the game alone for hours together, close at its very heels, in all its turnings and windings." This ardour for the pursuit of the lion is only shewn, however, we are to remember, according to Dr. Sparrman, by the horses trained to the purposes of hunting; for he has told us on another occasion, that their common horses, as well as their oxen, sighed deeply, and betrayed such symptoms of fear, as even to lie down panic-struck when the lions were reconnoitering them; and these assurances seem strongly to confirm the observation of Buffon; namely, that it is necessary the horses with which the lions are hunted should be trained to the purpose, or be at least accustomed to the pursuit of beasts of prey, and the perils attendant on their chase. It furthermore appears from the same author, that it is only on the plains that the hunters ever venture to go out on horseback in this chase. If the lion remains in the coppice or wood on a rising ground, they endeavour to tease him with the dogs till he comes into the plain. They also go in parties of two or three together, or even more, in order to assist and rescue each other, in case the first shot should not take place. When the lion sees the hunters at a great distance, it is allowed universally that he flies from their approach with all possible speed, in order to escape; but if they chance to discover him at a small distance only from them, he retires with full dignity, and at a slow pace, as though he were above betraying by his actions any symptom of apprehension. This, therefore, also shews, that when pursued with vigour, he is soon provoked to resistance, or at least disdains any longer to fly. He slackens his pace, and at length only slides slowly off, step by step, at the same time watching his pursuers obliquely, till he finally makes a full pause, and, turning round upon them, shakes his mane, roars with a short and sharp tone, expressive of his indignation, and appears ready to seize on them, and tear them in pieces. This is the moment for the hunters to be on the spot, or within a convenient distance, to commence the attack; not in a body, but at proper intervals from each other. The foremost huntsman, or he that is most advantageously posted, and has the best mark of that part of the lion's body nearest his heart or lungs, must be the first to jump off his horse,

and, securing the bridle by putting it round his arm, discharge his piece; then, in an instant recovering his seat, must ride obliquely athwart his companions; and in case, giving his horse the reins, must trust entirely to the speed and fear of the latter to convey him beyond the reach of the lion, should he have only wounded him, or absolutely missed him. Under either of these circumstances a fair opportunity presents itself for some one of the other hunters to jump off his horse immediately, as he may then discharge his piece with effect, and save his companion. If this shot should miss likewise, a third sportsman rides after the lion, which at that time is in pursuit of the first or second, and, springing off his horse, fires his piece as soon as he arrives within a proper distance, and the animal presents itself in a favourable position. In the event of the lion turning again and attacking this pursuer, the other hunters return to his rescue with their pieces ready charged, having loaded them on horseback while flying from the wild beast. No instance, it is said, has ever been known of any misfortune happening to the hunters in chasing the lion on horseback. The remote parts of Africa are most exposed to the ravages of wild beasts, and the colonists in those districts, from the habits of hunting them, become excellent marksmen. The lion, which has the boldness to seize on their cattle, the most valuable part of their property, and that sometimes even at their doors, is as odious to them as he is dangerous and injurious; and hence they consequently seek out his lurking places, and pursue him with the greatest ardour and delight.

It is rather with the view of exterminating these formidable beasts of prey that the Africans hunt them; though, as already observed, the flesh is eaten by the negroes: the grease also, which is of a penetrating nature, is used in medicine, and their skin serves as a cloak or mantle, and was formerly worn as such only by persons of distinction. On some occasions also lions seem to constitute a part of the established pomp of royalty in the eastern world. The monarch of Persia, as appears from the travels of Mr. Bell, has on the days of audience two large lions, secured by means of golden chains, on each side the entrance of the hall of state.

The anatomy of the lion is described by Bartholinus in 1671, and in the Transactions of the Royal Society of Petersburg for 1771.

TIGRIS. Tail long; body varied with long dark streaks. *Tigris maculis virgatis*, Ludolf. *Felis flava, maculis longis nigris variegata*, Brull. *Cauda elongata, corpore maculis omnibus virgatis*, Schreber. *Tigris*, Gesner, &c. *Tigre*, Buffon. *Royal tiger*.

It is difficult to form any just conclusion either as to the size or beauty of this tremendous animal from the individuals retained captive from early life in our menageries; and where, from the smallness of their dens, and consequent uncleanness, their want of exercise, and of those habits of life which render them robust, their growth must naturally be suppressed, and their robe exhibit an infinitely less degree of brilliancy than when they roam at large in their native deserts.

The size of this animal, according to some authors, is larger, and, according to others, rather smaller than the lion; and in this respect the comparisons by different travellers vary materially, some affirming that it is the size of the deer, others of the horse, and some again even of the buffalo. There indeed appear to be two or more distinct animals confounded under the general name of tiger, in the same manner as the panther has been called the leopard, and the cougar the panther; and all, as well as the jaguar, are

indiscriminately termed tigers by various writers, a circumstance that has given rise to no small degree of confusion. The true tiger is the largest and most powerful of these animals, and which has obtained the appellation of the royal tiger in testimony of this pre-eminence. Buffon relates, on the authority of M. de Lalande Magon, that the latter had seen a tiger in the East Indies fifteen feet in length, including the tail; but this even is inferior to others recorded by travellers. L'Abbé Richard says they have tigers at Tonquin eighteen feet in length. The height of the tiger, according to Fouché d'Obsonville, is four feet ten inches, and the length nine feet from the front to the base of the tail; and Grandpré, in his voyage to India, describes tigers as large as oxen.

Tigers are peculiar to Asia, and are not, as some authors suppose, inhabitants of the new continent; and moreover they are confined to the warmer parts of Asia, and principally to India and the Indian islands, though the species extends as far north as China and Chinese Tartary. They abound most in Malabar, Bengal, and the kingdom of Siam, and Tonquin.

A more beautiful animal than the tiger does not exist; he is as unrivalled for the brilliancy and elegance of his fur, as he is distinguished for his ferocity, and the want of every quality which, as a beast of prey, could palliate the nature of his disposition. His whole figure is expressive of the powers of his strength and activity. The head is short and roundish, the ears short, and the armament of his teeth truly formidable. The general colour of his fur is a deep tawny, or yellow orange, which is of a deeper hue on the back than the sides; and the face, throat, and under side of the belly are nearly white: the whole body is traversed by numerous perpendicular stripes of black, and the tail is also annulated with the same. In different individuals the colours vary in the brightness of the yellow-orange, which constitutes the ground-colour of the fur, and the intensity of the bands of black, with which it is relieved; these bands are in some parts double, in others single, and are fewer in number about the head and under parts of the body than on the upper. The tiger is the most rapacious of all carnivorous animals; fierce without provocation, and cruel without necessity, his thirst for blood is insatiable; although glutted with carnage he is not appeased; he seizes, and tears in pieces every animal with equal fury and rapacity, nor ever desists so long as a single object remains in sight that he can vanquish; he lays waste the country he inhabits; flocks and herds fall indiscriminately victims to his fury, his cruelty, and cunning; he attacks the elephant, the rhinoceros, and even braves the lion himself; he neither fears the sight nor the opposition of men, whom he frequently makes his prey, and is even said to prefer human flesh to any other. The tiger seems to have no other instinct than a constant thirst after blood, and which often stimulates him to devour his young, or the cubs to tear the mother in pieces for defending them. Sometimes he lies in wait on the banks of rivers, where the heat of the climate obliges other animals to repair for drink, but from the velocity of his flight he is equal to the chase of the fleetest animals, and oftentimes pursues them to their inevitable destruction.

The strength of the tiger is so great, that when it has killed a deer, or even a buffalo, it carries off the prize with such ease, that it seems no impediment to its flight. This it does to prevent interruption, as it can devour the slaughtered animal in the woods more at its leisure. The moment the animal he attacks is overcome, it plunges its head into the body, as if to satiate itself with the blood; and

when large it commonly tears out the entrails to facilitate its conveyance to the retreats of its lurking place.

Neither force, restraint, nor violence can subdue the ferocity of the tiger; he is equally irritated with good as bad treatment, and is so insensible of its keeper, that he would equally tear the hand that feeds him, as that by which it is chastised. It is nevertheless admitted that the tiger, when very young, has much playfulness and some docility. In Bewick's quadrupeds it is related, that a young male tiger, lately brought from China in the Pitt East Indiaman, at the age of ten months, was so far domesticated, as to allow every kind of familiarity from the people on board. It seemed to be quite harmless, and was as playful as a kitten. It frequently slept with the sailors in their hammocks, and would suffer two or three of them to repose their heads upon its back as upon a pillow, whilst it lay stretched out upon the deck. In return for this it would, however, now and then steal their meat. Having one day taken a piece of beef from the carpenter, he followed the animal, took the meat out of its mouth, and beat it severely for the theft, which punishment it suffered with all the patience of a dog. It would frequently run out on the bowsprit, climb about the ship like a cat, and perform a number of tricks, with an agility that was truly astonishing. There was a dog on board the ship with which it would often play in the most diverting manner. From these circumstances, one might be led to suppose that the disposition of the tiger, like that of many other animals, was capable of some degree of culture. But, as this author remarks, it ought to be remembered, that at the time this one was taken on board the ship it was only a month or six weeks old; and when arrived in this country it had not quite completed a year. How much longer its good humour might have continued it is impossible to say; but it is not to be doubted that its innocent playfulness would not have formed a part of its character when arrived at maturity, at least there is every reason to conclude this, when we recollect that most of those tigers kept in our menageries have been made captives when very young, and must necessarily acquire that ferocity of character which so invariably distinguish them from instinct only, not from their habits or manners of life.

As the tiger attacks all animals, without exception, it has not unfrequently to sustain the most arduous conflicts with the rhinoceros, the elephant, and even the lion; and its combat with either occasionally proves fatal to one or both of the combatants.

It is affirmed of the tiger, that if it happens to miss his aim he does not pursue his prey, but, as if ashamed of his disappointment, runs off with speed. In the beginning of the last century some ladies and gentlemen, being on a party of pleasure under the shade of some trees near the banks of a river in Bengal, observed a tiger preparing for its fatal spring, when a lady, with almost unexampled presence of mind, furled a large umbrella in the face of the animal, which instantly retired, and thus gave an opportunity of escaping from so terrible a neighbour. Another party had not, however, the same good fortune, but in the height of their entertainment lost, in an instant, one of their companions, who, being seized and carried off by a tiger, was never heard of more. Another distressing accident, of a similar kind, took place so lately as the year 1792, the particulars of which, as related by an eye-witness, must be strong in the recollection of many readers. The unfortunate victim of this event was Mr. Munro, the son of Sir Hector Munro. "We went," says the writer of the narrative, "on shore at Sangar island to shoot deer, of which we saw innumerable tracts, as well as of tigers; notwithstanding which, we continued our diver-

sion till near three o'clock, when, sitting down by the side of a jungle to refresh ourselves, a roar like thunder was heard, and an immense tiger seized on our unfortunate friend, and rushed again into the jungle, dragging him through the thickest bushes and trees, every thing giving way to his monstrous strength; a tigress accompanied his progress. The united agonies of horror, regret, and fear rushed at once upon us. I fired on the tiger; he seemed agitated; my companion fired also, and, in a few minutes after this, our unfortunate friend came up to us bathed in blood. Every medical assistance was vain, and he expired in the space of twenty-four hours, having received such deep wounds from the teeth and claws of the animal as rendered his recovery hopeless. A large fire, consisting of ten or twelve whole trees, was blazing by us at the time this accident took place, and ten or more of the natives with us. The human mind can scarce form any idea of the scene of horror. We had hardly pushed our boat from that accursed shore, when the tigress made her appearance, almost raging mad, and remained on the sand all the while we continued in sight." A similar fate attended one of the servants in the retinue of Grandpré, a French traveller in India, a tiger, rushing on the party, seized him, and carried him off.

Marfden says, the number of people killed by the tigers in some parts of India is incredible. In Sumatra the natives are so infatuated that they seldom kill them, as they have a notion that they are animated by the souls of their ancestors; and from this weak and superstitious idea suffer themselves to be devoured without attempting by their united strength to destroy these rapacious creatures. In other parts of India, where the use of fire-arms is unknown, the devastations committed by the tigers exceed all calculation; in the provinces of the mountainous and woody tracts of the Tonquin, for example, whole villages are depopulated by them. L'Abbe Richard speaks of a single tiger entering one of those villages and destroying four or five and twenty persons, there being no fire-arms to resist him, and the inhabitants endeavouring to escape death by flying in all directions, such as were pursued became an easy prey to the destructive monster. The woods of Sundry, and others adjacent to the banks of the Ganges, and its tributary rivers, are celebrated as the resort of tigers, and it is dangerous to navigate those waters close along the shore, the tigers having sometimes even the audacity to plunge into the water to attack the men in their boats.

Pliny has incurred the censure of some modern writers for describing the tiger as an animal of tremendous swiftness, "animal tremendæ velocitatis;" which they say is applicable to his spring when darting on his prey, and not to the swiftness of his pace when running. In this remark they are contradicted by two travellers of authority, namely, Pere Gerbillon, and Mr. Bell, the first of whom speaks of it as an animal of vast swiftness, and the other saw a race between a tiger and a swift horse, whose rider escaped merely by rushing into the midst of a circle of armed men. One point does not, however, appear to have been considered; it is not unlikely that the animal spoken of by Pliny under this appellation may be the tiger of the moderns; yet, from the very slight account he has left us, this is not certain: (vid. lib. viii. c. 18.) and if it be really the animal intended, there is still no cause to distrust its accuracy, for the tiger must be a creature of amazing speed. The accounts given by writers of the attachment shewn by the tigress to her young, the manner in which she defends them, or if carried away endeavours to regain them, and the fury of her conduct for their loss, is a repetition only of the observations made by Pliny, or with little variation. She

is at all times furious, but when robbed of her young her rage rises to the utmost extremity. She then braves every danger, and pursues her plunderers, who are usually mounted on the swiftest horses, so closely, that they are often obliged to release one in order to retard her; this she stops to convey to some thicket or place of safety, and then again halts after the hunters, who may be compelled to drop another of her cubs in the same manner in order to escape with the rest. The hunters on this arduous occasion are generally provided with boats on the nearest river, or the shore of the sea, to which they retreat with all speed, the tigress pursuing them to the water's edge, and when her hope of recovering them is lost, she expresses her agony by the most hideous howlings.

The amours of these animals are ferocious in the extreme: it has not hitherto been well ascertained how long the tigress goes with young, but it is commonly believed to be about the same period as the lion: they have about four or five young at each litter.

Among the Chinese the skin of the tiger is held in much higher esteem than it is by Europeans, and forms an article of dress for persons of particular distinctions; and it besides serves as a covering for the seats and cushions in the houses of the great, and in their halls of public justice. The Indians pretend that the fat of the tiger is an universal remedy for all external ailments. The tongue, dried and reduced to powder, is a specific for diseases of the nerves; their eyes have also some imaginary virtues, and probably many other parts of the animal are alike considered as sovereign remedies for different maladies of the human frame.

Hunting the tiger is a favourite diversion of the great in the eastern parts of the world, and is always conducted with much pomp and ceremony. When the monarch, princes, or nobles hunt the tiger, they are usually mounted on elephants; and their retinue, consisting of hunters and soldiers, attend, some on horseback and others on foot. Combats between the tiger and the lion, or the elephant, are also, on some grand occasions, the amusements of those eastern nations. They consider the tiger as a more powerful animal than the elephant, and therefore cover the head of the latter with a kind of shield previously to the engagement. Sometimes the tiger is matched against two elephants at once, instead of one, and even then the issue may be doubtful from the superior dexterity of the tiger. Tachard has given an account of a battle of this kind at Siam, of which he was an eye-witness. The heads, and part of the trunks of the two elephants, were defended from the claws of the tiger by a covering made for the purpose. They were placed in the midst of a large inclosure. One of them was suffered to approach the tiger, which was confined by means of cords, and received two or three heavy blows from the trunk of the elephant upon its back, which beat it to the ground, where it lay for some time as if it were dead; but though this attack had greatly abated its fury, it was no sooner untied, than, with a horrible roar, it made a spring towards the trunk of the elephant, but which that animal dexterously avoided by drawing it up, and, receiving the tiger on his tusks, threw him up into the air. The other elephant was then allowed to assist, and after giving it several heavy blows, would undoubtedly have killed it, if an end had not been put to the combat. Under such restraints we cannot be surprised the result was unfavourable to the tiger. We can only be astonished at its strength and fierceness, that after being disabled by the first attack of the elephant, and whilst yet held by its cords, it would venture to continue such an unequal conflict.

Tigers are destroyed by various means, besides that of hunting,

hunting, or combat; divers contrivances, machines, and toils having been invented by the more ingenious tribes of Indians for this purpose. One, the most simple and effectual, seems to be that of fastening an animal to a tree in the known track of the tiger, which they easily discover by the footsteps, and placing near the spot a vessel filled with water saturated with arsenic; the tiger, after devouring its victim, eagerly drinks the water to quench his thirst, and thus inevitably becomes poisoned and dies.

PARDUS. Tail long; body marked above with orbicular spots, beneath with stripes. Schreber. *Panthera*, Gefn. *Pantherè*, Buff. *Panther*.

LEOPARDUS. Tail moderate; body fuscous, with nearly contiguous black spots. Erxleb. Schreb., &c. *Leopard*, Buff.

The difference between the panther and the leopard is so very trivial and ambiguous, that it has been long considered doubtful among naturalists whether they are in reality specifically distinct or not; and indeed it seems to be so nearly decided of late years that they are the same by the best writers, that we cannot entirely refuse our assent to this conclusion. The panther is the largest of these two animals, and in point of size ranks next to the tiger, measuring about five or six, and, in some instances, seven feet, from the nose to the origin of the tail, and the tail itself nearly three feet. The hair is short and smooth, and the general colour fine tawny yellow, thickly marked over the upper parts of the body, shoulders, and thighs, with roundish black spots, disposed into circles, consisting of four or five spots, with sometimes a single dot in the middle. On the face and legs the spots are single. The breast and belly are white, the former with dusky transverse stripes, the latter, and also the tail, with large irregular spots of black. The head is moderate in length, the ears pointed, the eyes pale yellow, and its whole aspect fierce and cruel.—The leopard is about four feet in length from the nose to the origin of the tail, and the latter about two feet long. The predominant colour is yellowish, of a paler hue than that of the panther, and more inclining to luteous; the spots with which it is diversified are also black, and disposed in circles, but are smaller, closer, and less distinct than in the panther, and the space in the centre of the rings, formed by the disposition of the marginal series of spots, is usually plain. This is the general appearance of the two above-mentioned animals, but they vary in colour, and also in the size and form of the spots, and ocellated marks in different individuals. The supposed varieties of the panther and leopard, described by some travellers and other writers, cannot be mentioned with implicit confidence; such are the *black leopard*, and *less leopard*.

Both the panther and the leopard abound in the interior of Africa, from Barbary to the remotest parts of Guinea, and are the scourge of every country they inhabit. The panther, from its superior size and strength, attacks the larger quadrupeds, and is extremely destructive among the camels and horses; the leopard commits dreadful havoc among the herds and flocks of goats, sheep, and other animals, and the different kinds of game.

These animals frequent the banks of rivers, and take their prey by surprise, either lurking in thickets, from which they dart on them when they approach within a convenient distance, or creeping on the belly till they reach their victim: they climb trees in pursuit of monkeys and smaller animals with perfect ease; it is only when pressed with hunger that they attack man.

Travellers relate that the flesh of these animals is of excellent flavour, and white as veal. The Indians and Ne-

groes eat it, but prefer that of the dog; they however take it in pitfalls for the sake of the flesh, as well as the skins, which latter sell for a high price. Collars, bracelets, and other ornaments composed of the teeth of these animals, also constitute an article of finery in the dress of the negro-women, and are esteemed the more valuable as charms to repel the power of witchcraft.

UNCIA. Tail long; body whitish, with irregular black spots. Erxleb. *Once*, Buff.

The once is about three feet and a half long from the nose to the tail, strong, the back long, and the legs short. The hair is long, and of a light grey colour, tinged with yellow, and paler on the breast and belly; the head is marked with small round spots, with a larger spot of black behind each ear; the back is beautifully varied with a number of oval blotches rather darker, and surrounded with a margin of black dots; the spots on the sides are more irregular, and those on the legs and thighs small, scattered, and few in number; the tail is long, and full of hair, and is irregularly marked with large black spots.

This is supposed to be the panther of Pliny, and the smaller panther of Oppian. It inhabits the northern parts of Africa, Persia, and China, and is said to abound in the Thyreanean forests. The once, according to most writers, is trained to the chase like the hunting tiger; but it is conjectured that Tavernier, upon whose relation this is stated, was deceived, and that the animal he means is no other than the *felis jubata*.

ONCA. Tail moderate; body yellowish, with black, rotundate, angulate spots, yellow in the middle. Schreber. *Pardus aut lynx Brasiliensis, jaguara didus, Lusitanis onza*, Ray. *Jaguara*, Marcgrat. *American tiger, or jaguar*.

The colour of this animal is bright tawny; the upper part of the head striped with black; the sides beautifully variegated with irregular oblong ocellar spots; the thighs and legs are variegated with black spots without central spaces; breast and belly whitish; tail not so long as the body, above marked with large black spots in an irregular manner, beneath with smaller spots.

This species grows to the size of the wolf, or larger, and inhabits the hotter parts of America, from the illimus of Darien to Buenos Ayres; at Brazil it bears the name of *janouara*; at Paraguay, and in other parts of South America, it is called *yagouareté*.

The jaguar is neither so timid, nor so indolent as some writers have represented; it is fierce and destructive to man and beast: like the tiger it plunges its head into the body of its prey, and sucks out the blood before it devours the flesh. It runs swiftly, and by means of its talons ascends the loftiest and smoothest trees with a facility that is inconceivable, when in pursuit of quadrupeds, that endeavour, by climbing up the trees, to effect their escape. The Indians, who are much afraid of this animal, entertain the silly persuasion that it prefers them to the white inhabitants, who perhaps are better prepared to repel its attacks, and are not therefore so often annoyed by it. In travelling through the deserts of Guiana they light large fires in the night time, to prevent these animals from attacking them. The howl of the jaguar is dreadful; their cry plaintive, grave, and strong, like that of the ox. The female is supposed to produce only two young at a birth.

PARDALIS. Tail long; upper part of the body striped, beneath spotted. *Felis pardalis*, Schreber. *Ocelot*, Buff. *Mexican cat, or ocelot*.

Greatly resembles the common cat, but is three or four times its size, measuring in length about four feet, and its height two feet and a half.

In the variety of its markings, as well as colours, the ocelot is extremely beautiful, the male especially. The general colour is bright tawny above, with the breast, belly, and lower part of the sides, together with the limbs, white. A black stripe extends from the top of the head, along the back, to the origin of the tail; the forehead is spotted with black, as are also the legs; the shoulders, back, and rump are finely variegated with ovate blotches and interrupted longitudinal bands of a deeper tinge than the ground colour, the edges of which are black; the spots are generally marked in the middle with a single spot of black, the stripes with a series of black dots disposed at nearly an equal distance from each other. The tail is diversified with blotches of an irregular form and black at the tip. In the female the fur is neither so vivid in colour, nor so beautiful in variety.

The ocelot inhabits the hotter parts of South America, where it inhabits mountainous situations, and resides chiefly among trees, like the lynx, or caracal; it lies in wait upon the boughs concealed among the leaves, and seizes its prey by darting on them from its lurking-place, when they approach within a convenient distance. Sometimes it surprises them by stratagem, extending itself along the boughs, where it can be seen as if it were dead, and springing on them when, from natural curiosity, they approach within its reach; monkeys are often caught by the ocelot in this manner. It is said to prefer the blood of animals to their flesh. Though voracious and fierce, it is of a timid nature, and so afraid of dogs that, when pursued by them, it flies to the woods for safety. The inhabitants of South America call it *chibigouazon*.

The ocelot is not uncommon in Paraguay, though, from its manners of life, and the secrecy of its retreats, it is seldom seen; its visits to the poultry-yards in the farms contiguous to the woods are often ascertained by its foot-steps and the devastation committed. The ocelot never leaves its lurking-places in the day time, nor even in the night, when the moon shines; it is under the obscurity of the darkest nights, and when the weather is tempestuous, that it ventures so far as the neighbouring farms in quest of prey. Each of the retreats of the ocelot appears to be inhabited by a male and female, with their family of young; and though there may be many ocelots in the same woods their haunts are separate. They are said to have about two young ones at a litter.

Some years ago a male and female ocelot that had been taken very young were carried to France. At the age of three months they became so strong and fierce, as to kill a bitch that was given them to nurse. When a live cat was thrown to them they sucked its blood, but would not taste the flesh. The male seemed to have a great superiority over the female, inasmuch as never to allow her to partake of the food till his own appetite was satisfied. In a state of captivity the ocelot has been known to eat about five pounds of meat daily; three or four pounds are the ordinary allowance.

TIGRINA. Tail long; body fulvous, striped and spotted with black, beneath whitish. Erxl. *Felis ex grijeo flavescens, maculis nigris variegata*, Briff. *Felis fera tigrina*, Barr. *Margay*, Buff.

The margay is considered by some late continental writers as the same animal with the ocelot, in a less advanced state of growth; but it appears to be more generally admitted as a variety of that species. It is a native of Guiana, Brazil, and various other parts of South America. In point of size it resembles the common wild cat. The ground colour is bright tawny; the face striped downwards

with black; the body is marked with stripes and spots of black; the breast and inside of the legs white, with black spots; tail long, and marked with alternate spots of black, tawny and grey. Like the ocelot it lives in woody situations, chiefly residing in trees, and is said to breed in the hollows of them. It is of a fierce disposition, preys on birds, and produces two young at a birth.

JUBATA. Tail moderate; body fulvous, with black spots; neck maned. Schreber. Erxl. *Tyger-wolf*, Kolbe. *Cuopard*, Buff. *Maned, or hunting leopard*.

This animal is about the size of a greyhound, the usual length being about three feet and a half; the head is small, the body long, the ears short, and the tail about twenty inches. The body is of a light tawny brown above, marked with small round black spots, which are scattered over the back, sides, head, and legs; the belly is white, and the tail marked on the upper side with three large black spots. In several of the above particulars this animal agrees with others of the cat or tiger kind, but that by which it may be at once distinguished from every other of the same tribe is the mane on the collar and between the shoulder, a character no other animal of this genus is known to possess; the hairs which constitute the mane are about five inches long, and sufficiently conspicuous to be distinguished.

The species of tiger, or leopard, which the Indians train for the purpose of hunting the antelope and other beasts of chase, has been described so vaguely, and under such dissimilar names, that we cannot speak precisely, but it is presumed the animal intended must be of this kind. The hunting tiger, according to the reports of travellers, is carried in a small kind of waggon, chained and hoodwinked, till it approaches the herd, when the animal is unchained and suffered to pursue the game. At first it creeps along with its belly close to the ground, stopping and concealing itself till it gets an advantageous situation; it then darts towards its prey with amazing agility, and, after five or six bounds, seizes it, and brings it to the ground. Should it not succeed in the first effort, it shews no inclination to renew the attempt, but gives up the point and returns to its master.

CONCOLOR. Tail long; body fulvous, without spots; beneath whitish. *Felis concolor*, Schreb. *Felis ex flavo rubescens, mento et infimo ventre albicantibus*, Briff. *Puma f. leo Americanus*, Hernand. *Cuguacuerana*, Maregr. *Cougouar*, Buff.

The puma, or cougar, is sometimes called the American lion. It is the largest of the beasts of prey known to inhabit the new continent, measuring in length rather more than five feet from the nose to the tail, and the tail itself measuring two feet eight inches. The form is slender, the body being long, and the animal standing high on his legs. The predominant colour is pale brownish red, inclining in some parts to blackish, especially on the back, which is darkish. Its chin is white; breast and belly tinged with ash-colour, as are likewise the insides of the legs; the tail inclines to dusky ferruginous, with the tip black.

This is an animal of great strength and fierceness, preying on cattle and deer, to attack which it will swim rivers, and burst through the bounds of inclosures. Sometimes it is said to climb trees, and watch the opportunity of springing on such animals as pass beneath. The species is common in Guiana, Brazil, and Mexico, and is found in various parts of North America, from Canada to Florida.

Notwithstanding its ferocity, the cougar, when brought into captivity, is allowed to become almost as gentle as the common cat, allowing itself to be caressed, and permitting boys to mount on its back. When satisfied with eating, it conceals the rest of its food; purs like the cat, and some-

times howls dreadfully. The flesh of this animal is white, and is eaten by the American Indians, who esteem it excellent food. The fur is soft, and forms an article of winter clothing amongst these people.

DISCOLOR. Tail long; body above black, beneath whitish. *Felis discolor*, Schreber. *Felis nigra*, Erxl. *Le cougar noir*, Buff. *Jaguar, or black tiger*, Penn.

This inhabits the same parts of America as the former, and resembles it pretty nearly, except in colour, which is dusky, and in general plain. The throat, belly, and inside of the legs are pale ash; the upper lip white, and furnished with long whiskers, and the eye-brows beset with long hairs; at each corner of the mouth is a black spot; the ears are sharp-pointed, and the paws white. The tail is of the same colour with the rest of the body.

The black tiger is a cruel and ferocious creature, and greatly dreaded by the Indians, but is fortunately not common; it grows to the size of an heifer of a year old, and is remarkable for its strength; its form, like that of the puma, is rather slender. M. De la Borde relates of the black tigers that they frequent the sea shore, and eat the eggs deposited there by the turtles. They also devour alligators, lizards, and fishes, and sometimes the buds and tender leaves of the Indian fig. They are excellent swimmers. In order to catch the alligator, according to this writer, they lie down on their belly at the edge of the river, strike the water to make a noise, and immediately that the alligator raises its head above the water, the tiger darts his claws into the eyes, and drags it on shore.

CATUS. Tail long and annulated. Gmel. *F. catus*; *canda elongata, auribus equalibus*, Linn. Fu. Suec. 3.

The wild cat (*ferus*) is distinguished from the varieties of the domestic cat by the superiority of its size, measuring four or even almost five feet in length from the muzzle to the end of the tail. It is comparatively more robust, and possessed of far greater strength and spirit. The head is larger, and the face flatter; the teeth and claws more formidable; and the colours and stripes in general nearly uniform. The fur is grey, mixed with yellowish, and sometimes slightly tinged with tawny. A dark list extends along the back, from the head to the origin of the tail, and the back, sides, and flanks traversed with a number of blackish lines, which originating in the longitudinal dorsal line, point downwards, in nearly a perpendicular direction towards the belly, like the streaks in the fur of the tiger. The tail is thick, and marked with alternate bars of black and whitish grey, and the middle of the throat and breast, and the lower part of the belly, are usually of the same colour.

Cats are found in a state of wildness in many of the forests of Germany, and, from the nature of its haunts, acquired among the old writers the names of *felis sylvestris*, and *catus sylvestris*. Some writers affirm that the wild cat, which may be truly considered as the parent stock of our domestic cats, is confined to the woods of Europe and Asia. Others assert that wild cats are found with very little variety in almost every climate; they existed, according to those authors, in America before its discovery by the Europeans, and it is advanced in argument, that one was brought to Columbus, which was of the ordinary size, and of a brownish grey colour, with a long tail. It is also concluded to be a native of Africa, as Sparrman describes one shot at the cape, which, he says, was similar in every respect to those of Europe; this was of a grey colour; and measured from the nose to the tail almost twenty-two inches; the tail was thirteen inches long, and its height about a foot and a half. Its intestines were full of moles and rats.

In this country the wild cat is the largest and most de-

structive beast of prey extant, if we except the fox; the bear and the wolf, which in early times infested our woods, being wholly extirpated. Formerly the wild cat was abundant in our forests; and were considered among the beasts of chase, as appears by a charter of Richard II. to the abbot of Peterborough, which grants him permission to hunt the hare, fox, and wild cat. This animal was hunted chiefly for the sport it afforded, the flesh being useless, and the skin bearing an inferior price; at least it was not esteemed of the most luxurious kind, for it was ordained that no abbots or nuns should use more costly apparel than such as was made of lamb's or cat's skins. The wild cat is now become rare in Britain, one was killed some years ago in Cumberland, and another in Warwickshire, which latter is in the collection of Mr. Donovan. In the Hebrides, and the north of Scotland, the wild cat is supposed to be more frequent than in South Britain. They are taken in traps, or by shooting.

It prefers woods in mountainous situations, and living on trees, preys on birds and the smaller quadrupeds, such as rats, mice, bats, and squirrels; it also pursues rabbits and hares, makes great havoc among poultry, and will even kill young lambs, kids, and fawns. It is dangerous in the chase of those animals to wound them slightly, for they defend themselves with great spirit, attack the dogs with fury, and even fall on the sportsman, and, from the strength of their talons and teeth, can prove themselves no despicable enemies.

The common domestic cat, *catus domesticus* of the Linnæan system, *felis vel catus* of Gesner, and *felis domestica* of Brisson and Jouslon, derives its origin from the former, and is so infinitely varied in its appearance from culture and domestication, as to baffle all description. Schreber distinguishes the domestic kind from that existing in a state of wildness, by its smaller size, and the comparative shortness as well as thickness of the hair. Among the principal varieties of the domestic cat, we may mention those entirely black, or black with white spots. White without spots or variation; white with black spots; white with brown spots. Dun or grey, plain or with little variation; or greyish, with darker stripes, which last approaches nearest in appearance to the parent stock. There are also many varieties spotted with white, black, and fulvous, occasioned by crossing the breed of the common with the Spanish or tortoise-shell cat, which latter is supposed by naturalists to constitute a distinct breed, though not specifically different from our domestic cat.

We can add nothing to the general history of an animal so fully described as the present species, and whose manners of life are familiar to every reader. It is represented as an useful but deceitful domestic. Although when young it is playful and gay, it possesses at the same time an innate malice and perverse disposition, which increases as it advances to maturity, and which education instructs it to conceal, but not to subdue. Constantly bent upon theft and rapine, though in a domestic state, they are full of cunning and dissimulation; they conceal all their designs, seize every opportunity of doing mischief, and then, sensible of their misconduct, fly from punishment. Thus they assume, it is said, the habits of society, but never its manners; for they have only the appearance of friendship and attachment. Nothing can be more illiberal, however, and oftentimes more unfounded, than general observations. We are too apt to deduce unlimited inferences from certain traits in particular individuals, or which may be evinced under peculiar circumstances, and thus establish the character of a whole race of animals from the most partial views. In some degree the reproach at-

tached

tached to the character of the cat from its want of gratitude and attachment to its benefactors may be true, but surely not to the extent described; and we are to consider, also, that the treatment or the instruction this animal receives is not always of such a nature as to excite attachment. We bestow chastisement, and expect fondness in return; we betray apathy, and require affection; or we desire gratitude for favours which are not worthy of that sentiment; and that without reflecting that the cat is of all others the most unrestrained of our domestics; one of those inmates which, even under our own roofs, leads a life of independence, and is cared for and admired only in proportion as she exhibits those proofs of ferocity towards the minor race of animals, which inspires her with the worst passions of her race, a love of carnage, cruelty, and unrelenting vengeance; a propensity to destroy all creatures she has the strength and address to overcome. Thus early inured to habits of rapine, she becomes the tyrant of her inferiors, while to larger animals, and to man, she owns obedience, rather because she is sensible of her own weakness, and looks up to them for protection, than from any tie of friendship or regard. The hand that ministers to her wants and supplies her food she may respect; few of the most ferocious beasts of prey are destitute of this attachment, and none reduced by culture to domestication. Thus reared and tutored, we instruct her to be rapacious when she can conquer; we teach her to be deceitful towards those she cannot overcome; and then accuse her of dissimulation because she profits by our instruction. The ingenious Somini, overlooking those propensities of the cat inherent in her nature, or imbibed from culture, is anxious to place this animal in its most amiable point of view; his reflections are just, but we are to remember that it is ferocity, at least to a certain extent, and not mildness, that best fits the cat for that station in society which it is destined to fulfil; and that those traits of character, which alone constitute its value as a domestic, at the same time that they cannot fail to render it rapacious and deceitful, ought surely not to have been forgotten in describing the disposition of this valuable animal. "The cats," says Somini, in speaking of those found in Egypt, "are gentle and familiar; they have no distrust of man, the ferocious character, which, in some parts of France, render them a race of animals rather wild than domestic: but these differences are as much the work of man as the effect of climate. In the department where I live, and in those adjacent, the cat, especially in the country, is the most miserable of beings, next to the horses set apart for husbandry. Masters and servants agree in hunting the cat, in beating her, in pelting her with stones, in worrying her to death by dogs, after having almost starved her to death. If hunger, which her leanness clearly witnesses, incites her to spy the moment for stealing a little morsel, the pretended thief, because nature would not suffer her to let herself die of absolute want, pays with her life the address she has employed to support it. How is it possible that cats should not assume, under the discipline of such masters, whose cruelty to animals borders on barbarity, a wildness of physiognomy, an imprefs of ferociousness? And if you compare those wretched cats of my country with such as are entertained at Paris, where, more kindly treated and sheltered from perpetual alarm, they are of an amiable familiarity, you will have a new proof of the influence which the character of man exercises over that of the brute creation."

The cat brings forth twice or sometimes thrice in the course of the year. She goes with young about fifty-five or fifty-six days, and produces five or six young at each litter. The female exhibits every degree of maternal tenderness

for her young, and often conceals them, lest the male, as is sometimes the case, should devour them; and, if apprehensive of being disturbed, she will remove them, one by one, in her mouth, to some other place of greater security.

Cats are in particular attached to the place where they were brought up, and if carried elsewhere seem lost and bewildered, and frequently take the first opportunity of escaping to their former haunts. These animals have been known to return to the place from whence they were carried, though at miles distant, and though they could not possibly have any knowledge of the road or situation that would lead to it.

This animal is about eighteen months before it acquires its full growth, and about ten years is the usual period of its life; some remarkable instances of longevity are, however, recorded, cats having lived to the age of twenty years, or more. It is generally remarked, that cats can see in the dark, which is not absolutely true, yet it is certain that they can see with much less light than most other animals, owing to the peculiar structure of the eye, the pupil of which is capable of being contracted or dilated in proportion to the degree of light by which they are affected. During the day the pupil of the eye is perpetually contracted; and it is with difficulty that it can see by a strong light, but, as in the twilight, the pupil resumes its natural roundness, the animal enjoys perfect vision, and takes advantage of this superiority to discover and surprize its prey. The cry of the cat is loud, piercing, and clamorous; and, whether expressive of anger or of love, is equally violent and hideous. When pleased the cat purrs and moves its tail; when angry spits, hisses, growls, and strikes with its feet, it is also said to emit a fetid smell at such times, and climb with great agility. In hunting and seizing its prey, the cat exhibits all the actions of the tiger, lying in wait, crawling on the belly, wagging the tail when preparing for its leap, and bounding on it when within a convenient distance. The cat is averse to water, cold, and unpleasant smells; it delights in certain perfumes, and is in particular partial to the aromatic emanations of the valerian, marum, and cat mint, and, if not prevented, would infallibly destroy the plants of this kind, growing in gardens, by rubbing itself against them, and trampling over them. The cat drinks sparingly; eats flesh and fish, the latter of which it prefers, and seldom eats vegetables, unless pressed with hunger. It is proverbial, that the cat washes behind its ears before a storm; that when it falls from a height it alights on the feet, and that it is tenacious of life. The eyes have a somewhat phosphorescent or sparkling appearance in the dusk; and the hair being dry emits an electric fire which is visible in the dark: the fur is indeed said to yield the electric sparks so readily, that if, in frosty weather, a cat be placed on a stool with glass feet, and rubbed for a certain time, in contact with the wire of a coated pial, the latter will become effectually charged by that means.

In the days of Howel Dda, or Howel the Good, who reigned a short time before the Norman conquest, the domestic cat was valued at a considerable price, both on account of its scarcity and utility, and its life protected by law. The price of the kitten, before it could see, was to be a penny; till proof could be given of its having caught a mouse, two-pence, after which it was rated at four-pence, a great sum in those times; it was, however, required, that it should be a good mouser, have its claws whole, and, if a female, be a careful nurse; but if it failed in any one of these good qualities the seller was to forfeit a third part of its value. If any one should steal or kill the cat that guarded the prince's granary, he was either to forfeit a milch ewe, her fleece and lamb, or as much wheat as, when poured on the

cat suspended by the tail (its head touching the floor), would form a heap high enough to cover the tip of the former.

The cat was held in high veneration by the ancient Egyptians. When a cat died in a house, the owner of the house, Herodotus informs us, shaved his eye-brows; they carried the cats when dead into consecrated houses to be embalmed, and interred them at Bubastis, a considerable city of Lower Egypt. If any killed a cat, though by accident, he could not escape death. These laws were politically useful; it was necessary to put under the immediate protection of the laws a species of animals whose protection was indispensable against the prodigious multitudes of rats and mice with which Egypt was infested, and the most effectual means of procuring respect for them was to render them objects of deification. Cats, no longer regarded sacred in Egypt, are nevertheless to this day treated with the utmost care in that country, and are to be found in all the houses. The cats are trained in some of the Grecian islands to attack and destroy serpents, with which those islands abound.

The following are considered as permanent varieties, or distinct breeds, of the common cat species, *felis catus*.

Angora cat, the hair of which is silvery-white, silky, and long, that surrounding the neck longest. This is the most beautiful of all the varieties; its nose and edges of the lips are fine rose colour; the eyes in general blue or yellow, and of a sparkling brilliancy, and its whole aspect mild and composed. The hair is of a dazzling whiteness, remarkably thick and long, and the tail, when elevated above the body, forming a beautiful plume. Angora, the place celebrated for this race of cats, is in Asia Minor, not far from Smyrna; the comets manufactured with the hair of this animal is celebrated for its beauty and fineness throughout Asia.

Tortoiseshell cat, Hispanicus, Gmel. *Chat d'Espagne*, Buff. is black, varied with white and orange.

Blue cat, ceruleus, Gmel. *Chat des Chartreux*, Buff. *Blau kaze*, Kolbe. The hair of this is blue-grey. It was originally a native of Russia, from whence it has been dispersed, and cultivated in various parts of Siberia.

Red cat, ruber, Gmel. *Rothe kaze*, Kolben. This is distinguished by having a streak of bright red running along the ridge of the back to the tail, and losing itself in the grey and white on the sides. It is found at the Cape, and the skin is much valued from a singular idea the colonists entertain that it affords ease in the gout.

Japan cat, Chat sauvage Indien, Vofmaer. This is described as being about the size of the common cat, and has a tail ten inches and a half long; the ears are upright and pointed; colour of the face and lower part of the neck whitish; breast and lower belly clear grey, mixed with black, disposed in transverse streaks. Along the back is a broad band of black, which extends over the upper part of the tail; the lower part is fawn annulated with black and grey. Its cry is said to resemble the mewling of a great cat.

Guiana cat, Penn. *Felis Guiana*, Molin. According to Molina this is a native of Chili, and is the size of the common cat. Its haunts are inaccessible forests. The colour is tawny, marked with round black spots, rather less than half an inch in diameter, and extending the whole length of the back close to the tail. The head in this and the following is rather larger in proportion than in the common cat.

Coroloto-cat, Felis Coroloto, Molin. Like the former this inhabits forests, and preys on mice and birds. The colour is white, marked with irregular spots of black and yellow, and the tail encircled with black to the tip. Tail rather larger in proportion than in the common cat.

We cannot conclude this enumeration of the varieties of

the common cat without observing, that it is extremely probable, when the three last mentioned animals become better understood, they may be found specifically distinct; whether also the variety said to occur in China, which has pendulous ears, and fur variegated with black and yellow; and the Madagascar cat with twisted tail, be of the same species with the common cat, seems rather undetermined. The *felis manul* of Gmelin appears, on the contrary, to be no other than a variety of the common cat.

MANUL. Tail elongated, and annulated with black; head spotted with black, and marked with two lateral black bands. Pallas.

Inhabits the wastes of Tartary and northern Asia. Its size is that of the fox, but its form is more robust in proportion. The colour is tawny; the cheeks with two dusky lines running obliquely from the eyes; the feet are obscurely striped with dark lines; the tail longer than that of the domestic cat, thickly beset with hair, and encircled with ten distinct black rings, three of which nearest the tip are placed so contiguous as almost to touch each other. This is considered as a variety of the common wild cat, *felis catus*.

CAPENSIS. Tail rather long, and annulated with black; body fulvous, with stripes above, and spots beneath black; ears naked with a lunated white spot.—*Felis capensis*, Gmel. *Felis tigrina capensis*, Forst. A&S. Angl. v. 71. *Cape tiger*, Penn.

This animal appears to be of the same as that described by Labat under the name of *Noussi*, and which he states to be the size of a dog, with a coat as much striped and varied as that of a tiger. Its appearance he tells us bespeaks cruelty, and its eyes fierceness; but it is cowardly, and gets its prey only by cunning and insidious arts. When Dr. Forster touched the second time at the Cape of Good Hope, namely, in 1775, an animal of this species was offered to him for sale, but this he declined, because he was apprehensive, as one of the legs was broken, it would not live till they reached England. It was brought in a basket to his apartment, where it remained about twenty four hours, and this allowed him sufficient time to describe it with greater accuracy than had been previously done, and in some degree of observing its manners and economy. These he found to be perfectly analogous to those of our domestic cats. It ate fresh meat raw, and was very much attached to its feeders and benefactors: though it had broke the fore-leg by accident it was very easy. After it had been several times fed by Dr. Forster it followed him like the common cat. It was pleased when caressed, and, in token of its gratification, rubbed its head and back against the clothes of the person who fed it, and purred at the same time like the domestic cat. This animal had been taken when quite young, and was not above eight or nine months old when described, yet it had nearly, if not entirely, attained to its full size. Dr. Forster was told that the species lives in the mountainous and woody tracts; and that in their wild state they are highly destructive to the hares, rabbits, jerboas, young antelopes, lambkins, and the whole of the feathered race. This animal is fully described in the 71st volume of the Philosophical Transactions.

CHAUS. Tail moderate; annulate near the tip, which is black; body brownish yellow; ears brown on the outside, and bearded with black at the tip. *Guldenft. Caspian lynx*, Penn.

Resembles the wild cat in manners, voice, and food. Its general length is about two feet six inches from the nose to the tail, though in some instances it has been known to measure three feet. The prevailing colour is yellowish brown.

brown, with the breast and belly much brighter, or more inclining to orange colour; the tail reaches only to the flexure of the legs, and, besides the black tip, has three obscure black bands at some distance from it; and on the inside of the legs near the bend of the knee are two dusky bars; the tufts at the extremity of the ears are black.

The species was first described by Guldenstedt in the Transactions of the Royal Society of Peterburgh; it is found in the woods and marshy tracts on the borders of the western side of the Caspian sea, and in the Persian provinces of Ghilan and Masenderan, and is frequent about the mouth of the Kur, the ancient Cyrus.

Serval. Tail rather short; body marked above with roundish dusky spots; orbits of the eyes and belly white. Erxl. *Le serval*, Buff. *Chat-pard*, Perrault.

An animal much resembling the lynx in form, but smaller, the ears are also destitute of that tuft of hair so conspicuous at the tip in the lynx, and the tail is, comparatively to the general size of the animal, rather smaller. The specimen described by the French academicians measured two feet and a half from the nose to the tail, and the latter was eight inches long. The colour on the head, back, and sides are fawn colour, the throat, belly, and insides of the legs white, and the whole surface is covered with small, but very distinct spots of black, which are not disposed in roses like the spots on the panther, but separate. As in the lynx the head is large, the feet also are strong and thick, and the eyes brilliant.

The serval inhabits the mountainous parts of India and Thibet, where it resides chiefly among trees, from which it rarely descends, but, feeding on birds, pursues them by leaping among the branches, or from one tree to another. In its disposition it is extremely fierce, but avoids mankind unless provoked, when it darts furiously upon the offender, and tears and bites in the same manner as the panther. The provincial name of this animal among the natives of Malabar is maraputa; the Portuguese established on that coast call it serval.

CARACAL. Tail rather short, and with the body reddish brown; ears outwards black, tip black and bearded. *Siyah-ghush*, Charleton. *Lynx cauda vitulina*, Klein. *Caracal*, Buffon. *Persian cat*, Penn. *Persian lynx*.

The caracal, or Persian lynx, resembles the common lynx in figure and aspect, and nearly corresponds in size. It differs from that animal in not being spotted; its hair is rougher, and its colour dissimilar; the tail longer, and of an uniform colour with the rest of the body; its face is of a more lengthened form, and its disposition more ferocious. The species inhabits only the warmer climates, and is common in Persia, India, Barbary, and other parts of Asia and Africa. In the Persian language it is called syah-ghush, and in the Turkish *karrak-kulak*, both which signify the cat with black ears. The caracal is said to follow the lion, and to feed on the remains which that animal leaves of its prey, and for this reason it is called among the Arabs the *lion's guide*. Its height is about that of the common fox, but is stronger and more robust; and Dr. Charleton mentions one which killed a hound, and tore it instantly in pieces, notwithstanding the vigorous defence of the latter.

This animal, though tamed with extreme difficulty, when taken young, and reared with great caution, may be trained for the chase. It is employed with success in the pursuit of the smaller tribes of quadrupeds, but it is said, whenever it meets with one that is superior to it in strength, that it loses its courage and gives up the chase. Herons, cranes, pelicans, peacocks, and others of the larger kinds of birds, it

takes by surprise, and overcomes with singular address. When it has seized its prey, it holds it fast in its mouth, and lies upon it some time motionless.

There are several varieties of the caracal, according to different authors. The caracal of Barbary, described by Buffon on the authority of Mr. Bruce, has the ears red on the outside instead of black; the tufts on the ears are black, the tail white at the tip, annulated with four black rings, and some black marks behind the legs. It is the animal which Mr. Bruce names the booted lynx, and is most probably specifically distinct. Another supposed variety inhabits Bengal, and has the tail as long as the legs; and a third the tail white, with four black rings at the extremity, the first of the two last mentioned is perhaps a distinct species.

RUPA. Tail rather short, beneath and at the tip white, above banded with black; body tawny spotted with brown; ears bearded at the tip. Schreber. *Bay cat*, Penn.

Twice the size of the common cat; its colour a bright bay, obscurely marked with small dusky spots; the lips, throat, and whole underside of the body and limbs white. From beneath each eye three curved blackish stripes pass down the cheeks, and the upper part of the inside of the fore legs is marked with two black bars. The hair is shorter and smoother than that of the common lynx, and the species inhabits America.

LYNX. Tail obscurely annulated, and black at the tip; head and body whitish-tawny spotted with black; ears bearded at the tip. Schreber. *Pinnax dissypus*, Nieemb. *Lynx*, Aldr. *Le lynx*, Buff.

The lynx is about the size of the fox, or of a middling dog. The colour varies, but is generally of a pale-grey, with a very slight reddish tinge; the back and whole of the upper parts obscurely spotted with blackish or dusky; tail white, with the tip and rings black. The throat, breast, and belly are white; and the fur remarkably thick and soft. The eyes are of a pale yellow colour, and its whole aspect milder than that of the panther or once.

Writers describe several supposed varieties of this animal, one of which is white with dark spots, another yellowish-white above, and beneath white with dusky spots, and a third corresponding with the latter, but marked with spots still more distinct. The species is so generally diffused throughout Europe and Asia, and inhabits such various climates, that we are not to be astonished that such varieties should exist. The true lynx is found in the great forests in the north of Germany, in Lithuania, Muscovy, Siberia, and the northern parts of the old continent; but it admits of considerable doubt whether it inhabits southern Asia. The lynx of the Levant, Barbary, Arabia, and other hot countries, is certainly the caracal, and the fur of this is known by being destitute of spots.

In the museum of natural history in Paris, is a preserved specimen of an animal called "Le lynx du Canada," a supposed variety of the common lynx; its length is two feet three inches from the nose to the extremity of the body, and its height twelve or thirteen inches. The hair is long, greyish mixed with white hairs, and is spotted like the European lynx, but differs in the length of the tail, and the tuft of hair on the ears being smaller. There is another lynx in Mississipi, which has the tuft at the extremity of the ears smaller than that last mentioned, the tail more floppy, and the hair clearer in colour. In those northern climates however, where the vicissitudes of the seasons are so severely experienced, it is to be considered that the fur of animals vary in colour according to the season. Thus the winter furs are exceedingly different from those of summer

in all the animals that inhabit the north of America, or Europe. The fur of the American lynxes is most beautiful in winter, and bears a higher price than those of summer, and it is not only on account of their beauty these are preferred, they are more valuable for their softness and warmth. The same may be observed of northern Europe and Asia. The farther they are taken to the northward the whiter is the fur, and the spots more distinct. The most elegant of these are called *irbys*, and is taken near the lake Balkash, in Ussac Tartary. It is larger than the European lynx, measuring five feet from the nose to the tip of the tail, of which the tail measures about six inches. The skin sells in that country for about twenty shillings sterling. Vast numbers of these skins are exported annually to China and Europe.

The lynx is a very destructive animal. It feeds on weasels, ermines, squirrels, and other small quadrupeds, which it pursues to the tops of the highest trees. The lynx also watches the approach of larger animals, as the hare and even the deer, and darts upon them from the branches of trees where it lies concealed, seizes them by the throat, and sucks their blood; after which it abandons them and goes in quest of other game. It often eats no more of the sheep or the goat than the brain, the liver, and the intestines. The sight of this animal is remarkably quick, which enables it to discern its prey at a great distance, and it is so artful, that it will sometimes dig under the doors to gain admission into the sheep-fold. When attacked it throws itself on its back, and strikes desperately with its claws. The howl of the lynx is not unlike that of the wolf, and it frequently expresses its malignity by a kind of snarling scream. From the ferocity of its nature the lynx cannot be tamed.

The poetical fictions of the ancients respecting this animal are not unknown; they feigned that the chariot of Bacchus was drawn by lynxes; that its sight was so penetrating that it could see through the most opaque bodies, and that its urine was converted into precious stone. Pliny confounds the lynx with the ounce, and speaks of it as a native of Ethiopia: the same writer, however, in another part, seems to have known the true lynx of the moderns, and informs us, the first lynx that was seen at Rome was brought from Gaul, which country might at that time produce this animal, as the Alps and Pyrenées were known to have done at a later period.

FELIX I. in *Biography*, pope, and a saint in the Roman calendar, was born at Rome, and succeeded in the pontificate in the year 269. Little more is known of this pontiff than that he reigned, and in his time a persecution was commenced by Aurelian against the Christians, to which, it has been supposed, that Felix fell a sacrifice, after he had filled the papal chair between five and six years. In the third volume of the "Collectio Conciliorum" is a fragment of a letter which this pope wrote to Maximus, bishop of Alexandria, against the tenets of Sabellius and Paul of Samosata, and which was read in the councils of Chalcedon and Ephesus. Moreri.

FELIX II. pope, though by some writers denominated anti-pope, was a native of Rome, and archdeacon of that church when pope Liberius was banished by the emperor Constantius in the year 355. At this time the emperor and the Arian party were determined to place in the Roman see a person more favourable to the measures which they had adopted against Athanasius than Liberius, who had refused to sign his condemnation; they fixed upon Felix for that station. This excited much discontent, which kindled into insurrection; and the emperor recalled Liberius on the

condition that he should jointly, with Felix, preside over the see. The people were still indignant, and joined in general acclamation, "There is but one God, one Christ, one bishop;" and as soon as Liberius returned, they drove Felix out of the city with every mark of detestation. Upon being expelled from the city, to which the emperor in the sequel consented, he withdrew to a small estate, which he had on the road to Porto, and there spent the remainder of his life in retirement. He died in 365. Many centuries after his death it was a subject of warm and even fierce contention, whether he was to be considered as a pope or not; and, in 1582, it was determined by pope Gregory XIII. that the cause of this pope should be solemnly tried, when, with the aid of a well concerted miracle, it was agreed that his title was valid. Moreri.

FELIX III. pope, was son of a presbyter at Rome, and is thought to be the great grandfather of pope Gregory, surnamed the Great. He was elevated to the papal throne in the year 483, when he was chosen successor to Simplicius, by the unanimous vote of the people, clergy, and senate. He had not been long called to this high office before he found an opportunity, of which he was very desirous, of attempting to extend the influence of the Roman see over the eastern churches. Legates were accordingly dispatched for this purpose, who carried letters to Zeno the emperor, and Acacius the patriarch of Constantinople, conjuring them, as they valued the salvation of their souls, not to suffer a heretic to sit in the see of St. Mark. They had orders also to cite the patriarch to appear in person, or by proxy to justify his conduct in an assembly of bishops before St. Peter. With these instructions they set sail for Constantinople; but when they had arrived at Abydus on the Hellespont, they were arrested by order of the emperor, and thrown into prison, where they were harshly treated and threatened with death, as disturbers of the public peace. They were at length suffered to depart, bringing back letters from the emperor and Acacius to the pope in justification of their own proceedings. Felix immediately assembled a council of Italian bishops, by whom the legates were declared to have behaved in a manner highly prejudicial to the Catholic cause in the East, and to be unworthy of the episcopal dignity. Felix next engaged the council to undertake the trial and condemnation of Acacius. The pope, on this occasion, assumed an authority, when promulgating the sentence pronounced against him, for which, it is said, there is no precedent in church history. That sentence the pope transmitted to the emperor and clergy, enjoining them to submit to the sacred laws of the church, and adding, that they must renounce Peter Mongus, the heretic before referred to, who had been countenanced by Acacius in opposition to Talaia, the deposed patriarch of Alexandria, or that of the apostle Peter. The same sentence was conveyed to Acacius, who treated the pope and his anathemas with the utmost contempt, and in turn anathematized him, cutting him off from his communion, and ordering his name to be struck out of the sacred diptychs. This conduct of Acacius was approved by the emperor, the church of Constantinople, and by almost all the eastern bishops, who united in a separation from the communion of the pope. Such was the origin of the first schism between the Greek and Latin churches. In the year 487 Felix convened a synod at Rome, to discuss the question respecting the reconciliation of those to the Catholic church, who had been baptized or re-baptized by the Arians during the Vandal persecution in Africa. About the year 488 Fravita succeeded Acacius as patriarch of Constantinople, when measures were immediately taken to bring about a reconciliation between the

eastern and western churches, which Felix rejected, unless the name of Acacius was first struck out of the sacred diploms. The same inexorable temper proved an obstacle to the desired union during the patriarchate of Euphemius, the successor of Fravita. On the death of Zeno in 491, Felix wrote to Anastasius his successor, congratulating him on his accession to the throne, intimating an expectation, that under his authority the interests of the true faith would be respected and promoted. The emperor paid no attention to this letter, and Felix died before he could have any opportunity of witnessing his resentment at the neglect of the exhortation. He was, as our account will shew, an enterprising, ambitious, and arrogant man, more devoted to the extension of the papal power, than the true welfare of the church. In the 4th volume of the "Collectio Conciliorum" are fifteen letters ascribed to him, and Dupin has taken pains to distinguish between the genuine and spurious. Moreri. Mosheim.

FELIX IV. pope, a native of Beneventum, was raised to the papal see on the death of John, in the year 526. He was appointed to this high dignity by king Theodoric, who, when the senate and people were divided in their support of rival candidates, thought proper to interpose his authority, and fix upon a person of a most exemplary life, and every way worthy of the pontifical dignity, but whom the contending parties had overlooked. The people at first opposed his authority, but submitted when the king agreed that in future they should be allowed to choose whom they pleased, subject to his confirmation. After this Felix was ordained to his office, and presided over the Roman see about four years. He died in 530. Three letters in the 4th volume of the "Collectio Conciliorum" have been attributed to him, but the first two are not regarded as genuine. Moreri.

FELIX V. See AMADEUS VIII. and EUGENIUS IV.

FELIX, bishop of Urgella, in Catalonia, in the eighth century. See ELIPAND.

FELIX, *St.* in *Geography*, a small island in the Pacific ocean, N.N.W. of Juan Fernandez, not far from the coast of Chili. S. lat. 26° 10'. W. long. 80° 46'.—Also, a town of France, in the department of the Upper Garonne, and chief place of a canton in the district of Villefranche; 22 miles E.S.E. of Toulouse. The place contains 3,388, and the canton 11,458 inhabitants, on a territory of 185 kilometres, and in 13 communes.—Also, a town of France, in the department of the Aveyron; six miles S.E. of St. Afrique.—Also, a town of Brazil, in the government of Goyes, on the river Tocantin. S. lat. 15° 36'. W. long. 49° 36'.

FELIX, *Cap.*, a cape on the west coast of the island of Sumatra. N. lat. 4°. E. long. 96°.

FELIZAN, a town of France, in the department of Marengo; 12 miles E. of Alli.

FELIZES DE GALLEGO, *St.* a town of Spain, in the province of Leon; eight miles N.N.W. of Ciudad Rodrigo.

FELL, JOHN, in *Biography*, son of Dr. Samuel Fell, dean of Christ-Church, Oxford, was born in the year 1625. He received his grammar learning at Thame, in Oxfordshire, and from thence was admitted a student at Christ-Church college in 1636, when he was but eleven years of age. In 1640 and 1643 he took his degrees of B.A. and M.A., and about the latter period he bore arms for king Charles I. within the garrison of Oxford, and obtained the rank of ensign. In 1648 he was ejected from his student's place by the parliamentary visitors, from which time, till the restoration of Charles II., he lived in retirement at Oxford, joining many royalists in privately using the liturgy and rites of the church of England at Merton college. After the

restoration he was appointed prebendary of Chichester; canon, and then dean of Christ-Church in 1660, when he was created doctor in divinity, and appointed one of his majesty's chaplains in ordinary. He was, in every respect, a great benefactor to Christ-Church college, of which he was the head. He applied himself to the restoration of its discipline, and to the promotion of learning and religion among its members; and by his own benefactions, together with what he procured from others, he made many important additions to the buildings of the college. From the year 1666 to 1669 he filled the office of vice-chancellor of the university with the highest reputation. In 1675 he was promoted to the bishopric of Oxford, with leave to hold his deanery, in order that his college and the university might still enjoy the benefit of his services. To the former he continued through life a liberal benefactor, and at his death left an estate for the support of ten exhibitioners. As one powerful means of promoting literature, he paid great attention to the improvement of the university press, and became himself editor of numerous ancient and modern writers. From the time of his becoming dean of Christ-Church to his death, he annually published a book, generally a classical author, with a preface, notes, and corrections, which he presented as a new-year's gift to the students of his house. He was a liberal benefactor likewise to the poor and distressed. When he had filled the see of Oxford ten years his health began to sink under his exertions, and the anxiety which he felt on account of the changes attempted to be brought about in religion by king James II. He died in 1686, leaving behind him the general character of a learned and pious divine, of an excellent classical scholar, of a great assertor of the church of England, of another founder of his own college, and of a patron of the whole university. When the Royal Society was instituted, Dr. Fell was among the alarmists at the innovation upon the Aristotelian system, and encouraged Stubbe to write several pieces against the members, charging them with intentions to bring contempt upon ancient and solid learning, to undermine the university, and even to destroy the established religion and introduce popery. Dr. Fell was author of the life of Dr. Henry Hammond; he published some other original pieces. He translated, with the assistance of persons employed by himself, "Historia et Antiquitates Universitatis Oxoniensis," &c. in two volumes, folio. In his translation he omitted some things which Anthony Wood, the author, requested the public not to impute to him. He published an edition of the Greek Testament, and was author and editor of a great many other works, for an account of which, see Biog. Brit.

FELL, JOHN, a Protestant dissenting minister, was born at Cokermonth, in Cumberland, in the year 1732, and rose, by his talents and application, from a humble station as a scholar and a divine. He finished his education for the ministry at the academy at Mile-end, in the vicinity of London; and was much aided and encouraged by Dr. Walker, one of his tutors, who took pleasure in promoting the literary attainments of those who were committed to his care. Mr. Fell was one of his favourite pupils, and in the progress of his years appeared to have availed himself in a very high degree of the advantages which he had enjoyed under the instruction of his tutor. His first settlement, as a pastor, was at Thaxted in Essex, where he formed a connection with a congregation of the independent denomination in the year 1770, and where he continued for several years; uniting with his pastoral duties the superintendance of a respectable boarding-school. As
a school-

a school-master and a preacher he was highly esteemed and respected. When a vacancy of resident and classical tutor occurred in the academy where he had received his education, then removed from Mile-end to Homerton, he was earnestly urged to accept this office; which, on account of several unpleasant circumstances that attended it, arising partly from domestic discord, and partly from the unkindness and illiberality of some of the friends of the institution, proved in the event the occasion of great uneasiness, and served, indeed, to embitter and to accelerate the termination of his life. Although he was discharged from his office by a vote of the majority of his constituents, he was patronized after his dismissal by a very respectable minority, who devised plans for his future subsistence and comfort. With this view they engaged him to deliver twelve lectures on the evidences of Christianity, for which the sum of 200*l.* was contributed; and an active friend opened for him a subscription which was sufficient for purchasing an annuity of 100*l.* His constitution, however, was broken down by the treatment he had suffered; and the irritation of his mind was increased by his anxiety for duly discharging the service he had undertaken, and thus requiring the generosity of his friends; so that he did not long live to enjoy the provision which had been made for him. Four of the proposed lectures were delivered in the four first months of the year 1797 to crowded auditories; but a complicated disorder, under which he languished for four months, prevented his prosecution of them, and terminated his life on the 6th of September in this year, in the 65th year of his age. The course of lectures was completed by Dr. Hunter, and the whole series formed a volume, which was published after the death of Mr. Fell. The theological sentiments of Mr. Fell were such as are usually denominated Calvinistic; but he combined with his steady attachment to them a great degree of charity and candour towards those who differed from him. We knew him well; and though his temper was somewhat irritable, he was a pleasing and instructive companion. His memory was retentive; his reading various; and his knowledge extensive. To the interests of civil and religious liberty he was ardently devoted; and of these interests he was an able advocate. Under the article FARMER we have mentioned some of his most elaborate publications. Besides these, he was also the author of the following works: *viz.* "An Essay on the love of one's Country," 8vo. "Genuine Protestantism, or the unalienable rights of conscience defended," 1773, and 1774, 8vo. "The Justice and Utility of Penal Laws for the direction of Conscience examined," 1774, 8vo. "Remarks on the Appendix of the Editor of Rowley's Poems, &c." 1783, 8vo. "An Essay towards an English Grammar, with a Dissertation on the natural and peculiar Use of certain hypothetical Verbs in the English Language," 1784, 12mo. &c. Gen. Biog.

FELL, in *Rural Economy*, a term sometimes employed to denote the skin or hide of an animal.

FELL, a term applied to the knocking down of animals which are to be killed. The axe is mostly employed in this business, but should be discontinued, and that of *fitting* be made use of in its place.

FELL, in *Mining*, signifies small pieces of lead ore, and spar, which have passed through a riddle with openings about an inch square. Fell-sleet signifies large pieces of fastage, or feagh, that is, refuse spar.

FELLA, in *Geography*, a river of Carinthia, which runs into the Drave, near Machling.

FELLA, *Cape*, a cape on the west coast of Calabria. N. lat. 39° 38'. E. long. 16° 24'

FELLENBERG, a town of the Tyrol; four miles W.S.W. of Inspruck.

FELLETIN, a town of France, in the department of the Creuse, and chief place of a canton in the district of Auboussin; 21 miles S.S.E. of Gueret. N. lat. 45° 53'. E. long. 2° 15'. The place contains 2666, and the canton 10,713 inhabitants, on a territory of 207½ kilometres, and in 10 communes. The chief article of trade is cattle, and near it is a medicinal spring.

FELLIN, a town of Naples, in the Lavora; 13 miles E.N.E. of Naples.

FELLING, a town of Austria; 10 miles W.N.W. of Crems.—Also, a town of Austria; 11 miles S. of Vienna.

FELLING of Timber, in *Rural Economy*, the operation of cutting down trees for the purpose of timber. In the performing of this sort of business attention should in the first place be paid to the season of the year, especially where the timber is of the oak kind or such as is to be peeled for the bark, as it will only peel, or, what the workmen term *run*, at a particular period, which is generally in the spring months, just before the leaves expand. With many other sorts of timber trees this is not, however, necessary to be regarded; but they should, in general, be cut down previously to the leaves appearing.

It is the practice of some, where any sort of tree is to be cut down in the above intention, first to take off any branches that may be likely to injure it in its fall, much harm being frequently done to trees for want of care in this respect. Where the branches or limbs are of considerable size, they should be cut on both sides, close to the bole, in order to prevent their splitting. In cases where the trees are not grubbed up, they should be cut as close to the roots as possible, by which there will be a saving of the most valuable part of the timber.

In the work of felling there is considerable art to make them fall in the best way, which is only known by those woodmen who have had much experience. Where a large fall is therefore to be made, it is of much advantage to have men of this kind to undertake the business. The price of felling is regulated by a variety of different circumstances, as the kind of wood, the size of the trees, the nature of the situation, &c.; but the work is often done by the tree, or at a fixed price for a certain number of trees. See WOODS and TIMBER.

FELLINGSBRO, in *Geography*, a town of Sweden, in Westmanland; 24 miles W. of Stroomsholm.

FELLIS, a mountain of Africa, in Adel; 50 miles W. of cape Guardafui.

FELLOWS, or FELLIES, in *Artillery*, are six pieces of wood, each of which forms an arch of a circle, and these, joined all together by duedges, make an entire circle, which, with a nave, and twelve spokes, form the wheel of a gun-carriage.

Their thickness is usually the diameter of the ball of the gun they serve for, and their breadth something more. Their dimensions are as follow: for a 24 pounder, five inches thick, and 6½ inches broad; for a 12 pounder, 4½ inches thick, and six inches broad; for a six pounder, four inches thick, and 5½ broad, &c. made of dry elm.

FELLOWSHIP, COMPANY, or *Partnership*, in *Arithmetic*, is a rule of great use in balancing accounts amongst merchants and owners of ships; where a number of persons putting together a general stock, it is required to give every one his proportional share of loss or gain.

The golden rule, several times repeated, is the basis of fellowship, and fully answers all questions of that kind: for, as the whole stock is to the total thereby gained or lost, so

each man's particular stock is to his proper share of loss or gain. Wherefore, the several sums of money of every partner are to be gathered into one sum for the first term; the common gain or loss for the second; and every man's particular share for the third; and the golden rule is then to be wrought so many times as there are partners.

There are two cases of this rule, the one *without*, the other *with time*.

FELLOWSHIP *without time*, is where the quantity of stock contributed by each person is alone considered, without any particular regard to the length of time that any of their monies were employed. An example will make this process easy.

A. B. and C. freight a ship with 212 tons of wine; A. laying out 1342*l.* B. 1178*l.* and C. 630*l.* towards the same; the whole cargo is sold at 32*l.* per ton. Query, what shall each person receive?

Find the whole produce of the wine by multiplying 212 by 32, which yields 6784. Then, adding together the several stocks, 1342, 1178, and 630, which make 3150, the work will stand thus:

3150 : 6784	{	1342—Answ.—2890,1993, &c.
		1178 ————— 2537,0006, &c.
		630 ————— 1356,8.
Proof		3150 6784

FELLOWSHIP *with time*, usually called the *Double rule of Fellowship*, is where the time during which the money, &c. were employed, enters into the account. An example will make it clear.

A. B. C. commence a partnership the first of January, for a whole year. A. the same day disbursed 100*l.* of which he received back again, on the first of April, 20*l.* B. pays, on the first of March, 60*l.* and more, the first of August, 100*l.* C. pays, the first of July, 140*l.* and the first of October, withdraws 40*l.* At the year's end their clear gain is 142*l.* Query, what is each person's due?

A.'s 100*l.* multiplied by three months, the time it was in, makes 300*l.* and the remaining 80, by nine months = 720, in all 1020*l.* of A.'s contribution. For B. 60 into 10, gives 600; and 100 into 5, 500; in all 1100*l.* for B. For C. 140 into 3, gives 420; and 100 into 3, is 300; in all 720*l.* for C. Now, 1020 + 1100 + 720 = 2840 for the common antecedent, and the gain 142, is for the general consequent; the rule will stand thus:

2840 : 142	{	1020—Answ. 51
		1100 ————— 55
		720 ————— 36
Proof		2840 142

N. B. All the particular times (if not so given) must be reduced into one denomination, *viz.* into years, months, weeks, or days.

FELLY, in *Agriculture*, is a term which is sometimes provincially applied to the breaking up of a fallow. It is likewise the name of a part of a wheel.

FELNA, in *Geography*, a district of Russia, in the government of Smolensko, situated on the Desna.

FELO, CAPE, the S. W. point of Sicily. N. lat. 37° 46'. E. long. 12° 27'.

FELON *de se*, in *Law*, is he that commits felony, by willingly and deliberately killing himself; or doing any unlawful malicious act, the consequence of which is his own death; as if, attempting to kill another, he runs upon his antagonist's sword; or, shooting at another, the gun bursts and kills

himself. (1 Hawk. P. C. 68. 1 Hal. P. C. 413.) The Saxons call him *self-dane*. He must be of the age of discretion, and *compos mentis*. But if a real lunatic kills himself in a lucid interval, he is a *felo de se* as much as another man. (1 Hal. P. C. 412.)

A *felo de se* is to be interred without Christian burial, with a stake driven through his corpse; and is to forfeit his goods and chattels, real and personal; but he may make a devise of his lands, because they are not subjected to any forfeiture. (Plowd. 261.) However, these forfeitures are generally saved by the verdict of the coroner's jury, who find lunacy. See **SUICIDE**.

If a person *felo de se* is secretly made away with, so that the coroner cannot view his body, presentment is to be made of it by justices of peace, &c. in order to entitle the king to the forfeiture of goods.

FELON, in *Surgery*. See **WHITLOW**.

FELON wort. See **SOLANUM**.

FELONIOUS HOMICIDE. See **HOMICIDE**.

FELONY, FELONIA, was anciently used for a violent and injurious action of a vassal, or tenant, against his lord.

Menage derives the word from *felonia*, formed of *felo*, or *fello*, which occurs in the capitulars of Charles the Bald, and is supposed to come from the German *fehlen*, or Saxon *faelen*, to fail, or be delinquent. Others derive it from the barbarous Latin *vilania*. Lord Coke, Nicod, &c. derive it a *fello, gall*, as being supposed to be done maliciously. Others derive it from the Greek *φραση*, to deceive. But the learned Spelman, with greater probability, deduces it from two northern words, *viz.* *fee*, which signifies *feif, feud*, or *beneficiary estate*, and *lon*, which signifies *price or value*; so that felony is the same as *pretium feudi*, the consideration for which a man gives up his life; agreeable to the common expression, such an act is as much as your life, or estate, is worth.

In this sense felony was equivalent to petty-treason, or it was a crime next below high treason. The crime of felony imported confiscation of the fee, to the profit of the lord.

All those acts, whether of a criminal nature or not, which at this day are generally forfeitures of copy-hold estates, are styled *felonia* in the feudal law.

FELONY was also applied to an injury of the lord to his vassal, which imported a forfeiture of the homage and service thereof, and made it revert to the sovereign.

Fidelity and felony are reciprocal between the lord and the vassal.

FELONY, in the general acceptation of law, comprises every species of crime, which occasioned, at common law, the forfeiture of lands or goods. This most frequently happens in those crimes for which a capital punishment either was or is liable to be inflicted; for those felonies which are called clergyable, or to which the benefit of clergy extends, were anciently punished with death in lay or unlearned offenders, though now by the statute-law that punishment is, for the first offence, universally remitted. (See **BENEFIT of Clergy**.) Treason itself (says Coke, 3 In. l. 15.) was anciently comprised under the name of felony. And not only all offences now capital are in some degree or other felony; but this is likewise the case with some other offences, which are not punished with death; as suicide, where the party is already dead; homicide by chance medley, or in self-defence; and petty larceny or pilfering; all which are, strictly speaking, felonies, as they subject those who commit them to forfeitures. So that upon the whole, the only adequate definition of *felony* seems to be this, *viz.* "an offence which occasions a total forfeiture of either lands or goods,"

goods, or both, at the common law; and to which capital or other punishments may be superadded, according to the degree of guilt." (Blackst. Com. vol. iv.) The idea of felony is so generally connected with that of capital punishment, that it seems hard to separate them; and to this usage the interpretations of law now conform. For if a statute makes any new offence felony, the law implies that it shall be punished with death (*viz.* by hanging), as well as by forfeiture, unless the offender prays the benefit of clergy. (Hawk. P. C. i. c. 41. ii. c. 48.) So where a statute decrees an offender to undergo judgment of life and member, the offence becomes a felony, though that precise word be omitted; but the words of the statute must not in such case be the least doubtful or ambiguous. (1 Hawk. P. C. c. 41.)

FELONY is also used, in *Common Law*, for any capital offence, perpetrated with any evil intention.

Though capital punishment does by no means enter into the true idea and definition of felony, the true criterion of which is forfeiture; for in all felonies which are punishable with death the offender loses all his lands in fee-simple, and also all his goods and chattels; but in such as are not so punishable, his goods and chattels only. 1 Inst. 391.

In a stricter sense, felony denotes all capital crimes below treason.

Felony includes several species of crimes, such as petit-treason, murder, theft, homicide, sodomy, rape, wilful burning of houses, receiving of stolen goods, &c.; breach of prison, rescue and escape, after one is arrested or imprisoned for felony, and divers others found in the statutes, which are daily making crimes felony, that were not so before.

Felony by the common law is against the life of a man, as murder, manslaughter, *felo de se*, *se defendendo*, &c. against a man's goods, such as larceny and robbery; against his habitation, as arson and burglary; and against public justice, as breach of prison. 3 Inst. 31.

Piracy, robbery, and murder upon the seas, are felonies punishable by the civil law, and also by statute. 1 Inst. 391.

Felony is easily distinguished from treason.

From lesser crimes it is distinguished by this, that its punishment is death, though not universally; for petty larceny, *i. e.* stealing of a thing under the value of twelve-pence, is felony, according to Brook, though the crime be not capital, but only a loss of goods. The reason Brook gives for its being felony is, that the indictment runs, *felonia cepit*.

Till the reign of Henry I. felonies were punished by pecuniary fines; that prince first ordered felons to be hanged about the year 1108.

Felony is of two kinds; the one *lighter*, which for the first time is entitled to the benefit of clergy; as manslaughter. The other, more heinous, is not allowed the privilege.

Felony is also punishable by loss of all lands, not intailed; and all goods and chattels, both real and personal; though the statutes make a difference in some cases concerning lands, as appears by stat. 37 Hen. VIII.

Felony ordinarily works corruption of blood, unless the statute, ordaining the offence to be felony, provide otherwise; as the stat. 39 Eliz. cap. 17.

The punishment of a person for felony by our ancient books is to lose his life; to lose his blood, as to his ancestry, so as to have neither heir nor posterity; to lose his goods; and to lose his lands. (4 Rep. 124.) A felony by

statute incidentally implies, that the offender shall be subject to the like attainder and forfeiture, &c. as is incident to a felon at common law. (3 Inst. 47. 59. 90.)

Private persons may arrest felons by their own authority, or by warrant from a justice of peace; and every private person is bound to assist an officer in taking felons. But one ought not to be arrested upon suspicion of felony, except there be probable cause shewn for the ground of the suspicion. (1 Lil. Abr. 603.) A private man cannot justify breaking doors to take the person suspected; but he doth this at his peril. Whereas officers may break open a house to take a felon, or any person justly suspected of felony; and if an officer hath a warrant to take a felon, who is killed in resisting, it is not felony in the officer; but if the officer is killed, it is otherwise. Dalt. 289.

Persons indicted of felony, &c. where there are strong presumptions and circumstances of guilt, are not repleviable; but for larceny, &c. when persons are committed, who are of good reputation, they may be bailed.

If a person be committed to prison for one felony, the justices of gaol delivery may try him for another felony, for which he was not committed, by virtue of their commission. (1 Lil. 622.)

It is not very easy to re-capitulate the vast variety of offences that are made felony by innumerable statutes, which the security of society has required. We must refer for particulars to the appropriate articles as they occur.

FELONY, *Appeal of*. See APPEAL.

FELONY, *Compounding of*. See THEFT-NOTE.

FELONY, *Discovery of*. See DISCOVERY.

FELONY, *Misprison of*. See MISPRISON.

FELOOPS, in *Geography*, a people of Africa, who inhabit a considerable tract of country between the Gambia and the Rio Grande.

FELORE, a river of Africa, which runs into the Senegal, 60 miles above Galen.

FELSBURG, a town of Hesse Cassel, with an ancient castle on a rock; 12 miles S. of Cassel.

FELSTIN, a town of Austrian Poland, in Galicia; 40 miles S.W. of Lemberg.

FELSITE. See FELSPAR.

FELSPAR, *Feldspath*, Germ. Of this mineral there are the following sub-species: adularia, common feldspar, compact feldspar, continuous feldspar, Labrador feldspar.

1. Adularia. *Moonstone*, Kirw. The colour of adularia is yellowish, greenish, or milk-white, and in certain directions it exhibits a display of silvery and pearly colours, owing to the different reflections of light from the laminae of which it is composed. It occurs either in mass or crystallized. Its primitive figure is an irregular oblique-angled parallelepiped, of which the faces are smooth and well defined, and form an angle with each other of 90° ; while the faces in the third direction are uneven, and form with the others angles of 120° and $111^\circ 28'$. It also presents the following modifications: 1. An oblique four-sided prism, bevelled on two of its opposite sides. 2. An oblique four-sided prism with dihedral summits. 3. A six-sided prism with dihedral summits. 4. A double crystal in the form of a rectangular four-sided prism, composed of two half crystals united together in opposite directions. 5. A quadruple crystal, composed of four crystals of var. 2. united together by their summits, and mutually penetrating each other, forming a cross consisting of four triangles united round a common centre.

The surface of the crystals is smooth, and often striated longitudinally. They are for the most part middle-sized or large. The external lustre is shining and somewhat pearly; the

FELSPAR.

the lustre of the principal fracture is bright-shining, that of the cross fracture is shining, between vitreous and pearly. Its longitudinal fracture is perfectly foliated; its cross fracture is small conchoidal. It breaks into rhomboidal fragments. It is sometimes composed of straight lamellar distinct concretions. It is translucent, passing to transparent. Its hardness is inferior to that of quartz, but greater than that of common feldspar. It is easily frangible; sp. gr. = 2.5 to 2.6. It has been analysed by Vauquelin, with the following result.

Silix . . .	64
Alumine . . .	20
Lime . . .	2
Potash . . .	14
	100

Adularia was first found by H. Pini in the mountains surrounding St. Gothard, in Switzerland, especially in the summit called Mont Adula, (whence its name.) It here occurs in crystals, lining the cavities of micaceous schistus.

2. *Common Feldspar.*—The colour of this mineral is milk-white, yellowish, greyish, and reddish-white, also wax-yellow, and ochre-yellow, flesh-red, blood and brick-red, leek-green, mountain-green, and, rarely, verdegriis-green. It occurs in mass, disseminated, in rounded fragments, and crystallized. Its primitive form, and the other varieties of crystallization, are the same as those of adularia: it has also been found in ten-sided prisms, with dihedral, or other variously modified summits. The crystals are for the most part small and middle-sized. Externally, this mineral is more or less shining; internally, it is the same, with a lustre between vitreous and pearly. The longitudinal fracture is perfectly lamellar, the cross-fracture is fine-grained uneven, passing into splintery. Its fragments are rhomboidal, with four shining, and two dull faces. It varies from translucent to opaque. It occurs often in large or small granular concretions. It is not so hard as quartz, yet will scratch glass. It is brittle and easily frangible; sp. gr. 2.27 to 2.7.

It melts without addition, before the blow-pipe, into a white, somewhat translucent glass.

Feldspar has often been analysed, and with very different results: that perhaps the most to be depended on is of the green Siberian feldspar by Vauquelin, of which the following is the result:

Silix . . .	62.83
Alumine . . .	17.02
Lime . . .	3.
Oxyd of iron . . .	1.
Potash . . .	15.
	96.85

Feldspar, when exposed to the weather, acquires gradually an earthy appearance, and at length passes into porcelain clay. It also occurs in a state of semi-decomposition in several varieties of granite and porphyry, where it cannot have been affected by the atmosphere. When in this state it is usually of a yellowish or reddish-white colour, a faintly glimmering lustre, and a fracture imperfectly foliated, passing into earthy: it breaks into indeterminately angular fragments, is opaque, and considerably softer than common feldspar. A very light-coloured variety was analysed by Vauquelin, and found to consist of

Silix . . .	74.
Alumine . . .	14.5
Lime . . .	5.5
	94.
	6. Loss
	100.

Some of the coloured translucent varieties of feldspar contain particles of mica dispersed through their substance, and these, when the stone is exposed to the light, form so many luminous points which relieve the colour of the feldspar, and give the whole a spangled appearance, that has a pleasing effect. When feldspar exhibits this appearance it is called *aventurine* (a term also applied to a similarly glittering variety of quartz). The green Siberian feldspar sometimes contains spangles of a remarkably brilliant silvery mica, forming a very elegant aventurine. Another fine variety has been procured from Fedlovatoj, an island in the White sea, not far from Archangel, consisting of a transparent hyacinth-brown base, with gold-coloured spangles.

Common feldspar is the most generally diffused, both as to its local and geological situation, of any other mineral, except perhaps quartz. It is an essential constituent of granite and gneiss, of sienite and greenstone: it abounds in all porphyries, and in many rocks of trap-formation, and in the greater part of the real lavas.

3. *Compact Feldspar.*—*Feldite*, Kirw. Its colour is blueish-white, passing into sky-blue; or greenish-white, passing into brownish-green. The blue variety occurs in mass, the green is either disseminated or crystallized. Its lustre is glistering; its fracture is very imperfectly lamellar, approaching to splintery; its fragments are indeterminately angular; it is feebly translucent, and, though hard, considerably inferior to quartz.

It is fusible without addition, though difficultly, before the blow-pipe, into a frit or imperfect glass. It has not been analysed.

The blue compact variety was discovered by Widenmann at Krieglach, in Stiria, forming a granitic mass with white quartz and silvery mica: the green varieties occur in green porphyry and greenstone.

4. *Continuous Feldspar.*—Its colour is reddish-grey, or flesh-coloured; or pale reddish-yellow, or olive-green. It occurs in mass, and generally contains common crystallized feldspar dispersed through it in various proportions. It is sometimes dull, but generally possesses a feeble glimmering lustre; it is translucent on the edges; its fracture is fine splintery, passing into uneven earthy; its fragments are indeterminately angular; its hardness is fully equal to that of common feldspar, and it is less brittle. At a high heat it melts into a porous porcelain mass.

5. *Labrador Feldspar.*—The proper colour of this mineral is smoke-grey, or dark-ash colour, but, on account of the small crevices between the lamellae of which it is composed, it presents a most beautiful play of vivid tints, varying according to the position in which it is viewed. Of blue, it exhibits all the varieties from violet to smalt blue; of green, it displays the pure emerald green, and various other tints, passing on one hand into blue, and on the other into yellow; of yellow, the usual tints are gold and lemon-yellow, verging into deep orange, and thence into rich copper red, and tomback-brown. The parts exhibiting these beautiful colours are disposed in irregular spots and patches, and the same spot, if held in different positions, displays various tints. It has hitherto been found only in detached rolled

pieces Internally it is shining with a lustre between pearly and vitreous: its principal fracture is perfectly lamellar in two directions, the lamellæ crossing each other at right angles; its cross fracture is somewhat conchoidal; it breaks into rhomboidal fragments, with four specular faces; it is strongly translucent, passing into semi-transparent. Sp. gr. 2.6 to 2.7.

It is fusible, without addition, before the blow-pipe, into a white enamel. According to Bindheim, who alone has analysed this mineral, it consists of

Silex . . .	69.5
Alumine . . .	13.6
Sulphat of lime	12.
Oxyd of copper	0.7
Ditto of iron . . .	0.3
	<hr/>
	96.1
	3.9 Lofs.
	<hr/>
	100.

It was first discovered by the Moravian missionaries on the island of St. Paul, on the Labrador coast, and has since been found in Ingermannland, in Norway, and in the vicinity of lake Baikal, in Siberia.

It is in considerable estimation among lapidaries for ornamental works.

FELT, a kind of stuff, either of wool alone, or of wool and hair; neither spun, crossed, nor woven, but deriving all its consistence from its being wrought, and fullled with lees and size, and afterwards fashioned on a block or mould, by help of fire and water.

Castors, camels, and coney hair, lambs, and sheeps wool, &c. are the most usual ingredients of felts; and hats of all kinds are the works they are chiefly employed in.

The felt intended for a hat, being sufficiently fullled, and prepared, is reduced into one piece, somewhat in the figure of a large funnel; in which state it remains ready to be put into form, and becomes a hat. See *HAT*.

FELTING, in the *Manufactures*, denotes the operation by which the fur, hair, and wool of animals are wrought into a species of cloth, without either spinning or weaving. A hatter separates the hairs from each other by striking the wool with the string of his bow, thus causing them to spring up in the air, and they then fall in every direction on the table, spread and distributed in small flocks, which the workman covers with a cloth, slightly moistened; pressing it with his hands, and moving the hairs backwards and forwards in different directions. In this manner the different fibres are brought against each other, and their points of contact considerably multiplied; and the agitation gives each hair a progressive motion towards the root, in consequence of which the hairs become twisted together. As the mass becomes compact, the pressure should be increased, in order to keep up the progressive motion and twisting of the hairs, which is thus performed with greater difficulty. The various fibres of the materials being thus by a gradual pressure in different directions made to interweave and cross each other, form a piece of stuff of a soft and spongy texture; upon this first piece is placed another, formed in the same manner, and sometimes a third or fourth, according to the nature of the materials, and the intended thickness and consistence of the work. These different pieces are successively brought together, and disposed in a form suitable to the article which is to be fabricated; and in order to effect the cohesion, the operator uses a number of pressures

and alternate motions in different directions, during which he preserves the suppleness and flexibility of the material by slight aspersions of water. The next operation is *fulling*, which see. The hair intended for the manufacturing of hats is always cut off with a sharp instrument, and not pulled up by the roots; because the bulb of the hair, which would come out with it in the latter case, would render the end which was fixed in the skin very obtuse, and nearly destroy its disposition to unite with the adjacent hairs. The hairs should not be straight like needles, for then there would be no compactness in the stuff. The fibres of wool having naturally a crooked form, that substance is well adapted to the operation of felting. The hair of beavers, rabbits, hares, &c. being straight, cannot be used in felting; till it has been prepared for the purpose. See *HAT*.

FELTON, *the Rev. WILLIAM*, in *Biography*, prebendary of Hereford, and a dilettanti musician, above the common class of gentlemen performers. He was a good organ-player, and had a neat finger and powerful hand for common divisions, and the rapid multiplication of notes. As a composer he imitated Handel's organ concertos, and produced three sets, in which there were two concertos that were thought worth playing in London by Staley at the Castle Concert, and Butler at Ranelagh. Two of his airs, with variations, were long the pride of every incipient player on the harpsichord in town and country.

FELTRI, in *Geography*, a town of Italy, and capital of the Feltrin, the see of a bishop, suffragan of the patriarch of Aquileia; situated at the foot of mountains generally covered with snow, which renders the air cold. The principal trade of the place is iron. The town has broad and well paved streets, a splendid town-house, a large and fine market place with fountains, a cathedral church, which yields a good income to the bishop, three monasteries and three nunneries, a pawn-bank, and spacious suburbs, seated in a plain. The number of inhabitants is estimated at 5,200; 53 miles N.W. of Verona. N. lat. 46° 2'. E. long. 11° 48'.

FELTRIN, a small district of Italy, bounded on the north by the Bellunese, on the east and south by the Trevisan, and on the west by the Trentin and Vicentin. It is 28 miles in length, and ten in breadth, and produces a sufficiency of grain, and an abundance of fruit, especially fine nuts, wine, silk, black cattle, sheep, fire wood, and game. The air is salubrious. This territory contains, besides the capital, 120 villages, 20 parishes, and 42,000 inhabitants. The only place of note is Feltri.

FELTRINO, a river of Naples, which runs into the Adriatic, 4 miles S.E. of Ortona.

FELTRO, MORTO DA, in *Biography*, a painter of grotesque or ornamental works. He was born at Florence in 1468, and there he first studied the art of painting. His peculiar genius directing him to paint in the grotesque style, he went young to Rome, the grand emporium of works of the ancients in that kind, which he eagerly sought for among its antiquities and ruins. The vestiges of temples, baths, grottos, tombs, &c. supplied him with a great variety of studies, whose elegance of style he effectually imitated, and became eminent in that manner. It is no small praise of him that Giorgione employed him to introduce the ornamental parts of some of his grandest compositions.

FELUCCA, or FELUCCO, a little vessel with from ten to sixteen banks of oars, not covered over, much used in the Mediterranean as a passage boat. The natives of Barbary employ boats of this sort as cruisers.

The word is formed from the Arabic *falkon*, a *ship*.

It has this peculiarity, that the rudder may be applied either in the head or stern; there being dispositions in both to receive it. For size, it may be compared to a sloop or shallop. It is rigged and navigated like *galley*s; which see.

FELUDSJE, FELIJA, or *Felicha*, in *Geography*, a small island in the N.W. part of the gulf of Persia, near the coast of Arabia. N. lat. 29° 45'. E. long. 48°.

FEMALE, the sex that conceives and bears fruit.

An animal that generates within itself, is called female; and that which generates in another, male.

The female, in quadrupeds, and even in birds, is usually smaller and weaker than the male; though in birds of prey, as the falcon, hawk, &c. it is otherwise; the female being bigger, stronger, bolder, hardier, and more courageous.

The like is observed in most insects, particularly spiders; to that degree, that M. Homberg assures us, he has weighed five or six male garden-spiders against one female of the same species, which has been equal to them all.

For the numeral proportion of males to females, see *MARRIAGE*.

Naturalists also distinguish male and female plants; male and female flowers, &c.

FEMALE *Flowers*, in *Botany*. See *FERTILE Flowers*.

FEMALE *Flute-Player*. See *FLUTE*, *LANIA*, and *ANBUBAJÆ*.

FEMALE *Screw*. See *SCREW*.

FEMBLE-HEMP, in *Rural Economy*, a name given in some districts to the female hemp.

FEME COVERT, in *Law*, denotes a married woman; who is also said to be under covert-baron.

By the law of England, a feme-covert committing a bare theft in company with, or by coercion of, her husband, is not deemed guilty of felony; neither does she become accessory to a felony, by receiving her husband who has been guilty of it, as he does by receiving her. But if she commit a theft by the bare command of her husband; or treason, murder, or robbery, in his company, or by his coercion, or keep a bawdy-house with him, she is punishable in the same manner, as if she was sole; and generally if she be guilty of any offence not capital, she may be indicted, &c. without making the husband a party. But if she incur the forfeiture of a penal statute, the husband must be made defendant in the action or information. (Hawk. P. C. b. i. c. 1.)

Among the Romans, a married woman was as capable of making a will as a feme-sole, but with us she is not only utterly incapable of devising lands, but of making a testament of chattels, without the licence of her husband. For all her personal chattels are absolutely his. Yet by her husband's licence she may make a testament, and the husband, upon marriage, frequently covenants with her friends to allow her that licence. The queen consort is an exception to this general rule, for she may dispose of her chattels by will, without the consent of her lord (Co. Litt. 133.); and any feme-covert may make her will of goods, which are in her possession *in autre droit*, as executrix or administratrix, for these can never be the property of the husband; and if she has any pin-money, or separate maintenance, it is said she may dispose of her savings thereout by testament, without the controul of her husband. (Prec. Chan. 44.) A feme covert may *purchase* an estate without the consent of her husband, and the conveyance is good during the coverture, till he avoids it by some act declaring

his dissent. (Co. Litt. 3.) See more on this subject under the article *COVERTURE*.

FEME *sole*, an unmarried woman, whose debts contracted before marriage become those of her husband after it. If a feme sole makes her will, and afterwards marries, such subsequent marriage is esteemed a revocation in law, and entirely vacates the will. See *CUSTOM of London*.

FEMERN, in *Geography*, an island of Denmark, in the Baltic, separated from Holstein by a narrow strait, called "Femern Sound," about 27 miles in circumference. It contains the town of Burg, and a few villages. This island, though small, has always been considered as one of the keys of Denmark towards Germany. There is a fort at the landing-place from Holstein. N. lat. 54° 33'. E. long. 11°.

FEMININE, or FOEMININI, in *Grammar*, one of the genders of nouns.

The feminine gender is that which denotes the noun or name to belong to a female. In the Latin, the feminine gender is formed of the masculine, by altering its termination; particularly by changing *us* into *a*. Thus, of the masculine *bonus equus*, a good horse, is formed the feminine, *bona equa*, a good mare; so, of *parvus homo*, a little man, is formed *parva femina*, a little woman, &c. In French, the feminine gender is expressed, not by a different termination, but a different article: thus, *le* is joined to a male, and *la* to a female.

In English, we are generally more strict, and express the difference of sex, not by different terminations, nor by different particles, but different words; as *boar* and *sow*, *boy* and *girl*, *brother* and *sister*, &c. though sometimes the feminine is formed by varying the termination of the male into *ess*, as in *abbot*, *albeys*, &c.

FEMININE *Rhymes*. See *RHYME*.

FEM-OWL, in *Ornithology*, an English name used in Shropshire, and some other counties, for the *caprimulgus*, or goat-sucker, called also the churn-owl. It is a very beautiful bird, and more resembles the cuckoo than the owl-kind. See *CAPRIMULGUS*.

FEMSIO, in *Geography*, a town of Sweden, in the province of Smaland; 50 miles W. of Wexio.

FEMUR, or OS FEMORIS, in *Anatomy*, the bone of the thigh. See *EXTREMITIES*.

FEN, in *Agriculture*, a term commonly made use of to signify lands which are of the soft, boggy, or marshy kind; and which, from the great stagnation and retention of moisture, are disposed to the growth and production of different coarse vegetables, as well as to become unhealthy for those who inhabit them. In different districts of the kingdom, as in the counties of Lincoln, Cambridge, and those which adjoin them, immense tracts of this description of lands are still to be met with; which, by proper means, such as those of inclosing, effectual draining, paring and burning, and the growth of suitable kinds of crops, might be rendered of vast importance to individuals as well as the nation, but which in their present state afford scarcely any thing, except rushes, feeds, sedge, and coarse grasses.

The lands of this kind differ in their qualities according to the progress they have made to the state of firmness from the gradual depositions of earthy matters; in some cases being quite solid, while, in others, they are covered with water, except some small portions which rise above the surface in particular places. The former are mostly without any rivers passing into or through them, but the latter have commonly springs rising in them, and become the sources of rivers.

The first sort of fen lands is mostly injured by the stagnation

nation of such waters as come upon them from the higher grounds during the time of floods or heavy falls of rain, from their being generally of considerable extent, and for the most part lying perfectly flat, without the least fall to discharge or take them off. They of course continue upon them until they are taken up by the process of evaporation.

The other is constantly in a great measure covered with water, only having somewhat more dry ground during those seasons which are long free from rain.

In the drainage of these sorts of lands, which constitutes their chief first improvement, the operator must be principally directed by the circumstances of the particular cases, their situations, and the nature of the causes from which the wetness proceeds. See *DRAINING of Land*.

In some instances they will not only require the proper cutting of deep and surface drains, and ditches; but often extensive embanking, when on the borders of large rivers or the sea, as well as flood-gates to prevent the influx of water during the time of floods or high tides. And occasionally likewise other machinery in the nature of fen or lifting mills, in order to throw or discharge the water over the banks. See *MILL*.

In cases which arise from springs, as well as those which are produced by the stagnation of surface water, it will frequently be necessary, in order to effect their drainage, to have one or more deep open cuts, brought up in a proper direction from the lowest point at which the water can be discharged. Into this various other, either surface or other drains, must be formed, in suitable directions, according to the nature of the cases, that the water may be effectually carried off. In the execution of the business it will consequently be first necessary to ascertain the most depending part of the land by proper levelling with a spirit or other level, suitable to the purpose. Where this is not carefully done, the drainage can seldom be accomplished in a proper manner.

The main drain or drains, in cases of this kind, should constantly have sufficient depth and width to readily discharge the water from the whole extent of the level; and the flood and tide waters be kept as much as possible from flowing upon the lands by proper embanking and the use of flood-gates, as suggested above. See *EMBANKMENT and FLOOD-GATE*.

In most other points the drainage of these sorts of lands may be conducted in the same way as for common draining. See *DRAINING*.

When fen lands have been rendered sufficiently dry by proper draining, and are become in a state of proper solidity for carrying on the operation of tillage, where they contain much coarse vegetable matter upon their surfaces, the most advantageous method is to begin by paring and burning, which will afford an excellent preparation for a crop of rape, or even turneps where the lands are free from too much stagnant moisture; and either of these kinds of crops will leave the grounds in excellent condition for potatoes, beans, or cabbages, with which they should be constantly cropped until they are brought into a suitable state for the growth of grain, when a few crops of this sort may be taken in alternation with those of the green kind, keeping it always in mind that the great object is to lay them down as soon as possible to grass, for which they are in general the best calculated.

In the introduction of grain crops, it is for the most part the best to begin with oats, as such sorts of land are commonly well adapted to them. The other kinds may afterwards be had recourse to according to circumstances.

It has been stated by the writer of the "Survey of the County of Lincoln," that the probable improvement that might be made by the inclosing, draining, paring and burning, and judicious cropping of the east and west fens in that district, would not be less than is stated below.

Present Value, Dr.		Improved Value, Cr.				
				Val. per Acre.	Rent.	
£. s. d.		A.	R.	P.	£. s. d.	
To present value of all the common rights in the east and west fens	4,173 5 0	By the west fen	-	-	20	16,924 10 9
		By the east fen	-	-	15	9,318 14 11
		Total improved value, Cr.				26,243 5 8
		Deduct the former value				4,173 5 0
		Net improvement				22,070 0 8
		A.	R.	P.	Val. per Acre	£. s. d.
To present value of the common rights in the Wildmore fen	1,515 13 1	10,661	2	25	20	By the Wildmore fen
						13 1½
		Deduct Dr. as opposite				1,515 13 1
		Net improvement				9,146 0 0
		The whole improvement of the east and west Wildmore fens				31,216 0 8

It is remarked, that the calculation is drawn from the average of the common rights of two different parishes, those of Lushby and Reveby, the one being detached a considerable distance from the common, and the other greatly nearer, which furnishes a tolerable data for the whole of the towns; and if those two parishes common rights produce a given sum, and their two shares of land-tax amount for Lushby, 40*l.*, Reveby, 237*l.*; all the parishes which have rights upon the fens, amounting to 3975*l.* 15*s.* produce the sum of 4173*l.* 5*s.* per year, which gives the present value of the common rights upon these fens, from 29,349 acres, at about 2*s.* 10*d.* the acre; when, by the improvement from an inclosure, the same 29,349 acres would produce 26,243*l.* per year, which averages about 17*s.* 11*d.* the acre, and which is the moderate average value; although there are certain lands taken in to defray the expence of draining the west fen, let by auction for 34*s.* the acre; in the average about 4,000 acres in farms.

It is suggested, that the chief reason why these fens are so unprofitable in their present state, is from the disorder in stocking; because human nature being in its various capacities anxious of property, some persons, from avarice, or a wish to get rich at once, stock so largely as to injure themselves, and oppress the common; others, in the line of jobbing, put in great quantities of stock to sell again, which are altogether injurious to the fair commoner, who only stocks with what his farm produces. Because, suppose one man stocked a pasture of 29,349 acres, he would consider the different sorts of cattle to be depastured thereon, for each to thrive and yield their proportionable share of profit; but if 3,000 men stock, they have different views of supposed interest; some increase their breed of sheep, beasts, horses, geese, &c. There are instances of a cottager renting five pounds per year having fifteen hundred or two thousand breeding geese, which must injure his neighbour of five pounds per year, who has got only a few sheep, or a cow. The chief proprietors of these fens have long had their improvement in contemplation, especially since so many inferior neighbouring commons have been embanked and inclosed to such advantage, and particularly as it is evident that if this was the case, they would produce a yearly rent of 26,243*l.* 5*s.* 8*d.* There are plough farms being estimated to produce three years rent, 78,729*l.* 17*s.* which increase of property would, it is supposed employ more poor, maintain more farmers, increase trade, and produce great quantities of grain, which now costs English money to import from foreign nations. The reasons why the proceeding has been so long delayed has been the extent of the undertaking, and the intermixture of large mortmain estates, with some differences in the rights between the soken of Bolingbrooke and Holland town. This great work has however since, we believe, been accomplished, and a vast extent of valuable land reclaimed and brought into the state of cultivation.

It was formerly supposed that fens were of great advantage to those who resided in the vicinity of them, in the large quantities of fowl and fish which they afforded; but this does not appear to be really the case, when the value of the land in other views is fully considered. The kinds of wild-fowl with which they principally abound are those of the wild-duck and teal sorts, which are often extremely numerous, being taken in decoys, and conveyed to the London markets.

The fish are chiefly pike and eels, which are in great numbers of large size, and taken without any very great difficulty; but they are held not to be so delicate for eating as those of some other situations.

But the principal benefit was probably derived from the vast number of geese that were kept upon them, as, besides their use as food, they afforded very considerable profits in the feathers and quills. It is shewn by the books in the custom-house at Bolton, in the county of Lincoln, that formerly there were not unfrequently sent away from that place, in one year, the quantity of three hundred bags of feathers, each bag containing one hundred and a half weight. They pluck the geese several times in the year for the feathers, and once for the quills. See FEATHERS and GOOSE.

FEN, in *Rural Economy*, the name of a pernicious distemper to which the hop is particularly exposed. It consists of a mould or moss, which grows with great rapidity, spreading itself greatly, and occasioning much injury in the hop plantation. The fine smell and condition of the hop are in this way very much impaired.

FENCE, in *Agriculture*, a term signifying any sort of construction raised for the purpose of inclosing land, such as a bank of earth, a ditch, hedge, wall, railing, paling, or any similar kind of erection.

It seems evident that fences only became known, and were recurred to, as the pastoral state of society disappeared; and that during that of the feudal system they were but little necessary, except in the case of villages, for the purpose of inclosing the little portions of grass lands, which were scattered about them; or in particular instances for protecting the more exposed parts of parish fields, while they were kept in the state of corn.

In this country, however, fences are now generally prevalent, except where the remains of the feudal practice is still permitted to continue; or where the appropriated mountains and high lands are managed under the sheep system; and where the extensive ranges of chalk hills in the state of appropriation, which are more favourably situated and conducted under a mixed kind of cultivation, are still wholly open. These hills are, however, particularly suited to the sheep husbandry, the more elevated, bleak, and least fertile parts of them having constantly been kept in the state of sheep walks by their occupiers. Consequently large flocks of sheep are preserved on them under the care of shepherds, who attend them during the day, and fold them in the night, by which practice the crops are effectually protected from injury.

But whether this system of management be proper or the contrary, it is clear that wherever horses, neat cattle, or small numbers of sheep, which have not the attendance of shepherds, are the pasturing stock, fences become essential to the due cultivation of the land.

The materials which are the most commonly employed in the raising of fences are, earthy substances, living plants of various kinds, stones, bricks, and wood of different sorts. Iron, and even rope, or cord, are likewise occasionally made use of for forming fences.

The first of these, though frequently made use of in the forming of fences, are far from being good materials for the purpose, as they soon begin to decompose by the action of the air, and moulder away, leaving any sort of plants that may have been set upon them in a naked and exposed condition. In most situations they likewise become dry and parched by the heat of the sun in the summer months, that the plants never thrive properly upon them. They are also very apt to be thrown down by neat cattle and sheep, rubbing against them in hot seasons. The mould fences are much met with in different counties, as Devonshire, Lancashire, and in some parts of Wales.

The second sort of substances for the purpose of fences affords great variety, there being many kinds of plants that

answer

answer perfectly well, but the best are unquestionably the white thorn and the holly. The black thorn, hazel, and crab-tree, may likewise be used in the same way. Fences made with some of these sorts of plants are by much the best and most durable.

Several other kinds of plants may likewise be employed in forming live fences, as the willow, the elder, the birch, and the alder for moist situations; the beech on those that are high and exposed; and the elm and horn-beam where they are low and the soil inclined to be heavy. These two last are, however, but little had recourse to in this intention. Of the willow there are many sorts, all of which may be cut into truncheons of suitable lengths, and planted out in that way.

Stones and bricks make excellent fences, both in respect to convenience and durability; but they are mostly much too expensive, except where they are abundant, and labour cheap. The latter can only be employed on particular occasions, and under particular circumstances, chiefly where ornament is required. On hilly, low, mountainous, and other stony-exposed situations, where live fences cannot be raised without great difficulty, and shelter is not required, walls are capable of being had recourse to with advantage, and are commonly the most proper sort of fence for the purpose. In less elevated districts, where these sorts of materials are readily procured, fences of the wall kind are likewise not unfrequently met with, as constituting the division of lands merely in the state of tillage, as well as for the confining of the inferior sorts of live stock. Their appearance is, however, extremely naked and disgusting.

Wood is a sort of material which is certainly the worst and most expensive that can be had recourse to in the construction of fences; as whether it be the smaller sorts of wood for the forming of dead hedges, the defending of the banks of ditches, &c.; or the larger kind of timber-wood employed in making paling, railing, and other similar fences, it may be said to be in a constant progressive state of decay from the very period of its being put up. It can of course be very rarely made use of as a fence, except in the case of dead hedges, where living ones cannot be raised; and for inclosing about the farm-lands and parks, or other pleasure-grounds, where ornament is required, or in the form of paling, for protecting new-planted quickset hedges, &c.

The two last materials can evidently never be had recourse to as farm-fences from their expensive nature; it is only in ornamented grounds, where a peculiar degree of neatness is required, that they can be employed. The latter is a very perishable kind of material, and the former stands in need of frequent expensive painting, to preserve it from decay.

Fences may be capable of being divided, from the nature of their construction, into two classes or kinds, as

1. *Simple Fences.*
2. *Compound Fences.*

The first class, or division, comprehends all those which are sufficient of themselves for the purposes of inclosure, without requiring the assistance of any other sort; as those of simple ditches, dikes, hedges, walls, palings, railings, &c.

The second sort comprises all such kinds as stand in need of the assistance of some other kinds, in order to guard and protect them in their young growth, or which may render them more safe and secure when farther advanced; as hedge and ditch, or bank, hedge ditch and paling, hedge ditch and railing, double hedges, hedge and

wall, hedge ditch and wall, hedge ditch and trees, hedge, or hedge, wall, and belt of planting, and others of the same kinds.

After this arrangement and division of fences, it will be proper to consider the different kinds in a separate manner, in order to explain more fully their particular nature and advantages, as well as the most proper methods of constructing and preserving them so as to render them the most durable.

Simple fences.—These are mostly formed with much less trouble, and kept in order with far less difficulty, than those of the compound kind.

Open ditch, or water fence.—This sort of fence consists simply in a ditch of considerable width and depth, which is kept as full of water as possible. It has been remarked by a late writer on this subject, that though ditches now form a part of that class of fences which are termed compound, they in their simple and original state were considered rather in the light of open drains; and in place of being looked upon as a fence, their greatest benefit was supposed to arise from their receiving or carrying off the superfluous moisture from the inclosed field. In a variety of instances, ditches are made for this purpose only, where there is no intention whatever to inclose the field. They are, however, sometimes meant as fences; but, in such cases, they are made very deep and wide, and the earth taken out of them is sometimes formed into a bank, the height of which, when added to the depth of the ditch, forms a tolerable barrier. In general, however, the greatest value of the ditch is met with, when it is used in conjunction with other fences, as will be seen under the second class, or compound fences.

The forms of ditches are various; some of them being of an uniform width both at top and bottom; others are wide above, and have a gradual slope downwards; those of a third kind have one side sloping, and the other perpendicular. For whatever purpose the ditch is meant, however, the sloping form is by much the best, as it not only costs less money in the digging, but is at the same time much more durable, and has a neater appearance. Where open ditches are indispensably necessary for the drainage of the field, the sloping ditch is preferable to every other, as the sides are not liable to tumble in or be undermined, or excavated by the current of the water, when properly executed. The slope should be considerable, perhaps not less than three times the width at top that it is at bottom. The advantages of this construction will, however, be more fully explained in speaking of *hedge and ditch fences*.

It has been remarked that the open ditch, with a wall or perpendicular sides, is liable to much objection both in its simple and compound state: that in its simple state the sides are perpetually tumbling in, especially after frosts or heavy rains; and if the field round which these ditches are made has any considerable declivity, the bottom is undermined, and large masses tumble down, bringing the hedge along with them. These circumstances are of themselves sufficient to bring this kind of ditch into discredit; but while they are thus improper as open drains, owing to the circumstances we have mentioned, their shape is, it is conceived, the best possible for a covered drain, as the broader these covered drains are at bottom the more water will they carry off; with this additional benefit, that, by being broad below, they are less liable to choking, or obstruction, than if they were narrow; in which case a single stone or two clapping close together, will so far interrupt the course of the water, and so much sand and mud will accumulate behind them, as to render the drain useless: whereas, when there is a sufficient

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cat breadth at bottom, if the water is obstructed by one stone, it readily finds a passage in some other place.

The *open ditch*, or *water fence*, is most commonly employed in low, marshy, and fen-land situations; and where it is made of the width of not less than half a statute pole, and is capable of being preserved constantly full of water, it may be a eligible fence, even in the summer season. But in open extensive tracts, where the land is much exposed, from its affording little shelter, it is obviously an improper fence. In severe frosts it also loses its qualities as a fence against sheep; and when they are more flight, and the ice covered with snow, but not sufficiently solid to support the weight of sheep, often betrays them to their destruction. In particular situations it is, however, the only sort of fence that can be had recourse to. A representation of this sort of fence is quite unnecessary, as the following will, in some measure, shew it.

Simple ditch, and bank of earth.—This is a kind of fence which consists simply of a gradually sloping ditch, in which the earth that is removed in forming it is laid up into a bank on one of the sides, leaving a scarcement, or projecting space of six or eight inches on the side where the bank is formed, to prevent the earth from tumbling in and filling up the ditch. The earth or clay, in some places, is likewise gathered into heaps, after being taken out of the ditches, and used as manure. This sort of fence is represented in the former plate in *Plate XVIII. (Fence) Agriculture*, at *fig. 1*, in which *a* is the opening, and *b* the bank of earth on the side.

Double ditch with intermediate bank of earth.—This is a kind of fence not often used, unless in cases where it is meant either to plant hedges or trees on the bank between the ditches. In some cases, however, double ditches are made, where there is no intention whatever of planting either hedges or trees, and in several instances are highly valuable. Considered as a fence, it has an evident advantage over the single ditch, as the earth taken out of the two ditches, when properly laid up in the middle, forms a pretty steep bank of a formidable appearance, which, without any other addition, makes a very tolerable temporary fence. For the purposes of open drainage the double ditch is excellently adapted, especially by the sides of highways, where the lands have a considerable declivity towards the road; the ditch next the field, by receiving the water on that side, prevents it from overflowing and washing the road, a circumstance which very frequently happens in such situations; while the ditch on the side next the road, by receiving and carrying off the moisture that falls upon, and which would otherwise lodge there and destroy it, keeps it constantly dry and in good repair. The double ditch is also useful in dividing high from low flat lands, particularly where the high grounds slope very suddenly down upon the low fields; that next the high ground, by receiving the water from it during heavy falls of rain, saves the inferior grounds from inundation, while the ditch on the other side serves as an open drain for the lower fields. It is trusted that it will not be thought foreign to the present subject to mention, that where double ditches are made in the immediate vicinity of high grounds, or on the sides of highways, care should be taken to prevent the water from the furrows, or side-drains, from running into the main ditch at right angles. Where this is neglected, much trouble and inconvenience arise; as when the water comes from a height, during heavy rains, in a straight line into the ditch, it presses with accumulated force against the sides of it; and if the soil is of a loose incoherent nature, the bank will be undermined and washed away in many places. To prevent this, nothing more is conceived requisite than to alter the direction of the furrows,

or small side-ditches, a few yards from their opening into the main ditch; and, in place of permitting the water to fall upon the bank in a straight line, to give the furrows or side-ditches a gentle curve; by that means, instead of falling into the ditch in a straight line, and acting against the bank in the manner described, the furrows will empty themselves into it in an oblique direction, and, by joining immediately with the stream in the ditch, will be prevented from having any bad effect upon the bank. It is obvious that the water, by thus having its direction changed, can do no harm to the sides of the main ditch: and what is of advantage, the earth and sediment brought along with it from the high ground, instead of being deposited in that place where the cuts enter the main ditch, which seldom fails to be the case where the water falls into it in a straight direction, are carried off along with it; and though this sediment ultimately falls to the bottom of the ditch, yet, as it falls down gradually in its course, it is equally divided over the whole, and occasions no obstruction in any particular part of the ditch. This form of fence is shewn at *fig. 2*. in the same plate, in which *a, a*, are the two ditches, and *b b* the intermediate bank of earth.

Where soils are moist and retentive, this is often a beneficial method for raising live fences, both with the thorn, and other sorts of hedge-plants.

There are other methods of constructing fences of this nature. They are in some cases formed by raising up long piles of earth between two sod facings, in a battering manner, or leaning somewhat inwards towards each other, to the necessary heights and widths, as will be seen below.

Various other modes of planting on banks of this nature raised to different heights, have also been practised in different districts of the kingdom.

Bank of earth with perpendicular sod-facing and slope behind.—This, it may be observed, is a very common sort of fence, and in some situations extremely useful, as in making folds, for instance, for the confinement of sheep or cattle. It is also valuable on the sides of highways, for defending the adjoining grounds, and for laying off clumps or belts of planting in the middle or corners of arable fields, for inclosing slack-yards, cottages, gardens, and other similar purposes. The front of the bank is made with the sod pared off from the surface of the sloping ditch, and the mound at the back with the earth taken out of it. In all cases, it is remarked, where this fence is used in the field, the perpendicular front should be made on the outside, and the bank on the inside of the field. But when it is employed for folds, the front should be on the inside of the fold, as in that way it will not only present a much more formidable appearance to the sheep or cattle, but the depth of the ditch will be an addition to the height of the bank; and the earth taken out of it being laid behind will serve as a kind of buttress to support the facing of sod, and give it a degree of firmness and durability, far superior to that of the common turf walls, or fold-dikes, as they are generally termed in North Britain. When this fence is properly constructed, a work at which the labourers in that part of the kingdom are now pretty expert, it lasts a considerable time; but in its most perfect state it is only to be considered as a temporary expedient; for however neat it may appear, or however well it may answer the purpose at first, it ultimately loses its value. Where wood for paling is scarce, or cannot be had, and where other materials for the shelter or protection of young hedges are equally scanty, this may be used with advantage for a time, and will both shelter the young hedge and inclose the field; but where permanent plans of inclosing are intended it should never be had recourse to, as however cheap it may be in the first instance, it is by no means durable. It is

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represented at *fig. 3.* in which *a* shews the half-section of a high road; *b* the sloping bank of earth on the side; and *c* the perpendicular facing of turf or sod in the front.

Perpendicular earth-wall.—This is a species of fence that may be occasionally had recourse to with advantage, as in inclosing rabbit-warrens, and other similar cases, where better sorts of materials cannot be provided, except at too great expence. But it is only a temporary kind of inclosure, as the sods soon decay, and begin to moulder down. And by neat cattle, sheep, and swine such fences are soon thrown down and destroyed. When it is employed, it should have the ditch on the inside or piece of ground that is inclosed, and be firmly built with turfs or sods cut out from the surface of it, being well backed with the earth taken from below. It is shewn at *fig. 4.* in the same plate. Under the head *wall-fences* below, this sort of wall is more fully explained, in speaking of *turf-walls*.

Ha-ha, or sunk fence.—It has been observed by Mr. Somerville, that this description of fence is calculated chiefly for fields that require no shelter, and where an uniform unbroken prospect is an object to be preserved, as is the case in pleasure-grounds, gardens, and extensive lawns; but in all situations where shelter is wanted, the sunk fence ought to be avoided, unless a hedge is planted upon the top of it. The form of the sunk fence very nearly resembles the mound of earth with the perpendicular facing of turf just described, with this difference, that the facing of the former is turf or sod, and the height of the fence depends entirely, or in a great measure, upon the depth of the ditch. While these sunk fences are either faced with brick, dry-stone, or stone and lime, and are of various heights, according to the ideas of the proprietor, or the circumstances of the case. In the Agricultural Report drawn up for the northern districts, in the account of Cromarty the following description of the sunk fence is given: "Upon the line where this fence is intended, begin to sink your ditch, taking the earth from as far as eight feet outward, and throwing it up on the inside of the line. This ditch and bank is not made quite perpendicular, but inclining inward towards the field as it rises; to this is built a facing of dry-stone, four feet and a half in height, one and three-quarters broad at bottom, and one foot at top, over which a coping of turf is laid: the ditch or sunk part forms an excellent drain. The whole of this is there performed when the stone can be procured at about a quarter of a mile distance, for *6d. per yard.*" But in other cases it will stand greatly higher, according to the distance of the materials, the price of labour, and various other circumstances. It is a sort of fence which is seen at *fig. 5.* in the annexed plate.

With regard to the advantages of ditches as fences, it has already been observed, that none of the different kinds of ditches taken by themselves are to be considered as good fences, with the single exception of the sunk fence, which is under the necessity of being classed along with them. This last sort answers the double purpose of an open drain and a fence. But though ditches in their simple state are thus defective as fences, their use is attended with many advantages; not only in draining the field, but in affording a supply of earth, which, under proper management, may be converted into excellent manure. Where the soil in which ditches are made is deep, and of a good quality, the earth taken out of them, if it is either made into a compost with lime or dung, or even spread by itself upon the adjoining fields, will greatly increase their fertility, and prove a lasting and valuable improvement. Even where the soil is moss or clay, it may be converted to the same valuable purpose by burning: moss being burnt, and the ashes used as a manure

in many parts of the kingdom; and the same is the case with clay. It has been found in the marshes of Somersetshire that the clay taken out of the ditches and burnt is, upon strong tenacious soils, highly valuable; as it breaks their cohesion, and by that means renders them not only less retentive of moisture, and of course easier cultivated, but also much more favourable to the growth of plants, by affording room for the roots to extend and stretch themselves out in search of food. Their value, as making a part of any of the compound fences, will be further seen below, and under the article *ditch and hedge*.

Compound ditch fence.—This is that sort of fence in which the ditch is only a constituent part, being combined with some other, in order to form a perfect fence.

Double ditch and hedge.—This is a kind of fence sometimes employed in the inclosing of land. In considering the double ditch as a simple fence, its use, and the various situations in which it is applicable, whether as a fence or an open drain, have been noticed. To what has been mentioned, we may add that the custom of inclosing with double ditches, and a hedge in front of each, is now practised in many parts of the kingdom, especially upon what are termed cold lands; from an idea, that a single row of plants would not grow sufficiently strong or thick to form a proper fence. The advocates for this sort of fence farther allege, that in addition to the two rows of plants forming a more sufficient fence, an opportunity is afforded of planting a row or rows of trees in the middle of the bank, as represented at *fig. 6.* in the plate.

It has been observed that the double ditch and hedge is liable to many objections; the expence of forming the ditches, the hedge-plants made use of, and the ground occupied thereby, being double of what is requisite in a single ditch and hedge. From twelve to eighteen or twenty feet is the least that is required for a double ditch and hedge; this space, in the circumference of a large field, is so considerable, that upon a farm of 500 acres, divided into fifteen inclosures, the fences alone would occupy above forty acres. By throwing up a bank in the middle, the whole of the nourishment, not only of both hedges, but also of the row of trees, is confined solely to that space, which, from its being insulated by the ditches, and elevated so much above the common surface, not only curtails the nourishment of the hedges and row of trees, but exposes them to all the injuries arising from drought, frost, &c. The idea of two rows of plants making a better fence than one, is certainly no good reason for such an unnecessary waste of land and money, as in almost every instance, where the plants are properly adapted to the soil and climate, one row will be found quite sufficient; but, if it should be preferred to have two rows, the purpose will be answered equally well with a single ditch, or even without any ditch at all; for in every situation where the soil is tolerably dry, and the fields much elevated above the level of the sea, the ditch, except for the purpose of drainage, may be dispensed with.

In addition to the double ditch, and while the hedges are still young, the fence is sometimes strengthened by a paling, either of young firs or other wood placed upon the top of the bank; in other cases, a dead hedge is put in the middle, between the two quick hedges; and not unfrequently an open wall, resembling a Galloway-dike, made with round stones, is placed in the same situation; any of which, when properly executed, not only inclose the field completely for the time, but also very effectually shelter the young plants that constitute the fence. Under every circumstance this is a very expensive sort of fence.

Simple hedge fences.—These are of two kinds; either such

such as are made up of dead materials, or such as are formed of living plants, of some sort or other. They are likewise made in different ways according to custom and circumstances.

Dead hedges.—It may be observed that these are made either with the prunings of trees, or the tops of old thorn, beech, or other hedges that have been cut down; and are principally intended for temporary purposes, such as the protection of young hedges till they have acquired a sufficient degree of strength to render them fencible without any other assistance. For this purpose the dead hedge is well adapted, and lasts so long as to enable the live fence to grow up and complete the inclosure.

In many cases, however, dead hedges are had recourse to as the sole fence, and where there is no intention of planting quicks, or any other hedge. From their very perishable nature, however, they are found to be exceedingly expensive; so much so, indeed, that, after the first or second year, they cannot be kept in repair at a less expence than from a fifth to a tenth part of the value of the land, and sometimes more. When dead hedges are meant for the protection of young live fences, if the quick fence is planted upon the common surface, the dead hedge is made in a trench or furrow immediately behind it, in such a way as to prevent the sheep or cattle grazing in the inclosed field from injuring it. Where the quick fence, however, is planted upon the side of a ditch, the dead hedge is, for the most part, made on the top of the mound formed by the earth taken out of the ditch; these are called plain dead hedges, being made by cutting the thorns or brush-wood, of which they consist, into certain lengths, and sticking or putting them into the earth. They are called plain, in opposition to other descriptions of dead hedges, where more art is used; such as the dead hedge with upright stakes wattled, and the common plaited hedge, bound together at the top with willows; but of which the reader will be able to form a much better idea than can well be conveyed by words, by consulting the annexed plates; in which *fig. 7.* represents a dead hedge inclining a little, placed upon the plain surface in the ordinary manner; *fig. 8.* the common dead hedge; which, it is observed, is almost the only fence met with in several of the counties of England, with the thorns or dead wood let into the earth about twelve or fourteen inches, and fastened at the top with willows or hazels; *fig. 9.* shews the wattled dead hedge, with strong upright posts, or what is generally termed stake and rise, or in Scotland stake and rice, and in some places staff and band. This last, and the one immediately preceding it, form, it is remarked, very handsome fences; it is only to be regretted that they are not permanent ones, seldom lasting above a year or two. This defect is complained of in many of the reports published under the authority of the Board of Agriculture. The words of the surveyor of one of which are; “dead fencing supplies the place of live, which occasions an eternal expence to the occupier; 1st, in purchasing the fencing stuff, and bringing it from a considerable distance; and, 2dly, in the delay of his interest, by reason that the land occupied by a dead fence might sustain a live one, which would not only answer the present purpose, but, in place of decaying, would be annually improving.” The truth of this observation cannot be disputed; as the soil and climate, in almost every situation where these dead hedges are complained of, are such, that hedges of live plants would not only grow, but could be made at equal, perhaps less expence, than these temporary erections; and with this advantage, that, in place of decaying, and occasioning an endless loss and expence for repairs, they would be every year growing stronger, would require little expence

to support them, and, in place of the forlorn decayed appearance which dead hedges never fail to give a country, they would at once shelter and ornament it. It cannot, therefore, in the opinion of Mr. Somerville, be too strongly recommended to proprietors and farmers, in those parts where dead hedges are at present so much used, and so justly complained of, to substitute live hedges in their place; the expence of doing which will be trifling, and the benefit arising therefrom immense.

In carrying a plan of this kind into execution, there is no occasion to throw such fields as are at present inclosed with these temporary fences open; quite the contrary: the dead fences ought to be preserved till the young plants have attained such a strength and size as to enable them to form a good fence without any auxiliary aid. In that way the inclosure will not only be preserved, but the dead fence, from the shelter it will afford to the young plants, will accelerate their growth, and render them much sooner useful than they would otherwise be. This change of system would be at once pleasant and profitable to all concerned; the expence of inclosing, which is at present severely felt, would be done away; the appearance of the country considerably improved, and the public benefited in a great degree; and, as no doubts can be stated as to the practicability of this scheme, it is trusted that the bare mention of it will be sufficient to dictate a better system of inclosing to those concerned. The idea entertained by some landlords, that, provided a farm is once let, with the usual burden upon the tenant of supporting the fences, the nature of the fence is of no importance to them, deserves the strongest and most pointed reprobation: indeed, it could scarcely be supposed that men, who have a permanent interest in the property, would reason in such a manner. There can be no doubt, if lands are let to a good tenant for a term of years, that the landlord is certain of drawing his rent during the currency of the lease, whatever the expence of supporting the fences may be; but if this tenant is a man of sense, the offer he makes will proceed upon the value he has in his own mind formed of the nature of the soil, and the expence which must unavoidably arise from cultivating and sheltering it, and bringing the produce to market: the farmer who has not made, or is not capable of making such a calculation, can never be a desirable tenant to any proprietor; but if the tenant possesses this necessary knowledge, the yearly rent he will offer for the farm will be less in proportion to the sum which he expects annually to expend in constructing or supporting these fences. It is trusted, that but very slender observation is necessary to convince intelligent proprietors or farmers, that the substitution of live for dead fences will not only make the inclosures more perfect, but will make an addition to the annual value of the property, equal to, if not greater, than the expence at present incurred in keeping these dead fences in repair. It need hardly be added, that as the greatest value of these fences consists in their completing inclosures, and sheltering the young hedges till they arrive at a certain age, they should never be thought of by either proprietors or farmers, except for these or other temporary purposes.

In the making of all sorts of dead hedge fences, considerable art is required to perform it in a proper manner, and so as to become the most durable and lasting possible. Whatever the nature of the materials may be which are to be employed in this way, they should be neatly deposited and wrought into the fence, according to the manner in which it is to be made.

Live hedges.—These may in general be considered as the ordinary farm fences of this country. And, except in

particular situations and circumstances, and for particular purposes, they are unquestionably the most proper and useful.

It is found, that in districts which have been for a considerable length of time inclosed from the pastoral or forest state, without having previously undergone cultivation, the hedges are seemingly of great age, having mostly crooked irregular directions, as if originally formed out of the brushwood of such forests, or wales. While, in other cases, coppice-woods of different sorts are found growing on low wide banks, which seem as if they had been formerly gathered in the woods, and afterwards planted in such banks. The practice of planting out full grown plants in this way has, however, been long, in general, discarded in this kingdom, and young hedges chiefly raised with plants of a few years' growth, planted in different ways according to situations and circumstances, being first reared for the purpose in some proper place.

In respect to live hedges, it may likewise be further observed, that they are in general made either entirely with one kind of plants, or a mixture of different kinds; and for this purpose almost every tree or shrub known in Britain are either wholly or in part employed.

Under the head *INCLOSING of Land* some account will be given of each; but there are certain circumstances common to all of them, and upon which the success of every attempt made to rear good fences will be found ultimately to depend. These circumstances are, 1st, the plants being suited to the soil and climate; 2dly, the preparation of the earth or soil; 3dly, the time and mode of planting; 4thly, the age of the plants; 5thly, the size of them; 6thly, the dressing or pruning of the tops and roots before planting; 7thly, weeding and hoeing them while growing; 8thly, trimming and after-management; 9thly, filling up the gaps in hedges; 10thly, diseases to which hedge-plants are liable, and their remedies.

With regard to the first, it has been observed, that upon the proper choice of plants suited to the soil and climate where the hedge is to be made, the success of every attempt to inclose with live fences will be found to depend. A mind given to observation, and capable of applying it in practice, may receive considerable assistance upon this point by attending carefully to the indigenous trees or shrubs which thrive best, and attain the greatest size and perfection, upon particular soils and in certain climates: by an attention of this sort many plants, which are seemingly of small value at present, might, it is remarked, be rendered highly useful by planting hedges with them. But though an observation of this kind will in some instances serve as a guide, and lead the person who makes it to certain useful practices, it is not always to be depended upon, as there are many situations where neither trees nor shrubs, fit for making hedges, are to be met with in an indigenous state; and even when they are met with, their nature will not admit of their being transplanted. Fortunately in these cases, though nature affords no guide to assist us in the choice of the plants, we shall find sufficient direction from the experience of the country, by carefully noting the circumstances of soil and climate under which certain plants that have been introduced into them have prospered, and either risen into trees, or made good fences. In speaking of the nature of inclosing land, notice will be taken of the great loss which attends the fence, and the plants of which it consists, in not being properly adapted to the natural circumstances of the soil they are meant to inclose. Many mistakes of this kind might be enumerated; especially in the more elevated situations, where great labour and expence have been employed

to raise hedges of hawthorn, which, after many years' care and attention, were found totally unfit for such inclement regions. In such situations, experience has now sufficiently proved that good fences can be reared in a short time with beech, birch, larch, and the Huntingdon willow: hedges of these kinds ought, therefore, to be the only ones used in hilly countries, or upon cold wet soils. The three first upon the dry soils, and the last, with the addition of poplars, upon such as are wet, or marshy. In the low country, however, and in the less elevated part of the uplands, the white thorn will be found the best upon all the dry, or moderately dry parts of the soil; especially the different kinds of loamy, sandy, or gravelly lands: upon clays, or cold yet soils, however, beech, crab, birch, poplar, willow, and alder, may be used with advantage. The birch, poplar, alder, and Huntingdon willow, are peculiarly calculated for the coldest, wettest, and most marshy parts; while beech, crab, &c. will be found to answer best upon the stiff clays. Hazel, sweet-briar, mountain-ash, or rowan-tree, and indeed all the different kinds of forest trees that are at present known to delight in dry soils, may also be employed for making hedges in the low lands with success; but which-ever of these is used, they should, if possible, be without mixture, or have as little of it as possible. See *INCLOSING of Land*.

It may be remarked, that it is seldom indeed that any soil, however good, will be found equally favourable to the growth of plants so very opposite in their nature; this circumstance alone will render their growth unequal, and of course make the fence faulty and defective. These defects in the fence, and inequalities in the growth of the plants, will increase with time, become every day more apparent, and be every day more sensibly felt; as the plants which have thus acquired the ascendancy will continue to keep it, and not only shade the weaker ones, and prevent them from enjoying the influence of the sun and air, but also deprive them of nourishment. Independent of these considerations, there is another, it is observed, of equal, perhaps greater moment, that requires to be mentioned: allowing the soil to be equally favourable to the growth of the whole plants, of which the mixture consists, there are certain plants which are highly inimical to the growth of others, when planted in their immediate vicinity; ivy and honey-suckle for instance, when mixed with thorns, or other plants in a hedge, never fail to destroy such of the hedge-plants as they fallen upon; indeed moss, which is known to be one of the worst enemies to all hedges, is not more dangerous, or more certainly ruinous; even the different kinds of sweet-briar, brambles, &c. have the same effect; and in the end never fail to produce a gap in that part of the hedge where they grow, by rubbing, corroding, and smothering the thorns or other plants of which the fence consists.

There is one plant that may, however, be employed in mixture with the white thorn, without any inconvenience of this nature, and with the advantage of rendering the hedge more formidable, as well as much more ornamental. This is the common holly. It thrives remarkably well in such combination where the soil is sufficiently dry, and not too heavy.

In what regards the second point, or the preparation of the soil for hedges, and even plantations, it is remarked that, though at present shamefully neglected, it is nevertheless one of those points intimately connected with, indeed essential to, their success. Except in a very few instances, however poor the soil may be, or however strong the cohesion of its parts, no attempt is made either to break that cohesion by proper tillage, or improve its quality by enriching

riching or alterative manures; the young plants being for the most part laid upon the old surface, which has perhaps never been opened by the labour of man, and their roots covered with the earth taken out of the ditch, consisting very often of the poorest and coldest *till*, or of earths loaded with iron, or other metallic impregnations. To those who have considered the matter with the smallest attention, the fate of such a hedge will not appear doubtful; the surface upon which the plants are laid will be so hard and impervious to the roots, as to preclude the possibility of their penetrating it; of course their only chance of either extending themselves, or procuring nourishment, is by spreading out between the surface and the mound made by the earth taken out of the ditch, or by striking up into the mound, where, though the soil will be sufficiently open to admit of this, the roots, in place of finding an establishment in a situation friendly to their growth, will very often be either starved or poisoned. In the culture of the grain, and the whole of our most useful and valuable vegetables, proper preparation of the soil by tillage and manure is, it is remarked, deemed indispensably necessary; and experience has sufficiently evinced, that upon the perfection of the tillage, and the quality and judicious application of the manures, the success of the farmer or gardener, and the value of their crops, entirely depend. Is it not strange then, that the same farmer who is convinced of the utility and necessity of tillage and manures for his other crops, and who would think himself for ever disgraced, were he to sow or plant grain, or any other useful vegetable upon an unploughed, dirty, unmanured field, should, without shame or compunction, commit a hedge, which is to form the inclosure of the field, and upon which a considerable part of its future improvement is to depend, to the earth without any one of these aids? Incredible as it may appear, this is however certainly the fact; unless, as has formerly been observed, in a few instances where better sense and stronger observation have dictated a different management; it being the uniform custom in most plans of improvement, be the quality of the soil what it may, to mark off the line of the fence, dig the ditch, and commit the hedge-plants to the earth, without any previous preparation, either by tillage or manures.

In every instance where a hedge is to be made, the ground should, it is contended, be previously prepared by a complete summer fallow, in order to destroy the weeds; when this is accomplished a certain proportion of dung, lime, or compost should be laid on the tract upon which the hedge is meant to be planted; after this is done, and the manure properly incorporated with the soil, a furrow should be drawn with a common plough about the end of November; in this furrow the plants should be placed, and the earth, thus impregnated with the dung or compost, drawn up to and trod firmly about their roots. When the soil has been previously cleared of weeds in this manner, and a sufficient quantity of manure bestowed, the hedge, if the plants are healthy, and suited to the soil and climate, may be committed to the earth, with every prospect and chance of successful growth.

With regard to the third circumstance, or the time and mode of planting, it is contended, that of whatever plants the hedge is to be made, they ought always to be put into the ground, either before winter, or very early in the spring, before any vegetation takes place. In this way, if the plants have been carefully taken out of the nursery ground, and no material injury done to their roots by laceration, pruning, or otherwise, their growth receives scarcely any check, and they make more progress in one year, than they would do in three or four years under different management.

The beginning of November, or any time during the month of January, seems the most proper time for planting thorns.

The holly, where it is made use of, must however have a different treatment, and be planted out at a very different season of the year, as upon these its success and progress seem wholly to depend. The proper time for transplanting or removing this sort of plants is about the middle of the summer season, as at this period they are found to scarcely suffer any check from the operation. From the want of knowledge of this fact numerous hedges of this sort have failed; as, when removed during the winter months, plants of this kind are almost certain to be destroyed; while, under the contrary circumstances, they grow with certainty, and in the most rapid manner. In putting them into the soil, their root fibres should likewise be as little trimmed off as possible, and the ground should not be in too moist a state.

The mode of planting thorn, and other sorts of hedges of that kind, differs in different places, and even in the same place according to the nature of the hedge: when hedges are made in the face of a ditch, bank, mound, or wall, the universal practice is to lay the plants horizontally, either upon the surface, or upon a paring of sod or earth taken from it; and afterwards cover them in such a manner as that about seven or nine inches of their length shall be covered with the soil, and about three inches left projecting without it. In this way, sufficient room is left for the roots stretching out and forming an establishment for the plant, while the part left projecting is so short as not to be able to produce above two, or at most three good shoots, which, from the smallness of their number, will be vigorous and useful; whereas, if a greater length had been left without being covered, the shoots would have been more numerous and of course weaker; the future value of the hedge depending entirely on the number and strength of the first shoots the plants make. We have already hinted at the necessity of preparing the soil properly by tillage and manures; and in this mode of planting, namely, upon the plain surface in the face of a ditch, bank, mound, or wall, it is equally necessary as in any other; dung, lime, or compost, ought to be laid upon the tract, and pointed in with a spade, and in place of laying the earth taken out of the ditch indiscriminately upon the roots of the thorns, care ought to be taken to cover them with the best of the surface mould; by such treatment, having a well prepared, well manured, bed below, and a covering of good earth above, the roots of the plants have not only abundant room to spread, but have also plenty of nourishment; this gives them a decided advantage at their first starting, and enables them to make more progress in two or three years than they would otherwise do in twice that length of time. In the bank method of planting hedges, there is much variety in the heights to which the banks are raised, but the proper height must probably be directed by the nature of the soil and the situation. And besides the horizontal mode of laying in the plants into the banks, there are other methods practised in particular cases.

In respect to the manner of planting a hedge upon the common surface it is very simple; a furrow, about eight or nine inches deep, is made with a common plough upon the tract that has been previously lined and dunged: to render the furrow as clean as possible the plough should be drawn twice along it; one labourer then goes along the furrow with a bundle of plants under his arm, which he drops in handfuls of six or eight together at certain distances: when he has gone over perhaps a hundred yards in this manner,

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he returns to the farther end, where he began to drop the plants; and, taking up the first handful, begins to set them in the bottom of the furrow, not in a direction perpendicular to the horizon, but inclining a few degrees in the same direction that the fence runs. These the labourer places, leaning against the perpendicular side of the furrow, at the requisite distance from each other, as from four to six or eight inches: having placed the whole of them in this manner, he covers them with the earth from the other side, or that which has been turned up by the plough: when this operation is finished, he sets a foot on each side of the hedge, and, beginning at one end of it, goes slowly along, treading the earth close to the roots of the plants the whole way; the soil is then pointed with a spade on each side, which finishes the operation. Where the necessary pains have previously been taken to pulverize the soil, a single labourer will, with great ease and exactness, plant several hundred yards of thorns or other hedge-plants in the course of one day.

Another method consists in one labouring man receiving the plants, by two or three at a time, from another, who carries a bundle of them, setting them in the middle of the furrow, with the top reclining a little, and drawing a quantity of earth from each side with his foot to cover the roots: when about fifty or a hundred yards are completed in this way, each labourer takes a common garden rake; and draws up a sufficient quantity of earth to each side of the plants; treading the surface with their feet, as they go along, in such a manner as to bind the soil moderately, and at the same time set the plants in a straight line.

And a third mode of practice consists in harrowing the tract or line of the hedge, or raking it with a garden rake, then stretching a line along it, laying out a furrow with the spade, and afterwards planting the thorns or other plants, and laying the earth to them in the manner described in the above methods. The laying out a furrow with the spade in this way admits of the work being done with great neatness and accuracy; but it is attended with considerably more labour and expence, and, after all, appears to possess no great superiority over planting with the plough. In some cases the hedge is planted with the dibble, but it will be seen below that this practice must be an improper one: for if the plants have the whole of their roots preserved, and are planted with a dibble, instead of the fibres being properly spread out, as they always ought to be, they will be crammed together into a very narrow space, with their points staring upwards; or, in other words, looking out of the soil, in place of dipping into it: or, if by much pruning they are cut so close as to be made fit for going into the dibble hole in an easy manner, their growth will sustain a very severe check by such injudicious pruning. In considering hedges as forming the constituent parts of compound fences, the circumstances connected with the planting of each will be more fully described and pointed out.

In regard to the state of growth or age at which hedge-plants may be used with the greatest advantage and propriety, it may be observed that it is extremely common, particularly where young hedges are made with quicksets, to plant them out at one, two, or three years old, but seldom exceeding this last age. Plants of this sort, when put into the earth at a proper season of the year, upon a line of fence which has been prepared in a proper manner, and which are afterwards kept clean by a careful attention, and the earth soft and loose, by regular weeding and digging, seldom fail to form good fences: such young plants are, however, it is suggested by some, long in a state of infancy, and require great nursing, and the most complete protection to bring them

to perfection, and are liable to be either much hurt, or totally destroyed by many accidents that would produce little or no effect upon older and stronger plants. It is the opinion of many sensible and well-informed people, that much time might be saved in the rearing of hedges, and the fences be much more perfect and useful, if older plants were employed for that purpose. Three years old is certainly the youngest that should be planted, and if they are even six or seven years old, so much the better: the prevailing idea that plants of this age will not thrive if transplanted, is, it is said, totally unfounded; as, with proper care, they not only grow readily, but make excellent fences in one half of the time that younger plants usually do, with this additional advantage, that they are much less liable to be killed or injured by frost, drought, weeds, or the other causes that affect younger plants. Thorns of six or seven years old, in place of being no thicker than a common straw, will be at a medium more than an inch in circumference; we leave those who are judges to determine how far a plant of this last description will be superior to one of two years old, and how much sooner it will answer the purpose of a fence. It is, however, very material to observe that, where plants of this age and size are used, the most complete care should be taken to preserve the roots as entire as possible. The degree of pruning which may be necessary before planting will be mentioned afterwards. In respect to the size of thorns, or other hedge-plants, it may be necessary to observe, that, when the plants are once obtained, they should be separated into sorts, according to their sizes and apparent strength, picking out the largest first, and so on downwards. This will be attended with several very material advantages, which those who have made observations on the subject will very readily understand: plants of the same size and strength, when planted together, keep pace with each other; no one of them takes from the earth more than its own share of nourishment, of course, the growth of the whole is regular and uniform, and the hedge, when arrived at a certain age, becomes a substantial efficient fence of an equal height throughout, and free of any gaps: whereas, when no pains have been taken in assorting the plants, and they are planted promiscuously, great and small, strong and weak, the consequence is, that the strongest plants very soon outgrow such as are weaker, and not only overtop them, but also deprive them of that nourishment which they so much require: as the hedge advances in age the evil becomes greater, small stunted plants, and innumerable gaps appearing throughout the whole line of the fence; these are interspersed with others remarkable for their strength and luxuriance, the whole conveying to the mind not the most distant idea of utility. And the worst part of it is, that, when hedges have been thus neglected in the beginning, no pains or industry on the part of the farmer will be sufficient to render them useful afterwards: there being nothing more difficult than that of repairing the defects of a hedge, after the third or fourth year of its growth. This assorting of hedge-plants has, it is contended, a farther advantage; namely, that of putting it in the power of the person who plants the hedge to put down the large, strong, healthy plants upon the poorest part of the line of the fence, and to set such as are smaller and weaker upon the richer and more fertile parts. He has it also in his power, by a more careful preparation of the soil, and bestowing a greater portion of manure upon the spaces where the small plants are set, to give them that nourishment and assistance which they require, and which would very soon enable them to form a fence equal to that part occupied by the strongest plants that have been employed.

With regard to the dressing and pruning of hedge-plants before

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before they are put into the earth, there is perhaps no part of the system of managing them, or forest-trees, more hurtful and defective than that now pursued in the common nurseries. It is a very common practice with nurserymen in the spring, when they wish to clear their ground for other purposes, to take up great quantities of thorns and other hedge-plants, and after pruning the tops, and cutting off nearly the whole of the roots, to tie them up in bundles, and lay these bundles in heaps till they are called for. In that mutilated state they often remain for many weeks, with the mangled roots naked and unprotected, exposed to every inclemency of the weather before they are sold. The consequence is obvious; the severe pruning, by curtailing the number of the roots, and depriving the plants of the means of drawing their nourishment from the earth, would of itself prove an effectual check to their future growth, even if they were planted immediately after this severe trimming; but by being allowed to remain so long exposed to the weather afterwards, the tender fibrous extremities of the remaining roots are most of them destroyed, and when the plants are then put to use, they are not only half dead, by being so long exposed above ground, but are, as it were, insulated, and their connection with the earth cut off by the severe pruning and destruction of their roots. Under these unfavourable circumstances they must remain in the ground till new roots are produced, during which period they suffer a total want of nourishment, and if the soil be dry, and much warm dry weather follows the planting of the hedge, many of the plants will perish before they are capable of pushing out and producing a number of new roots sufficient for their support. Accordingly, many of them fail from these causes, and numbers of hedges which, under different management and with small trouble, would soon have been complete fences, are full of gaps, and remain for ever after in an imperfect state. When thorns or other hedge-plants are thus severely handled, and their roots and tops so unmercifully cut off, they resemble cuttings more than plants, and must remain a very long time in the earth before they are capable of sending out new roots, or drawing from it a quantity of nourishment adequate to their support. Were nurserymen and others, who raise these plants, to bestow the smallest attention upon the subject, common sense would dictate a very opposite treatment. Men of observation know, that in every instance where either trees or herbaceous plants are to be transplanted, the more carefully they are taken out of the ground the more numerous and entire their roots, and the sooner they are again put into the earth, the less check will they receive, and the quicker and stronger will they afterwards grow. If these observations are just, how faulty and defective must the system we have just now described appear! Indeed nothing can be more repugnant to nature and common sense than to suppose, that when plants of any description are removed from the situation in which they are growing, and sent to such a new establishment in a different soil, and perhaps a worse climate, they will thrive better by having their roots cut off, and being almost entirely bereft of the means of obtaining nourishment. With equal probability might success be expected from planting a colony with people, after having completely mutilated them by cutting off their hands, putting out their eyes, &c. In place of this treatment, the defects of which are so obvious, and the consequences resulting from it so hurtful, no hedge-plants should be lifted out of the nursery-ground till the day on which they are to be re-planted; and instead of digging them with a spade, by which they are often much injured, they should be taken up with dung-forks with strong round prongs, taking care to disengage the roots carefully from the

soil; and, in place of the severe pruning and dressing already mentioned, every root, even to the smallest fibre, should be carefully preserved, and the use of the knife confined entirely to the necessary curtailing of the tops. Where this care is taken, and the plants are put into the ground at a proper season, they will suffer no kind of check, and when the spring arrives grow luxuriantly and with a vigour much greater than is commonly the case.

It may be farther observed, that much of the benefit arising from an attention to the foregoing circumstances will depend upon the after-management of the hedge. Complete weeding, loosening, and laying new earth to the roots for the first three or four years, are indispensably requisite; for whatever pains may have been previously taken in dunging and summer-fallowing the soil, unless it is properly attended to, and kept clean afterwards, this dunging and summer-fallowing, in place of being useful, will prove hurtful to the fence; as the manure and tillage, by enriching and opening the soil, will encourage and promote the growth of weeds, which, under circumstances so peculiarly fortunate, will become so luxuriant as either to destroy or materially injure the growth of the hedge, unless they are kept down by frequent and complete cleanings. These weedings are of two kinds, and ought to be conducted in two different ways. If the weeds are principally annuals, a slight scuffle with a hoe will be perfectly sufficient, and this to be repeated as often as a new crop of weeds appears; but when the weeds in place of annuals are composed of root-weeds, or, in other words, of perennial or biennial plants, the extirpation of these last will be attended with more trouble. With weeds of this description scuffling will not answer, as though the tops may be cut off by that operation, the roots remain, and not only furnish repeated crops of the same weeds, but also rob the hedge of its proper nourishment. In place, therefore, of scuffling and cutting off the tops of such weeds with a hoe, the ground ought to be carefully dug with a dung-fork, of the kind already described for lifting thorns. An instrument of this sort is preferable to a spade, as it cuts none of the roots of the hedge, loosens the ground sufficiently, and at the same time admits of the weeds being readily and easily picked out. The first weeding of this kind that is given to a young hedge should be early in the spring, when, if it is completely done, there will be little occasion for any farther trouble during the season. Cleaning at that period has a farther advantage, namely, that of loosening the soil at the exact time when the roots are beginning to spread and extend themselves; whereas, when it is delayed till the summer, the weeds have attained a considerable size, have deprived the hedge of much nourishment, and the opening of the soil then exposes the roots of the hedge to the parching heat of the summer sun. In the cleaning of young hedges, especially such as are situated in the face of a ditch or bank, it is the universal custom for the labourer to skim off the surface with a spade, and let it fall into the bottom of the ditch. This operation, though it gives the hedge an appearance of cleanness, is attended with some very considerable disadvantages; repeated parings of this kind, in the face of a ditch or bank, in a few years waste the front so much as in some degree to undermine the hedge, which after frost or wet weather is apt to slide and tumble down; the paring off and throwing into the bottom of the ditch so much earth, together with the roots and weeds it contains, very soon choaks and fills it up.

Notice will afterwards be taken of the necessity of constructing hedge-fences in such a way as that the hedge shall not project immediately from the front, but shall be placed
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upon a shelf, or what is termed a *scarcement*, of not less than twelve or fourteen inches broad. By such management the hedge will run no risk whatever of being undermined by the earth falling into the ditch, and may be kept clean with as much ease as a common garden-border. The proper method of cleaning a hedge, planted in this manner, seems to be that of digging the border with a short-pronged fork in the spring, picking out such of the weeds as can be readily taken up by the hand, and afterwards raking it with a garden-rake; this last operation, along with its making the surface smooth, and giving the work a finished look, will also bring out a great number of the smallest roots that had escaped the labourer's notice in digging it with the fork. Some imagine that by a slight weeding once or twice a year for the first two or three years after the hedge is planted, they do all that is requisite; this, however, is a mistake; for though a hedge may, by care and attention for the first five years of its growth, attain such a height as will prevent it from being smothered by the weeds, still it will suffer much injury from them, not simply by the nourishment they take from the hedge, though that must be considerable, but by the effect they have upon the lateral branches near the root, many of which they kill, and by that means render the fence open and naked at the bottom. Skilful hedgers are well acquainted with this circumstance, and very properly consider annual cleanings and loosening the soil about the roots as equally necessary to the welfare of the hedge as the other operations of switching, pruning, &c. &c. The apparent trouble and expence of cleaning every description of hedge yearly will no doubt present a formidable obstacle to the practice; but, when properly considered, this labour and expence will be found more apparent than real; for if a proper weeding has been given when the hedge was first planted, and the earth well opened, the only trouble required afterwards will consist in giving the ground on each side of the hedge a slight scuffle with a hoe, a work at which a labourer will be able to do a very great deal in the course of a day.

To this practice of keeping hedges clean with a view to promote their growth, is to be added another motive, of equal, indeed of superior, moment round most of the inclosed fields in Britain, the space occupied by the fence is considerable; and as no part of this space is under the plough, it is left to produce such plants as nature or accident may have brought into the soil; these, by being suffered to grow, and their seeds to ripen yearly, are waisted by the wind into the adjoining fields, where they multiply beyond conception, and create an endless trouble to the occupier, rendering abortive a great part of the labour and expence incurred in fallowing. A person who is sensible of the advantage arising from the extirpation of weeds of every description, either in the fields or their immediate vicinity, must feel a considerable degree of pain to observe, about the end of summer clouds of the winged or bearded kind rising from the side of every hedge or highway with the slightest breeze of wind, and scattering themselves over the adjoining fields, which have been perhaps fallowed the year before at a heavy expence; the evil is undoubtedly great, and affects the innocent as well as the guilty, it being no uncommon thing for the best farmers to have their fields rendered foul by the wind blowing the weeds of their slothful dirty neighbours upon them. The remedy is easy; let every farmer be obliged to cut down the weeds round the whole line of his fences, so early in the season as to prevent them from running to seed; and let the trustees of every county, in making contracts for the repair of the public roads, bind the contractors to cut down the weeds annually. The labour of

these operations will be very trifling, and their benefit to the public scarcely to be calculated.

It may be remarked, that in loosening the earth about the roots of hedges, whether old or young, it will be of advantage, if there is soil enough to admit of it, to lay up a few inches of it to the roots; doing this frequently encourages them to push out branches near the bottom, which prevent them from growing thin and open, a fault to which almost all hedges are liable, if due pains are not taken to prevent it. When a hedge has been planted in the face of a ditch, bank, or mound, with a projecting space or scarcement before it of sufficient breadth, a supply of new earth may be laid up to the roots every two or three years, from the sediment let fall by the water in the bottom of the ditch; this sediment is in general the richest of all soils; and as it is necessary to remove it from the bottom of the ditch, for the purpose of cleaning the water course, employing it in this way not only saves the trouble of carrying it elsewhere, but promotes the growth of the hedge, and gives the fence a much more finished look. Upon the sides of highways the same thing may be done with advantage, not only to the hedge, but the road also; for though there may be no ditch to require cleaning, yet as most of the highways in Britain have a greater or less declivity towards the sides, the decayed materials of which the road is made, together with the horse dung and other matters dropped upon it, are washed down from the top to the sides, where they accumulate in considerable quantities; shovelling this carefully up, and laying it to the roots of the hedge, afford the plants at once protection and nourishment. Where hedges are planted upon the plane surface, the earth can be laid up to the roots with great ease; and at each cleaning it certainly should be done. The trouble of doing so is trifling, the advantage very considerable in many points of view.

In speaking of the pruning and after-management of hedges, it is observed, that though a strict attention to the foregoing circumstances, during the infancy of the hedge, is highly necessary to produce healthy vigorous plants, a very considerable part of its beauty and future value will depend upon these being properly performed.

It may be remarked, that there is, perhaps, no part of the subject upon which a greater contrariety of opinion at present prevails, than the age at which the pruning of hedges ought to commence, the manner of that pruning, or the season of the year at which it may be given with the greatest possible advantage, and the least risk; the practice with some is to prune from the first year, not only the lateral branches, but the tops also; and they give as a reason, that cutting off the extremities of the shoots contributes to the thickening of the hedge, by making them push out a great number of new ones. The fallacy of this argument, and the mischief with which the practice is attended, we shall have occasion to notice afterwards. As to the manner of pruning, or the form of the hedge, these seem with many to be matters of indifference, no attention being paid to dressing them in such a way as to have them broad at bottom, and tapering gradually towards the top; many of them being not only of one width from top to bottom; and not a few much heavier and broader above than below, it is obvious that such hedges can neither look well nor be useful.

The season at which they are trimmed is, in many instances, it may be observed, an improper one; for in place of choosing that time when the plants are least in danger of suffering from an effusion of their juices, which is either at a late period in the autumn, or very early in the spring, the pruning is given in the summer season, when vegetation is in

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its prime, and the plants are full of juices: the check and injury they must receive from having the whole of their extremities cut off at that period may easily be conceived.

When speaking of the treatment of hedge-plants before they are put into the ground, notice has been taken of the necessity of preserving the roots as much as possible, and at the same time shortening the tops: this last operation has two good effects; for by curtailing the top and branches the roots have less to nourish; and by leaving only two or three inches of the top above ground, in place of growing up with a single stem, it sends out two or three; and as these strike out from the plant so near the earth, each of them has the same effect, and strengthens the hedge as much as the original stem would have done by itself; with this addition, that in place of one prop or support, the hedge will have three or four. After this first pruning, however, no hedge should be touched, or at least very gently, for some years: from an inattention to this circumstance, and the injudicious application of the knife or shears at an early period, many young hedges are rendered useless, which, under different treatment, would have made excellent fences; with one-half the trouble that was required to destroy them. The practice of cutting over the tops yearly, which is done with a view to render the hedge thicker and more perfect, is one of those mistakes which one would naturally have supposed common sense and observation would have sooner corrected; the effect produced being, in almost every instance, the very reverse of what was intended: shortening the main stem of a thorn or any other plant makes it brush out a number of small stems immediately at the place where it has been cut; and if this operation is repeated once or twice a-year, every one of these is again sub-divided, as it were, by sending out more branches; thus, in a course of years, during which the hedge makes very small progress upward, if it be examined, instead of being found to consist of strong vigorous plants, with a good main trunk, each reaching from top to bottom of the hedge, and a sufficient number of lateral branches throughout the whole length of it, it will be found by such repeated cuttings, in the same slanted situation, as certain young trees and shrubs that are frequently cropped by sheep or cattle. From the repeated crops of young shoots which the tops send out after every clipping, and the great quantity of nourishment necessary to support such additional numbers, the lateral shoots at the bottom, upon the strength and numbers of which the value of the hedge in a great measure depends, are stunted in their growth, and soon die; the hedge, of course, becomes open and naked at the bottom, and consequently useless as a fence. Where a hedge has been thus ruined, there is no remedy but cutting it over, close by the ground; this will immediately produce a number of healthy, vigorous, upright stems, which, under proper management, will soon form a good fence.

From the first year of planting, till the hedge has risen to the height of five or six feet, the main stems ought to be left untouched, and the pruning confined solely to the side branches, leaving those next the root pretty long, and gradually tapering towards the top; this pruning of the side branches will make them send out many new shoots from their extremities, which, by repeated trimmings, will become so thick as to fill up every interstice from top to bottom of the hedge; while the main stems, by being left untouched, continue their growth upward, till they arrive at the necessary height, when they may have their extremities cut off with perfect safety. When a hedge has attained the wished-for height, all that is requisite afterwards

is regular switching with a hedge-bill, preserving it pretty broad at bottom, and drawing it gradually to a point at top: this form of a hedge is pleasant to the eye, is well calculated to stand the weather, and, by being thus above the nourishment that would have been wasted in supporting a thick, bushy, over-grown top, is retained by the branches at the bottom, which are thereby strengthened, and their numbers considerably increased; while the trunk, by having no more exertion to make in an upward direction, becomes every year stronger and thicker. A hedge of this sort, in full leaf, has the appearance of a solid wall, and, when viewed after the leaves are shed, presents to the eye a set of massy growing piles, so strong and formidable as to bid defiance to any attempts that may be made to break through them. A hedge-fence trimmed in this way is represented at *fig. 10.* in the plate to which we have referred.

Cutting over old live hedges.—With respect to the cutting down of old hedges, the above directions and observations apply, it may be observed, with strict propriety, only to such as have been regularly attended to from the time of their being planted: as there are, however, innumerable hedges in the kingdom, which, by being neglected, have grown up to a great height, have become open and naked below, and bushy and unmanageable at top; it is of consequence to point out the means of reducing such hedges to a moderate scale, and rendering them useful. This purpose, it may be stated, can only be effected by cutting them down, and procuring from their stumps a growth of new shoots, which, with proper management, will soon make a perfect fence. If the fields inclosed by such hedges are alternately in pasture and tillage, the period most proper for cutting them down is when the field is to be ploughed. Under a corn crop the confinement of the stock is no longer an object; and by the time the field is again brought under the plough, the hedge, if properly treated, will have acquired strength enough to become a good fence.

This operation is performed in several different ways; in the first the hedge is cut over, about a yard above the surface, and is left in that state without any other pains being taken with it; if it has originally been good, and the plants thick enough at bottom, this kind of cutting will answer the purpose perfectly well, and in a few years the hedge will, with proper dressing, become both a neat and an useful fence. A hedge cut over in this way, with one year's growth of new shoots upon it, is represented at *fig. 11.* in the plate.

However, in this mode, when there has been a deficiency of plants, and the hedge is cut over in the manner above-mentioned, innumerable gaps will appear, which, without some art, it will be impossible to fill up. It was also this farther disadvantage, that if either horses or cattle attempt to leap into, or out of, the inclosure, the sharp points of the flakes are apt to run into their bellies; this, accordingly, often happens, and many valuable horses and cattle are killed, or greatly injured by such means.

Another, and indeed a preferable mode of cutting down old hedges, is, to cut a fourth part of the plants over, to the height which the fence is intended to be made, and to bend down and warp the remaining three-fourths with these upright stems. This method very effectually cures the gaps and openesses below, and, with slight attention, soon makes a good fence. At *fig. 12.* is a representation of a hedge done in this method of cutting.

And a third way of cutting over old hedges, is that of taking them off close by the surface; this practice, where the plants are numerous, and there are no gaps in the hedges, answers very well; but when there is a deficiency of plants

in any part of the hedge, the want will be very apparent. This last mode, though much inferior to the one immediately preceding, is nevertheless greatly preferable to that first described, as the young shoots sent out from the stumps, by being so near the ground, will in some measure remedy the defects occasioned by the want of original plants, whereas, when the old plants are cut at the distance of about a yard, or four feet above the surface, the young shoots produced by the cutting will be so high, as to leave the hedge open at the bottom, and very thin.

There is another method of cutting down old hedges; but which is yet but very little practised, which is first to cut them down even with the surface of the bank, &c. and afterwards to cover the stumps completely over with the earth taken out of the ditch, or from the road side. When this is carefully done, it is asserted that every single root sends out a great number of young vigorous shoots, each of which, by branching out from the stump below the surface, sends out roots, and acquires an establishment for itself: by this means, the bottom of the hedge becomes so thick, that neither sheep, cattle, nor indeed any animal, can break through it.

In which-ever of these ways the hedge is cut down, the directions formerly given for the management of *young* hedges should be strictly attended to, as soon as the young shoots have made some progress; the side branches should be trimmed, and the hedge put into a proper shape, preserving it broad and full at bottom, and tapering gradually towards the top, as shewn above. The same caution is also to be observed with regard to the upright shoots, none of which should be shortened till the hedge has attained the wished-for height. It is surprising what close beautiful fences are raised in this way, in a few years, from the stumps of some over-grown useless hedges; which, at the same time with their being naked below, and of course faulty as fences, occupied four times the space they ought to have done, to the great loss both of the proprietor and farmer.

The observations formerly made with regard to the proper season for pruning and switching young hedges apply with equal, indeed greater propriety to the cutting down of old ones; as, if this operation is done at an improper season, from the largeness of the stumps, the extent of wounded surface exposed to the weather, and other circumstances, the plants are in imminent danger of being destroyed; indeed this very often happens when, through ignorance or inattention, the proprietors of hedges have them plashed or cut over during summer. It is unnecessary in this place to enter into any digression as to the use of leaves and branches to plants of every description; it is sufficient for the present purpose to state what experience and common sense have abundantly proved, *viz.* that the loss of either, especially when the plants are in a growing state, and the juice circulating through them, is in most cases attended with the destruction of the plant; indeed the thing speaks for itself; the juice of the plant, instead of being employed in nourishing the top and branches, flows in great abundance through the section of the trunk, and by finding so ready an exit, draws from the root a quantity of nourishment, far exceeding the proportion required for its former support; by such an unusual drain, the plants are exhausted, or, as is commonly said, they bleed to death. It is to be observed, however, that every description of plants is not equally affected by a summer cutting; those that are most juicy and succulent, and have the largest circulating vessels, always suffering more than such as are of a harder texture, have smaller pores, and less sap circulating through them. The birch, larch, poplar, willow, and, in general, all plants that contain a large

proportion, either of resinous or saccharine matter, are to be ranked in the first class; the different kinds of thorn, crabs, &c. &c. belonging to the second; the former are almost infallibly killed by a spring or summer pruning; while the same operation is often practised upon the latter with little apparent injury. But though we thus readily admit that one description of plants will survive an operation by which others would be killed, it by no means follows that they are not injured thereby; there are, indeed, too many proofs to the contrary, as in almost every county there are thorn-hedges met with, that have been plashed or cut over in summer; and which, though they have not died in consequence of the operation, yet, by the loss of juices, and the exposure of their naked trunks and wounded extremities to the parching rays of a summer sun, have been so much weakened, as to prevent them from putting out new shoots, and have ever afterwards remained in a naked state, exhibiting an appearance no way better than that of a dead-hedge. This picture is the very reverse of what, under different treatment, would have been the case; as when the old plants are cut over at a proper season, a healthy luxuriant crop of young shoots never fails to be produced.

The proper season for cutting over hedges is either at a late period in the autumn, or very early in the spring; at both of these periods the plants are equally safe from injury; at the former, the juices are retiring towards the root, and early in the spring they have not begun to rise. In either case, no danger whatever can arise from the bleeding of the plants, as, long before the circulation takes place, the wounds occasioned by the cutting will be completely healed; all cuttings or trimmings ought therefore to be done at one or other of these periods. The same remarks also apply to the modes of cutting over and repairing fences mentioned below.

Plashing hedges.—There is a practice in many of the English counties, which is common in respect to fences; that of, after the plants have attained the wished-for height, cutting their stems about half through, within a few inches of the bottom; then bending them a little down, all in one direction, and binding them together at top with willows, as represented at *fig. 3.* in the second plate on fences. This, when properly executed, forms a very pretty neat looking fence, but is liable to several objections. By the cutting of the plants so near the root, unless great pains are taken, there is a chance of cutting them too much; indeed, in some instances, they are cut through altogether; the value of the hedge is by this means lessened, and gaps appear in many parts of it. The binding at top being of dead wood soon decays; and the plants either rise up, if they have not been very much cut, or if the cutting has been deep, they are apt to be blown to one side, and even broken over by the wind. Owing to these causes many hedges, where the plants are sufficiently numerous and healthy, and which, with little trouble, would have formed beautiful and useful fences in a short time, have their value impaired, and are rendered faulty and defective. Cutting the stem too much subjects them to another evil, namely, the mischief arising from heavy falls of snow, by which, when the quantity is considerable, especially if there is a high wind to accumulate it about the hedge, it is thereby pressed down, and many of the plants break entirely over.

The practice noticed above, of cutting one-third of the stems over, at the height of about four feet from the surface, leaving those as standards, and warping them with the others that have been left of the full length, makes a much stronger fence, and one that is less liable to injury, either from the attempts of cattle, or from the wind, or heavy

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falls of snow. What adds to its value is, that the warping and binding of the bushes, being done with live wood in place of decaying, as is the case when willows or hazels are made use of, grow stronger with time, and the plants are in the end as completely interwoven, as to form a fence, which nothing can exceed either for closeness or durability. The way in which this operation is commonly done is liable to one objection, however, it being customary to trim away the whole of the branches before the stems are bent down: this renders it, no doubt, a much easier business for the workman; but it materially injures the hedge, leaves it thin and open in many places, and gives it not only an unpleasant appearance to the eye, but makes it less useful as a fence. This defect is not in general repaired for a year or two; whereas, by leaving as many of the side-shoots as possible upon that part of the plants that is to be laid horizontal; and, after the whole hedge is warped, trimming it neatly with a hedge-bill, it will form at once a solid and useful sort of fence. Hedges done in this way are represented at *figs.* 11. and 12. in the first plate on fences.

Where, however, the business of plashing hedges is executed in a proper manner, the above objections will in a great measure lose their force. This is the case in the county of Hertford, and the method of performing the work is this; the hedgers first begin to clear the old hedge of all the dead wood, brambles, and other irregular growing rubbish, leaving all along the top of the bank the straightest and best growing stems of the thorn, hazel, elm, ash, oak, fallow, and beech, as well as other kinds, to the number of about five or six in the yard. But where there are any gaps, or places that are thin of live wood, more are left on each side of them. This being done, they have recourse to the repairing of the ditches, which should not be less than three feet by two and a half, having the width of six inches at the bottoms in dry soils; but in such as are wet, not less than four feet by three, and one at the bottom. The whole of the earthy materials which are raised from the ditches is laid up on the banks with great care, the overlooker being attentive to the matter. When the ditches have been thus finished, the men begin with the hedges. Such of the stems of the plants as are left in cutting the old hedges over, that are found growing in the line where the new hedge is to run, are cut off at the height of three feet from the top of the bank, being reserved for hedge-stakes to the hedge which is to be raised. This is an excellent practice, as such stakes, from their being immovable and incapable of rotting, keep up the new hedge in such a manner that it never falls, or leans in any direction. The dead hedge-stakes are in the next place driven firmly into the bank, where they are wanted, fallows or willows being mostly chosen in order that they may take root and grow. The remainder of the live wood which had been left standing is then plashed down by the hedgers. In executing this part of the work they make two cuts in each of the sticks, one stroke being given near the ground, and the other at the distance of eight, ten, or twelve inches above it, but only just deep enough to slit out a part of the wood between the two cuts, leaving the stem supported by a little more than the bark, or about a fourth part of its first size. It is then laid down along the top of the bank, and interwoven with the hedge-stakes. All the plants are served in the same way, and where they are not sufficient to fill up and complete the hedge, dead wood is had recourse to; but this should be avoided as much as possible, from its injuring the living plants in its decay. The work is completed by running an eddering along the top of the fence in the manner which is practised in making dead hedges.

The making of this sort of hedge fence is a matter which requires great exactness and judgment in order to perform it in a proper manner. It is, however, mostly done by those who are in a great measure ignorant of its nature, often cutting the plants in a downward direction instead of an upward one, by which they are exposed to speedy decay and destruction. Where the work of plashing is well executed, the cuts formed for the laying down of the plants should not be made in the manner shewn at *fig.* 13. in the first plate on fences; but as is represented in *fig.* 14.

In the execution of this business, it is very material that the operator be furnished with a hedge-bill which is perfectly sharp, as the neatness of the work depends greatly on this circumstance. The old stubby parts of the hedge should be cut so low as that it may be covered with the mould from the ditches in the after cleanings of them, and the layers, or parts laid down, should not have more connection with the old stumps than is barely sufficient to convey the sap juice in due proportion to the plashes, or layers. In this way the stumps soon throw out plenty of young shoots for a new hedge, the layers being merely designed to serve that purpose until the young wood gets up again. The most healthy and best plants should always be selected for the plashes, and those designed for stakes should not be too large; the size of a strong walking stick is quite sufficient, as they increase fast. It is the practice of some districts to lay the plashes high, while in others they are laid down very low. Both these extremes are attended with disadvantages, as by the first too much sap juice rises into the plashes for the due support of the bottom shoots, by which they become weak and trifling, the hedge being of course left thin where the contrary should have been the case; and by the latter the hedge is left too low, and consequently more liable to injuries from cropping with cattle, &c.: the middle course should of course be pursued. After the layers, or plashes, are interwoven with the stakes, and the superfluous twigs of the hedge dressed off by the bill, some nick the layers in different places at the distances of about a foot, by which it is supposed more branches, or shoots, are thrown out from between the nicks, or cuts, as the sap juice rises more slowly.

It is of great advantage to the rising of the hedges in these cases to have the inclosures under the plough for two or three years after they have been plashed.

This system of making fences should be more generally practised in those districts where it is yet but little known, by having labourers from those where it has been long in use, as by it the farmer must derive considerable advantage in having hedges which are chiefly formed of living materials instead of such as are dead, and consequently on the constant decay.

In most places the wood which is thinned out in forming such fences, will amply repay the expences which are incurred in making them.

A hedge plashed in the proper manner is shewn at *fig.* 15. in the plate.

It should be constantly recollected that in every operation of the above kind, in which old hedges are either cut over or plashed, and bent down so as to consolidate a fence, the ground on each side should, as soon as circumstances will admit of it, be completely dug over, cleared of weeds, and the earth laid up to the roots of the plants. It is truly surprising what numerous and luxuriant shoots the stumps send out when managed in this way: while, on the contrary, when these necessary operations are neglected, fewer shoots proceed from the old trunks; and of these few a considerable proportion is choked and destroyed by

the weeds and other rubbish in the bottom of the hedge-bank.

Filling up gaps in hedges.—In respect to filling up gaps in young hedges, it may be remarked, that when young hedges are planted, if the plants made use of are of a nature suited to the soil, the hedge may be kept free of gaps with very little trouble: for this purpose it is, however, necessary, about the end of the first autumn, after the hedge has been planted, to examine it carefully throughout its whole extent, and take out such plants as are either in a decaying sickly state, or those that are actually dead, and fill up the spaces they occupied with the strongest and most vigorous ones that can be found: where this care is taken for the first two or three years, there will be no defects in the hedge, which will be uniformly thick and strong throughout.

But when old hedges are meant to be cut down, that have many gaps or open spaces in them, so wide as to prevent the possibility of the young shoots filling them up, some expedient must be had recourse to, in order to render the fence complete. This purpose may, it is supposed, be answered in different ways: the easiest, and indeed the most common method is, for the hedger, when he comes to a place where any of the plants are wanting, to take one of the strongest plants next to it, and after giving it a gentle stroke with the hedge-bill, to bend it across the opening, and entwine its branches with the thorns on the opposite side: indeed, as has been already stated, some have a custom of cutting down only a fourth part of the stems, and warping the remainder with these, which appear like stakes driven into the earth. Where the hedge is shortened to within three or four feet of the ground, both of these plashing methods answer pretty well, and the openings which would otherwise have been left, are in some degree filled up: but when the old hedge is cut close to the earth, other methods of supplying the defects become necessary. One very simple, and at the same time very effectual mode, consists in first digging the ground pretty deep with a spade, and taking one of the strongest plants on each side of the opening, that have been purposely left uncut, removing the earth from their roots so much as to loosen them, and admit of their being bent down, and laid close to the earth in the opening, as represented at *fig. 16.* in the plate. They should then be fastened down with wooden hooks, or pins, and entirely covered throughout the whole of their length with earth. Where this plan is properly executed, the plants so laid down send up a great number of young shoots, which very soon fill up the vacancy: when it is practised upon a hedge that is cut over close by the surface, no other care is requisite; but where it is done with hedges that are cut at three or four feet above it, there will be a necessity for placing a temporary paling in the gap, to protect the young shoots from injury, till they acquire a sufficient degree of strength, as represented at *fig. 1. Plate XIX.*

It may be remarked that there is scarcely any thing attempted by farmers in which they are so unsuccessful as in the mending of hedges: in some cases the defect is attempted to be supplied with young plants, which, from want of attention, very seldom succeed, as they are not only shaded by the strong old plants on each side, but are also deprived of their nourishment, by their roots spreading into the vacant space. To render an attempt to mend the defects of an old hedge with young plants successful, two things are absolutely necessary: the first is, that the whole of the roots of the old plants, which extend themselves into the opening, be entirely cut off;

the next, that the hedge shall be cut down close to the earth, for at least a yard or more on each side of it. By cutting away the roots which extend themselves into the opening, the young plants are prevented from being robbed of their nourishment, and cutting down the old ones, for a little distance on each side, keeps them from being shaded, and allows them to enjoy the full benefit of the light and air: cutting down so much of the old hedge, no doubt, renders the opening larger, and of course requires more railing or paling to supply the defect; but this extra expence will be more than compensated by the success with which it will be attended. In many instances these vacancies are filled up with dead wood; indeed it is a common practice, after a hedge is dressed, to cram the greatest part of the prunings into these spaces, and under the bottom of the hedge, where it is any way open or naked. The most perverse imagination, it is said, could hardly suppose any thing more absurd; for if it be the wish of the owner that the plants on each side should send out new branches to fill up the openings, the purpose is completely defeated by cramming them full of dead brush-wood, which not only prevents the extension of the branches, but from the violence and injury that is committed in thrusting in dead thorns, the plants are often materially hurt; and when this brush-wood decays, the opening, in place of being diminished, is considerably enlarged: the mischief is the same where they are thrust under the hedge, the practice of which, when continued, never fails to render it naked at bottom.

The use of stones for mending hedges is equally absurd and pernicious: where dead wood is used in the way above-mentioned, the hedge, instead of being improved, is made worse. The utmost that can be said of stones is, that though they do no additional harm, the hedge is not bettered by them; and from the opening being filled up in that way, the defect is perpetuated, and both the usefulness and beauty of the fence are impaired.

In some instances where the attempt has been made, the defects of grown-up hedges have been very completely, and indeed almost immediately, repaired, by planting strong beeches in the openings; these should be at least six or seven feet in height, and should be supported by a couple of pieces of coarse railing put across the opening. If planted early in the winter, they suffer no check whatever, and grow so vigorously in the spring as to fill up the vacancy the first season, as represented at *fig. 2.* in the same plate.

And the ground in this, as indeed in every other case where young plants are used, should be well dug, and enriched either with dung or compost; the plants should be the healthiest and strongest that can be procured, and the whole of their roots as carefully preserved as possible, as very much depends upon proper attention in these respects.

Diseases of hedge-plants.—With regard to the diseases of hedge-plants, it is supposed that the principal one to which they (especially thorns) are liable, is being covered with moss, which, when it arrives at any considerable height, gradually destroys them. Upon certain soils, such as till or cold wet clay, it may be remarked, woody plants of every description are subject to this malady; and as it is evidently owing to the nature of the soil, it becomes a matter of importance to be able to apply a proper remedy. Lime is well known to be unfriendly to the growth of every description of moss, and in every instance where it is applied the moss disappears. This circumstance, once known, furnishes a cheap and effectual remedy, both for preventing the disease upon young hedges, and curing it upon such as are grown up. If the

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hints formerly thrown out with regard to the preparation of the soil before a young hedge is planted are properly attended to, and a sufficient quantity of lime incorporated with the earth, let the former quality of the soil be what it may, its nature will be so much altered as effectually to secure the hedge from every risk of being hurt by mofs. The same remedy may be applied with equal success to old hedges, that are over-run with this vegetable vermin, and in which, though there may be plants enough in the ground, yet they are of no value, from the want of branches. To recover such hedges, and render them afterwards good fences, they should be cut down close by the surface, cleared completely of weeds, and the earth well dug for at least half a yard on each side of the roots. After this operation, which should be done about the end of autumn, the spaces so dug should be well lined upon the surface: it should be suffered to remain in that state during the winter, and early in the spring dug again, and the lime pointed in and incorporated with the soil. In the cases where this has been done, the plants have sent out a number of useful vigorous shoots, which soon made good hedges, and no mofs has afterwards appeared. It is from these experiments to be presumed, and it is hoped experience will confirm the idea, that in every case where either trees or hedge-plants are infested with mofs, the use of lime, in the way here pointed out, will prove a sufficient remedy for the evil.

Compound hedge-fences.—These are such hedges as do not wholly of themselves constitute or form perfect fences, but which have the addition of some other sort to render them complete.

Single hedge and ditch.—This is a sort of fence that may either have a railing, paling, or some other defence added to it, or be wholly without them, according to the particular circumstances of the case. And it is a description of fence in which the ditch is of very different dimensions according to the nature and circumstances of it; the thorns being, for the most part, as Mr. Somerville has observed, placed upon the common surface, upon what is termed a scarcement, or projection of six or seven inches, on which they lean, and which serves as a kind of bed, when they are cleaned. By placing the plants thus far back from the edge of the ditch, they are in a great measure secured against the accidents to which they would otherwise be liable, if they were placed immediately in the front of the bank; as there are few ditches, however carefully they may have been made, into which the earth does not afterwards slide and fall in. In cases, therefore, where the thorns are planted immediately in the face, or what is termed the brow of the ditch, if any portion of the earth falls in, it either carries the plants along with it, or deprives them of their nourishment; whereas, by placing them at the distance of six or eight inches back from the front, there is no risk whatever of their being injured by the earth falling down. It appears also, that the space commonly allowed for a scarcement is by far too little, being seldom more than four inches. In place of which it ought never to be less than twelve or fourteen inches. This would have several advantages, as it would not only prevent all risk of the earth tumbling in, and bringing the plants along with it, but would at the same time afford ample room for weeding the hedge completely, and drawing up the earth to the roots of the plants. These are matters of considerable importance, and which, along with their destroying weeds, promote the growth of the hedge, by affording sufficient pasture for the plants, and enabling them to resist the effects of drought, frost, &c. much more completely than they would have been able to

do if planted directly in the face of the ditch. It is common to lay the hedge-plants upon the plane surface, without any preparation whatever. But in other cases, the first spadeful that is taken out of the ditch is laid on the front, and the plants placed above it: whatever the soil or situation may be, it is of importance to place the plants upon a bed of good, rich, well prepared earth, capable of affording them not only a due degree of nourishment, but into which their roots may strike with the utmost ease. Upon a very dry soil, and in elevated situations, it is sometimes necessary to place the hedge plants considerably below the common surface, to prevent them from suffering by drought: where this is practised, the ditch is first dug of the ordinary dimensions, and the earth that is taken out of it laid about twenty inches back from the hedge; the labourer then, with a spade, cuts down a space about fifteen inches broad, and ten or twelve inches deep, along the whole front of the ditch; this space, when cut, resembles a shelf: an inch or two of the best mould, well broke down, and pulverized with the spade, is laid upon this shelf, or scarcement, upon which the plants are then laid, not exactly in a horizontal direction, but with the tops a few degrees higher than the roots. The earth taken out in forming the shelf is then replaced above the roots in such a manner as to form a good slope from the front of the ditch backwards: and where the soil is deep enough to admit of this being properly done, there are few situations, however dry, where the hedge will run any risk of suffering from too much dry weather at any season of the year.

It may be farther remarked, that in very cold wet situations this practice is reversed; and in place of planting the hedge upon or below the common surface, it is found necessary to raise it considerably higher; for that purpose the first two spadings, or spits, taken out of the ditch, and which always consist of the best earth, are laid about ten inches back from the front; this, when properly done, forms a bed of from twelve to fifteen inches in thickness, upon which the plants are laid; the roots are then covered with the remainder of the best earth, and the bank formed in the ordinary way.

Where the hedge is either white thorn, crab, or beech, the precaution of raising it above the common surface is essential to its welfare upon cold or wet soils; and in many of these situations good hedges are made in this way, that could not possibly have been done by any other means. It must be admitted, however, that by raising it so much above the common surface, the pasture of the plants is in a great measure confined to the bank formed by the earth taken out of the ditch; and, in many instances, when the winters are severe, and much black frost happens, it penetrates the bank so completely, as entirely to destroy the hedge.

In all cases where hedges are to be made either in this or any other way, the soil, so far as circumstances will admit, ought, as has been already noticed, to be cleared, pulverized, and enriched with lime, compost, or other manures, which will not only enable them to push away vigorously, but at the same time prevent, in a great measure, the distempers of mofs, or cankering, which hedges upon stiff clays, or other cold wet soils, are very liable to be affected with, and of course much injured by them.

In speaking of the *simple ditch fence*, notice was taken of the necessity of giving it a proper slope, to prevent its tumbling in after frost, or being excavated by the run of the water. Where a hedge is added to the ditch this precaution is equally essential, indeed more so, as the injury done to a simple ditch can be repaired with the spade at little or no expence; whereas, when a hedge is planted in

the front, any considerable portion of the earth falling down brings the plants along with it, and makes a breach in the hedge, which no industry will afterwards be able to remedy. To keep them pretty broad at top, and gradually tapering towards a point at bottom, ought to be a constant and invariable rule; ditches so constructed are seldom, if ever, undermined, and retain their shape for many years. Upon ditches so formed, from their containing little water at bottom, the greatest pressure and action of the fluid are upon the upper part, and upon that, from the nature of the slope, its effects are lost. Those who have made sufficient observation know, that in every instance where water acts upon a perpendicular surface (especially if the soil is of a soft incoherent nature) its force is greatest; whereas, when it operates upon a sloping bank its force is short, and it consequently does no injury. A knowledge of the laws of hydrostatics explains this. The pressure and operation of fluids is always in proportion to their altitude or perpendicular height. Upon a sloping bank this pressure is lost; and the more gradual the slope, the less effect the water has. It is owing to this circumstance that the low sloping parts, both upon the banks of rivers, and on the sea-coast, continue unaltered for many ages, while the high bold parts of the shore, unless they are entirely of rock, are continually tumbling down. The same thing holds good in regard to ditches; whatever the height of the column of water may be in the middle, or however rapid the current, the narrowness of the ditch at bottom, and its sloping gradually upwards, divides and diminishes the force so completely, that it is scarcely felt upon any part of it; whereas, when the ditch is wall-sided, and of one uniform width from top to bottom, the water, by being confined almost entirely to the under part, runs away the soil, and excavates and undermines the sides of the ditch, which occasions their breaking down and being carried away.

In cases where the purposes of the proprietor or occupier require that the fields recently inclosed with ditch and hedge should be made fenceable at once, it is very common either to surround them with a railing or paling placed upon the top of the bank, formed by the earth taken out of the ditch, or with a wall of coarse loose stones, in the form of a Galloway-dike, placed also upon the top of the bank. Where stones are in plenty, this last forms an excellent fence for the purpose of confining the cattle, and is at the same time a good shelter for the hedge. *Fig. 4.* in the plate, represents a young hedge protected by an open wall of this kind, which answers well, and has a neat appearance.

For cases in which a railing or paling is placed upon the top of the bank, they are made of different materials, according to the circumstances of the particular case; in some situations they are made of staves, in others of laths, the prunings of fir plantations, &c. in all of which, when properly executed, they not only answer the purpose of a temporary fence, but at the same time serve as a complete protection to the young hedge, from the depredations of sheep and other sorts of live stock.

Hedge and bank.—This is a kind of fence that consists of a hedge planted upon the plain surface, with a bank or mound of earth raised behind it by way of protection. A very good idea of this fence may be formed from the figure. This bank, in some instances, is faced with sod on both sides, sloping gradually towards the top; while in others, and indeed by far the greatest number, it is only faced on one side, which is nearly perpendicular, and has a gradual slope on the other, similar to the bank made with the earth taken out of an ordinary ditch. The hedge is frequently planted at the bottom of the perpendicular side that is faced with

sod; but in many cases it is planted on the other side, near the bottom of the sloping bank of earth. The last is certainly the best situation for the hedge; for if the earth with which the bank is made has been taken, as it generally is, from the side that is faced with sod, this fencing will form a kind of sunk fence, the bottom of which will be considerably below the common surface: of course, any hedge planted in such a situation will not only be put into the worst of the soil, but will at the same time be in danger of perishing from the moisture lodging there, and chilling the roots; whereas, when it is planted on the other side, near the bottom of the slope, the plants have the best of the soil to strike into, and are in a great measure secured against the bad effects of stagnant moisture and wetness.

It may be remarked, that in bleak exposed situations, where hedges cannot be successfully reared without shelter of some kind or other, the bank of earth is a good contrivance, as it screens the young plants from the inclemency of the weather, till they acquire a degree of strength sufficient to enable them to resist the rigour of the climate, which it is now well known many plants are able to do when they reach a certain age and strength, that would have been completely killed, had they been exposed in the same situation, without shelter, at an earlier period. In such cases of course earthen mounds, similar to what has been described, or stone walls, are essential to the rearing of good hedges, especially of white-thorn. But as this fence, like the common turf-wall, cannot be erected without a considerable destruction of the adjoining surface, it should never be used but in cases of the strongest necessity. The only instance in which it can be made without any loss is upon the sides of highways, where the road is not bounded by a ditch, but slopes gently to each side; in that case a sufficiency of turf and earth for facing and forming the bank may be had from the side of the road. This will have a double advantage; the earth, if taken from the road with judgment, and in such a way as to form a gradual slope from the middle towards the sides, will produce two very considerable advantages; the slope will keep the road perfectly dry, and the earth taken from it will, with the assistance of a slight paling, completely inclose the field, and serve as a protection to the young hedge. It is worthy of remark, that when the hedge is planted behind the bank, the paling should not be upon the top, as is commonly the case; but on the side next the field, to serve as a protection against the cattle grazing in it; when it is next the road, however, the paling may be placed upon the top, in which case it will render the fence more inaccessible and secure from all sorts of depredations. *Fig. 3.* in the first plate on fences, explains the manner of forming it.

Hedge in face of bank.—This is a kind of fence that differs from the former principally, in having the hedge in the front of the bank considerably above the common surface, in place of having it at the bottom, as already described. The work is executed in the following manner: the bank, faced with sod on one side, and having a gradual slope on the other, is raised to the height of eighteen inches or two feet; the top is then levelled, and covered with two inches of good earth, above which the plants are laid horizontally, with their tops projecting about a couple of inches over the edge of the bank; the roots are afterwards covered with the same mould, and the bank raised to the desired height. This fence is greatly inferior to that already described, as the hedge-plants, by being raised so much above the common surface, are liable to great injury, not only from the bank decaying and mouldering down, and by that means depriving them of their nourishment

ment and support, but also from the effects of frost, drought, &c. In many instances, however, it may be useful, especially in the inclosing of wet lands, where hedges would not thrive, if placed upon the common surface; but in such cases it is worth while to notice, that great advantage will arise from placing the hedge-plants about eight or ten inches back from the front, upon a sort of scarcement, similar to what is done in the common ditches. When planted in this way, there is little or no risk of the bank mouldering down; and the shelf or scarcement left admits of the hedge being completely cleaned, and the earth drawn up to the roots of the plants; circumstances of importance in the growth of the hedge. This method of forming a hedge is shewn at *fig. 5.* in the plate.

There is another description of hedge and bank fence which is met with principally by the sides of highways, in situations where the ground has a sudden declivity towards the road; in these cases it is common to cut down the face of the bank, in a sloping direction, to within eighteen or twenty inches of the bottom, where a bed is made of about two feet in breadth, covered with good earth broken very small; upon this the plants are laid, with their extremities about nine inches from the front; the roots are then covered with eight or nine inches of good mould; the bed below with the projection, in this case, serves the same purpose as the scarcement of the common ditch, and affords complete room for cleaning and drawing up the earth to the roots of the hedge-plants. In the construction of this fence it is essential to give the face of the bank such a slope, as to prevent the earth from tumbling down; if this is neglected, it will be continually falling in large masses after every frost, or fall of snow or rain. It is sometimes the practice, however, instead of planting the hedge within eighteen inches of the bottom, as here described, to slope the bank first in such a way, as to insure it against tumbling down, and plant the hedge upon the top, at the distance of about a foot and a half from the verge of the bank. A hedge planted in this way, when it thrives, will certainly look much more formidable than one planted at the bottom; but it will be liable to more accidents than the other, from drought, frost, and the falling in of the bank. It is shewn at *fig. 6.* in the plate.

Hedge on top of bank.—This is a sort of fence common in many parts of England, and also in some parts of Scotland, and consists of a high bank of earth taken from the adjoining ground, pretty broad at bottom, and tapering gradually towards the top, upon which the hedge is planted. It is, however, to be objected to on account of the great waste of soil, the want of moisture, and its predisposition to the production of moss. It is seen at *fig. 7.* This sort of fence is not unfrequently planted on the top with coppice-wood plants cut off short.

Mound, or Devonshire fence.—This is a sort of hedge and bank, as it consists of an earthen mound six or seven feet wide at bottom, five feet in height, and four feet broad at top, being mostly carried up between two sod banks, and upon the middle of which a row of quicks is planted, and on each side, at two feet distance, a row of willow stakes, of about an inch in diameter each, and from eighteen inches to two feet long, are stuck in, sloping a little outwards; these stakes soon take root, and form a kind of live fence for the preservation of the quicks in the middle. This fence nearly resembles the hedge on the top of a bank, and is equally expensive in the erection; the formation of the bank deprives the adjoining surface of its best soil, and the plants made use of are liable to every injury that can possibly arise from drought, frost, and the gradual decay or

crumbling down of the mound. The addition of the willows to this fence is certainly a disadvantage; if the quicks require protection, dead-wood is equal to every purpose that could be wished or expected; and at the same time possesses the additional advantage of requiring no nourishment, and having no foliage to shade the quicks or other plants. It is seen at *fig. 8.*

Different sorts of hedge-woods may be proper in forming fences of this nature in different soils and situations. In poor thin soils, in bleak exposed districts, furze is often found to afford a good fence, as well as considerable shelter. But in this case the sides should be kept pruned, so as to present a close firm face above the top of the bank. In similar exposed high tracts of land, the beech and sycamore are likewise found beneficial in railing fences. But in lower, more favourable exposures for the growth of hedge wood, the hazel, oak, and ash may be had recourse to for this purpose. The fallow is also a sort of wood that often grows well on the more high and dry aspects, and may be useful as a fence-wood in such places.

Hedge with post and rails.—This is also a sort of fence sometimes employed; the railings being frequently employed for the protection of hedges, as well those that are planted upon the plain surface, as for the hedge and ditch united. The addition of a paling is, however, more immediately necessary, in cases where the hedge is planted upon the plain surface, especially when the fields so inclosed are in pasture. If only one field is inclosed in this way, and the adjacent lands are under a corn crop, a single railing on the inside of the inclosed field will be quite sufficient for its protection; but when the adjacent fields are also under pasture, a double railing becomes necessary; or, in other words, a railing placed on each side of the young hedge, at a sufficient distance to prevent the sheep or cattle from cropping it; without such protection the hedge plants are not only liable to cropping, but also to being trodden and destroyed by their feet; an injury which, when it happens at an early period of their growth causes the plants to continue low and stunted ever afterwards. It is shewn at *fig. 9.* Any sort of coarse wood, as the thinnings of timber plantations, answer well for this purpose.

Hedge and dead hedge.—This is a fence that consists of a row of quicks, or other hedge-plants, set either upon the plain surface, or in the face of a ditch or bank, having a dead hedge to protect them. This dead hedge answers a double purpose, namely, that of protecting the young plants from the injuries they may receive from cattle, or the inclemency of the weather; and at the same time forming a temporary inclosure, which lasts till the hedge is grown up. Where dead hedges are made of proper materials, such as the cuttings of thorn hedges, &c. and are well let into the ground, they answer these purposes very completely, and should always be used for the protection of young hedges, where the materials can be obtained at a cheap rate. It is worthy of notice, however, that in every instance where dead hedges are used for the protection of live ones, in place of cramping them close together, as is commonly done, there should be a distance of at least three feet between them. In that way the hedge plants will have room to grow and spread out their lateral branches at bottom; a thing essentially requisite to the formation of a good hedge, while an opportunity will at the same time be afforded of weeding the hedge, and loosening the earth completely on both sides of the plants. This sort of fence is shewn at *fig. 10.* in the plate.

Hedge and wall fence.—This is of two kinds, one of which will be afterwards described, namely, a coarse open wall,
made

made of loose stones, resembling a *Galloway dike*, made upon the top of the bank formed by the earth taken out of the ditch. The second is chiefly used when hedges are planted upon the plain surface; in which case the wall, though thin and low, is regularly built, and answers the double purpose of sheltering and encouraging the growth of the plants, while they are in a weak tender state, and afterwards prevents the possibility of the hedge becoming open below; where gardens are entirely, or in part, surrounded by hedges; and in the inclosing of fields by the sides of highways, especially in the vicinity of great towns, where dogs and other destructive vermin are apt to creep into the inclosures, and annoy the stock; the low wall forms a valuable addition to the fence. It is customary in some cases, after the hedge has attained a certain height, and is thought to be out of danger, either to remove the wall entirely, or allow it to decay. This, according to Mr. Somerville, is certainly a bad practice, as it not only leaves the bottom of the hedge naked and open, but at the same time deprives the roots of the plants of a protection to which they have been accustomed, and the removal of which operates as a severe check to their growth. In every instance where the wall is intended to be removed, care should be taken to cover the roots of the plants that are left exposed with good earth; by that means they will be prevented from being hurt by exposure to the weather, and they will suffer little, if any, check. It frequently happens, however, to the utter disgrace of the proprietor, that the wall is removed, and the roots of the plants left naked, and exposed to every injury. In such cases, if the hedge has been planted a little above the common surface, as soon as the wall is removed, the earth begins to moulder, and fall down, and continues to do so till the plants, deprived of their support, tumble down also, and the hedge is by that means entirely ruined. A representation of this sort of fence is given at *fig. 11.* in the plate.

It may be remarked, that there is another description of hedge and wall which properly comes under consideration in this place; that is, where the hedge is planted upon the top of the wall: this differs from a hedge on the top of a bank already described, only in one particular, which is that of the bank being faced with stones, instead of sod or earth. When such a fence is attempted in a level country, the wall must be very broad, not less than four or five feet, and the middle of it filled with earth; in short, the construction should be nearly the same as the Devonshire fence, already described, only the facing on each side to consist of stones in place of turf. The objections made to the Devonshire fence apply with equal propriety to this, being expensive in the erection, troublesome to keep in repair, and in its nature by no means durable.

And there is still another kind of this fence, which, it is observed, in particular situations, is extremely useful; that is, where the land has a considerable declivity, which terminates abruptly on the side of a highway, or an inclosure running along the side of high grounds that leans very much to that side where the fence is intended to be made. This is commonly executed with a perpendicular front, and without any contrivance for carrying off the moisture; in consequence of which, after bad winters, or long continued rains, the earth swells, the wall bursts, and is thrown down; when the wall is of dry stone, there is, however, little risk of this accident happening, as its open texture readily admits of the moisture passing through it; but when the wall consists of stone and lime, stone and clay, or any other substance that prevents the discharge of the moisture, the earth, as already mentioned, swells, and the wall bursts, and is thereby

destroyed. In order to render a facing of this fort durable, it is requisite, if the wall is built with stone and lime, or a mixture of clay, turf, or any other materials that resist the passage of water through them, instead of building it perpendicular, as is commonly done, to give it an inclination of some degrees backward, and to have openings at the bottom, at regular distances from each other, for discharging the moisture that may issue from the bank. And in order to render these openings as completely useful as possible, it should have a space at the back of the wall, and immediately at the bottom of about twelve inches bread and the same depth, filled with small round stones; these, by serving as a kind of drain, will receive the moisture that soaks down, and afford it a ready passage by the openings that have been mentioned. This description of fence is shewn at *fig. 12.* in the plate.

Hedge in middle, or face of wall.—This is a sort of fence somewhat like that last described, but which can only be made in the face of a bank where the land rises immediately behind it; the practice Mr. Somerville considers as new, ingenious, and deserving of attention. It is executed in the following manner: the face of the bank is first cut down with a spade, not quite perpendicular, but nearly so; a facing of stone is then begun at the bottom, and carried up regularly, in the manner that stone walls are generally built; when it is raised about eighteen inches or two feet high, according to circumstances, the space between the wall and the bank is filled up with good earth, well broken and mixed with lime or compost: the thorns are laid upon this earth in such a manner as that at least four inches of the root and stem shall rest upon the earth, and the extremity of the top shall project beyond the wall. When the plants are thus regularly laid, the roots are covered with earth, and the building of the wall continued upwards; when completed, the wall is finished with a coping of sod, or stone and lime. When the plants begin to vegetate, the young shoots appear in the face of the wall rising in a perpendicular manner. This kind of fence is shewn at *fig. 1.* Plate XX.

It may be remarked, that Mr. James Hall, of Dunglass, has adopted this mode of inclosing pretty extensively upon his estates in East Lothian, and is the first who introduced that plan on the east coast of Scotland from Galloway. The appearance is at once new and handsome; the whole seems to be in a very thriving condition, and in several parts the hedges have made great progress. Most of them, however, being young, no decisive opinion can be formed as to the real advantages or defects with which this mode of inclosing may be attended. Apparently, it is liable to several objections. In the first place, if from weakness, or other accidents, any of the plants should sicken or die, a circumstance by no means uncommon, even where every possible care has been taken to select the stoutest and best; the defect thereby occasioned cannot be repaired without taking down the wall, at least as far as the place where the hedge was laid; this will be found highly expensive and inconvenient; the inconvenience would, however, be less sensibly felt, if the failure of the plants happened only in one part of the wall; but when, as will always be the case, the plants misgive in many different places, it will be found a very expensive and arduous business to take down and rebuild the wall in every place where two, three, or more thorns have failed. Were this labour and expence repaid by any extraordinary advantages, the practice might derive additional strength therefrom; that, however, is far from being the case; for though the plants in a hedge of this sort are, from the great quantity of earth laid upon their roots, less

liable

liable to injury from drought, frost, &c., they are at the same time further removed from the genial influence of the sun and the air.

Walls formed with or without lime have been raised on the banks behind the new-planted quickset hedges, instead of a paling or railing, to the height of about two feet and a half, with great success by Sir George Suttie in Scotland. The base of the wall is placed about nine or ten inches, or a foot, from the plants of the hedge, being made two feet thick at the bottom, battering to one at the top, and coped with flat stones and turfs. Where stones are plentiful these are found cheap and useful in rearing the young hedges.

Hedge and ditch, with row of trees.—This kind of fence differs from those which have been described only in having a row of trees planted in the line of the fence along with the hedge.

The advocates for this practice say, that by planting hedge-rows of trees in the direction of the fence, the country is at once sheltered, beautified, and improved; and that the interest of the proprietor is ultimately promoted by the increasing value of the timber raised in these hedge rows. It is also said that such trees produce more branches for stack-wood, knees for ship-builders, and bark for the tanners, and they sell at a higher price *per* load than trees grown in woods and groves. Besides, close-pruning hedge-row trees to the height of twelve or fifteen feet prevents their damaging the hedge; the shelter which they afford is favourable to the vegetation both of grass and corn; it also tends to produce an equable temperature in the climate, which is favourable both to the production of, and greater perfection and beauty in animals, and of longevity to man. Though the practice of planting hedge-rows of trees is very common (especially in England), though its advocates are numerous, and though these arguments are urged in its favour, yet the objections are also entitled to very serious consideration. When trees are planted in the line of a fence, if that fence is a hedge, the plants of which it consists will, Mr. Somerville says, not only be deprived of a great part of their nourishment by the trees, but will also be greatly injured by the shade they occasion and the weight of the drop that falls from them during wet weather; upon this point little reasoning is necessary, for, if we appeal to facts we shall find that no good hedge is to be met with where there is a hedge-row of trees planted along with it. The mischief is not, however, confined solely to hedges; the effects are equally bad, perhaps worse, where the fence is a stone wall; for though in this case the shade or drop of the trees is hardly, if at all felt, yet when they have attained a certain height, the working and straining of the roots during high winds are such, that the foundations of the walls are shaken and destroyed; accordingly, whenever large trees are found growing near stone walls, the fence is cracked and shaken by every gale of wind, is perpetually falling into large gaps, and costs ten times the expence to keep it in repair, that would otherwise be required if no trees were near it. Admitting, however, that the trees in hedge-rows were no way prejudicial to the fence, which we have already shown is by no means the case, another argument may be successfully used against the practice. It is seldom, indeed, that trees planted on hedge-rows arrive at any great size; on the contrary, they are generally low and stunted, and while they occasion a visible loss by the mischief they do the fence, their utmost worth, when they come to be sold, will seldom be found adequate to the loss and inconvenience they have occasioned. This is very satisfactorily accounted for from the want of shelter; trees planted in hedge-rows being exposed to every inclement blast, by that means they are de-

prived of what is very essential to promote their growth, and which is in fact the cause why trees in large plantations thrive better than when they are planted singly; namely, the mutual shelter which they afford to each other; it being observed that all trees on the skirts of plantations are much lower than those more removed from the extremity; this is owing to their bearing the first gust of the wind which after being once broken its violence is gradually abated, and in proportion as the trees recede from the verge of the plantations they feel it less, and rise to a larger size and dimensions.

It may be further observed, that hedge-rows of trees are in a still more unproductive situation than those which form the skirts of a plantation; the latter being exposed to the violence of the wind only when it blows in one direction: this is what is generally termed the prevailing wind; when the gale is from any other quarter they can hardly be said to feel it; whereas, hedge-rows are exposed to the ravages of every blast, in whatever direction it may blow. There are, no doubt, some favoured spots where not only hedge-rows, but even single trees, may thrive and attain a great size, without any protection whatever; the cases in which this happen are, however, but few, and can in no sense be quoted in support of the general practice of planting trees in this manner. Where the practice is adopted, the method shewn at *figs.* 2. and 3. in the plate may be followed.

It has been suggested by some, that various sorts of fruit-trees and shrubs might be planted in hedge-rows, with great profit to the proprietor and farmer, such as those of the plum, bullace, cherry, apple, gooseberry, and sibeet kinds. How far any material benefit could be procured in this way to the farmer or the nation is uncertain, as few trials have yet been made; but it is well known that where trees of any description are set out in hedge-rows, they quickly destroy the hedge-plants which are near them, and, of course, ruin the fence. And this would certainly be the case if they were planted in the close manner that has been advised. Beside, hedge-rows formed of such sorts of plants alone would never become fences of any great utility in the view of inclosing the lands, except in the case of the gooseberry, which has long been known to constitute an excellent fence. This plan of raising fruit is likewise liable to various other objections, grounded on the impossibility of protecting the produce.

Hedge and ditch, or wall, with belt of planting.—This sort of fence in exposed situations is strikingly useful and ornamental, while, upon the low grounds, it is not only unnecessary, but in some instances absolutely hurtful. For instance, in deep and broad valleys surrounded by hills, and sheltered from severe blasts, belts of planting are not only unnecessary, but even hurtful and ruinous to the ground they occupy, which could certainly be employed to greater advantage, and the original expence of inclosing and planting saved. There are many instances, both in Scotland and England, of low, flat, rich lands being inclosed, and completely protected from the inclemency of the weather, without any aid whatever from this fence. There are other situations, however, where, though the lands are very flat, and the soil good, yet, from the want of hills and high grounds in the neighbourhood, they are so much exposed to the sea blasts, and a current of air, passing over a great extent of country without any interruption, that the value of the soil is thereby very much diminished. The peninsula which forms the county of Caithness in Scotland is a striking proof of this: with a soil of a very good quality and highly improveable, its value is greatly impaired by the circumstance of its being so much exposed to sea winds,

winds, which, coming from a very inauspicious quarter, and blowing over a considerable extent of country, without meeting with any obstacle to break the force or change their direction, blow with uncommon severity and fierceness, and in that way are an effectual check to vegetation. There are very extensive tracts in England, in nearly the same situation, the whole of which might at a small expence be sheltered and rendered completely productive, by interfecting the country in a judicious manner with plantations and hedges, either separately or conjoined, as in the hedge and belt of planting. They should be properly disposed in directions so as to oppose the most injurious and offensive winds, and where their force can be the most effectually broken and warded off. Across valleys, dips, and exposed plains, as well as on the ridges, points, and hangs of hills, they may frequently be found particularly beneficial. In the formation of them considerable pains and attention will be found necessary. It is essential that the plants made use of should be well suited to the nature of the soil and exposure. Where the situations are of the bleak and barren description, the larch may be most beneficial as timber, but much inferior to the common fir in the view of shelter in the winter season, when most food in need of. Where live stock are to derive advantage in this way, the plants employed should be such as are close at the bottom, otherwise mischief may arise, especially to sheep, from snow driving through and drifting on the contrary side. Where larch is used, therefore, the common fir should be had recourse to for the outward margin, which, by being cut or headed down to about twelve or fourteen feet, will afford the necessary shelter for a great length of time, as they would, in that case, throw out lateral branches, and become feathered to nearly the bottom, while the larch, by rising to considerable height, would lessen the force of the winds above, and render the air more mild.

In less exposed situations the beech, by retaining its leaves through the winter season while young, constitutes a good plant for this purpose. Where the soils are deep, the oak may also be used in the same intention: and the holly is a sort of plant that, in particular cases, is capable of application in the same view.

In every case where it is meant that the hedge and belt of planting shall constitute a durable and efficient fence, it must be made of a certain breadth; from forty to fifty feet is the very least breadth that should be allowed: and in cases where the situation is very elevated, and the intrinsic value of the soil small, the belts should be three times this breadth; such a space will allow abundant room for planting such a number of trees as will, by the mutual shelter which they afford to each other, promote their growth, and protect them against the blasts which are so severely felt in those elevated regions. The more effectually to promote the desirable purpose of sheltering the young trees, they should be planted very thick; perhaps four or five times the number that is meant to be allowed to grow to the full size should be planted. The expence of the plants in the first instance will be very trifling, and much more than repaid by the value of the weedings after they have attained a certain age; with this additional benefit, that the whole plantation will grow faster, and in that way sooner answer the purpose of sheltering the lands. Planting an extra number of trees is also beneficial in another point of view, namely, that of affording a choice of the most healthy plants to be left, when the plantation is thinned out at first. This sort of screen fence is represented at *fig. 4.* in the plate.

It may be remarked that the manner of protecting these

belts is different in different situations; where wood is plentiful, a simple paling, or ditch and paling, forms the fence; where stone abounds, a wall is frequently made use of; but in by far the greatest number of cases the ditch and hedge already described, or sunk fence with a hedge upon the top, are adopted; or any of these, when properly executed, will answer this purpose extremely well; but as there are some of them better and more durable than others, and a permanence ought never to be lost sight of, either in this, or any other mode of inclosing, it is of consequence to fix upon that which unites immediate use with durability. The stone wall, sunk fence, and ditch and hedge, are certainly the most durable; the two first are indeed complete at once, and every benefit that can be derived from their use is immediately obtained; the hedge and ditch, on the other hand, rises by very slow degrees, during which the belts are exposed both to the weather and the injuries arising from sheep and cattle breaking into and trampling upon the young trees: after all, it is very seldom that a hedge which surrounds a belt of planting forms a good or useful fence, as being very liable to fall into gaps and open places.

Fences of this nature are obviously beneficial in several different points of view, as, by defending the soil and live stock upon it, from too much cold and exposure; by warding and breaking off the more severe winds and storms; and by promoting a general warmth and mildness of the atmosphere in such situations.

Hedge and ditch, or wall with corners planted.—This is a mode which is employed upon some estates instead of the belt of planting. Upon an extensive property, and where the fields are not very large, it is a mode of inclosing that has a good effect upon the scenery of the country, and answers the purpose of general shelter extremely well. It certainly has a more pleasing and natural appearance to the eye than the stiff formal look of a number of straight belts running in parallel lines; it is, however, greatly inferior to the belt of planting, for the purpose of sheltering particular fields. But as in every field there is a space in each angle that cannot be ploughed, by planting these spaces, which would otherwise be left waste, the country is thereby ornamented, and many valuable trees raised with little expence, and with scarce any waste of land. This is a plan which is particularly recommended in the Staffordshire Report. "In every act for an inclosure, let there be," says the writer, "a clause obliging the proprietor of the new inclosed land to plant a certain number of oaks in proportion to his share of the inclosure, and directing the plantations to be made in the angles of the fields; by adopting which plan a less quantity of posts and rails would be required, and the angles of each field would be converted to a profitable use, and corn would grow close up to the rails: whereas no corn will now grow in such angles. This is not the only advantage that would arise from this plan; the trees, full grown, would afford good shade for cattle, and an easy communication through these plantations would be from field to field. It would also be very ornamental to the country." Others, however, doubt the utility of this practice, as, in point of fact, the greater number of such corners are necessarily occupied by gateways that could not, without considerable inconvenience, and increasing the farmer's labour, be made use of in any other way. The method in which plantations are formed is shewn at *fig. 5.* in the plate.

Furze, or robin fence.—It is evident that hedges of this kind may be had recourse to with advantage, whenever such plants are found to grow vigorously in a soil; and others of a better kind cannot be had. Fences of this nature

nature are mostly made upon mounds or banks of earth by sowing the seed of the plant. Sometimes the bank is only sloped on one side, but at others on both; in the former case the front is perpendicular, and faced with turf or stone. From these fences being raised so considerably above the common surface, they are very liable to injury from frost and other causes in severe winters. Different fences of this sort are represented at *figs.* 6. and 7. in the plate.

Railing and paling fences.—These are such as are constructed of some sort of woody material, either in a rough or more finished manner. In speaking of paling or timber-fences in general, it has been observed by Mr. Sommerville, in his excellent essay on this subject, that in all permanent plans of inclosure, palings are only to be considered in a secondary light; for of whatever wood they are made, however substantially they may be executed, or in whatever situation they are placed, their decay commences the instant they are erected. The slightest attention will be sufficient to convince every person of observation of this truth. Where permanent use therefore is required, palings ought never to be adopted; but for ornament in pleasure-grounds, or for the protection of young thorns, they are highly valuable. When the different kinds of palings come to be spoken of, notice will be taken of the mode of constructing each; but as there are certain circumstances which may be considered as common to all palings, this is judged the most proper place to mention them.

In all cases where either dead hedges or palings are used, the decay and ultimate loss of the fence is owing to that part of it which is let into the ground being rotted by the moisture. Where dead hedges are planted, it is no easy matter to provide a remedy against this evil; as the stems are so numerous, that to give each of them a preparation that would completely defend it from the effects of moisture, would be attended with an expence equal to, if not greater than, the value of the fence. Where palings, however, are used, especially the most expensive and substantial kind of them, and such as are meant both for duration and ornament, it is desirable to prepare the standards, or upright parts that are placed in the earth, in such a manner as will enable them to resist the moisture for many years. In the south of England, the post is always more bulky at the lower end than the upper, and is fixed in the ground by digging a hole, placing it therein, shovelling the soil in gradually, and ramming it round the post till it be firmly fixed. It has been a practice, time immemorial, to *burn or char* that part of the standards or palings intended to be set or driven into the earth: the reason assigned for this practice was, that the fire hardened the parts thus subjected to it, and by rendering them impervious to moisture, made them more durable than they would have been without such operation: but it probably depends upon their being thus rendered less capable of decomposition. The best defence at present known against the effects of the weather is, the above writer asserts, the bark of the tree. This covering it has from nature, and it is possessed of every requisite that is necessary, being impregnated with oil, resin, and other matters, which secure it completely, not only against moisture, but other injuries arising from the operation of air, light, heat, &c.; of this we have strong proofs by observing what happens where the bark of any tree is destroyed, by cutting off a branch, or otherwise. If the surface laid bare by the wound is considerable, the body of the tree opposite to it begins immediately to decay, and continues to waste, unless some covering is made use of to supply the place of the bark for that purpose; nothing has yet been found

so effectual as a coat either of boiled oil, or of oil-paint, which, by completely excluding both air and moisture, not only preserves the tree from rotting, but also prevents it from bleeding and walling itself by an effusion of juices from the wound. When trees are cut down and sawn into planks, whether for palings or any other purpose, where they are afterwards to be exposed to the weather, the same thing happens that we have mentioned as taking place with the growing tree when deprived of its bark, but in a much greater degree, as the whole surface is then without a covering. To prevent this decay the same remedy should be applied, *viz.* painting the whole of the wood, or otherwise filling the pores with oil in such a manner, as to prevent the entrance of moisture. There are now coarse oil paints sold of all colours so cheap, as to enable persons erecting paling, or other works of wood, to paint them at a small expence. Another very good remedy is to be had at a moderate price, (lord Duodonald's coal-varnish,) into which, if the points of the standards that are to be drove or set into the earth are dipped while the varnish is boiling hot, it will preserve them from the bad effects of moisture for a very long time; previously to the dipping, they should be properly sharpened, and upon no account whatever charred or burnt, as every attempt of that kind will, upon inquiry, be found to injure the texture of the wood, and hasten its decay. This application, which has been found highly valuable for many purposes, and for which the noble discoverer is entitled to the gratitude of his country, has only one fault; namely, that it does not penetrate deep into the wood, and after being laid on a few months, is very apt to scale and throw off with frost, or the action of the sun; it has the farther disadvantage of hurting the appearance of the wood, and giving it an old, black, decayed look. Common tar, or melted pitch, may also be successfully employed for the purpose of defending the extremities of the upright parts of palings from moisture: linseed and train oils may also be used with success; the great object being to fill the pores completely with some unctuous or greasy matter, so as to prevent the admission of moisture. The posts should be completely dry before they are dipped in any of these preparations; for if they are either made of green wood, or have imbibed much moisture, if after being dipped they are exposed to the sun, or a severe frost, the moisture will become so much expanded thereby, as to burst through, and bring off the coat of paint and varnish, &c.; whereas, when they are made of well-seasoned wood, and are at the same time perfectly dry, and the pitch, oil, varnish, &c. boiling hot, it readily enters the pores, and by filling them completely, prevents the access of moisture, and consequently the injurious effects produced by it.

It is further remarked, that in a few instances, a method different from many of these has been tried, and found in some degree to answer. Instead of sharpening the points of the standards, they are left of the same thickness at both ends; and the extremities, instead of being drove into the earth in the ordinary way, are let into large stones sunk into the earth, with round or square holes cut in them, of such a size as to admit the round or square ends of the posts. In this way the upright parts of palings certainly last longer than when they are drove into the earth without any preparation; but the difference of durability in the two cases bears no kind of proportion to the difference of expence; and as the stones are sunk into the earth, and of course within the reach of the moisture, the decay of the paling, though somewhat protected thereby, is in the end equally certain. Upon the whole, when the expence and durability of these different methods are compared

pared, it will be found by much the best way to drive the standards into the earth, after having previously prepared them by dipping the extremities into any of the articles we have mentioned, and of which any of the coarse oils are supposed by far the best. In addition to which he has to add, that this dipping and preparation should be so applied as to rise several inches above the surface of the earth after the standard is drove into the ground; for if no more is dipped than what is driven in, the wood will imbibe the moisture at the surface, and very soon rot and decay at that place. Thus much is necessary to be said of the preparation of that part of the wood which is drove or set in the earth. To render the whole paling as durable as possible, it should receive a covering of lord Dundonald's varnish, or one of the coarser kinds of oil-paint, or oil. Where use only is wanted, and the appearance of the paling is not an object, a coat of varnish or oil will answer very well, but when a paling is made of dressed wood, substantially executed, and in sight of the road, or of a gentleman's house, it becomes necessary to unite use with ornament. In such cases a coat of white or green oil-paint will defend the wood equally well, and look much better; where it is intended that the paling should appear visible at any great distance, and convey an idea of inclosure, the white paint should be used; but when it is meant to conceal the fence, and give an unbroken view of extensive lawns or pleasure grounds, the green paling is preferable; next to the ha-ha, or sunk fence, it is the best contrivance for that purpose, being of the same colour with the grass, it is not visible to the eye at any great distance. After having thus mentioned what appears most essential respecting palings in general, we may proceed to notice the different kinds that are made use of for the purpose of inclosing land in different circumstances and situations.

Simple nailed paling.—This is a sort of paling, or railing fence, that consists of upright posts drove or set into the earth at certain distances, and crossed in three, four, or more places, with pieces of wood in a horizontal direction. This description of railing, or paling, is for the most part made of coarse fawn wood, without any dressing whatever; in Scotland it is, Mr. Sommerville says, termed a slab-paling, and is the one commonly employed for the protection of hedges, and for strengthening ditches, &c. For temporary purposes he thinks it answers extremely well; but that, where durability is required, and no other fence is used, it will be found a very insufficient sort of fence. A method of constructing it is shown at fig. 8. in the plate.

This railing is often made with only two horizontal pieces, and answers well where no great height of fence is required, as in defending young thorn hedges, and many other similar purposes. It has likewise, in some cases, only one longitudinal piece, sawn in a triangular form, nailed firmly down upon the tops of the upright posts.

Jointed horizontal paling.—This fence consists of mussy square piles, drove or set into the earth at regular distances, through which mortises, or openings, are cut, for the extremities of the horizontal pieces which traverse them. When properly executed, this fence, it may be observed, has a neat and durable appearance. It is, however, much less so than it appears to be, as the points of the piles drove into the earth soon rot, and the mortises, or openings, cut in the body of the piles for the reception of the horizontal pieces, weaken them very considerably; so much so, that, in many instances, the railings, or palings, decay fast at those places where the joinings, or mortises, are made. It may be further remarked, that where valuable palings of this kind are made, there is an easy method of fastening the hori-

zontal to the upright parts of the paling, without cutting or weakening any part of the upright posts. This consists in fixing the cross, or horizontal bars, to the upright posts with iron staples. These, while they answer every purpose that can be expected, from binding and connecting the different parts of the fence, have, it is conceived, not the smallest tendency to diminish the strength, or accelerate the decay of any part of the fence. This sort of paling is represented at fig. 9. in the plate.

Upright lath-paling.—This is made by driving or setting a number of strong piles into the earth at regular distances, and crossing these at top and bottom, and sometimes in the middle, with horizontal pieces of equal strength; upon these last are nailed, at from six to twelve inches distance, a number of flat, or square pieces of fawn wood, of the shape and size of the laths that are used for the roofs of tiled houses. This sort of paling, when properly executed, looks very well; and, notwithstanding its apparent slightness, if well supported by props, or rests, at regular intervals, lasts a long while; and, where there are plantations of young firs in the neighbourhood, laths may be made at a trifling expence. For the protection of young hedges, &c. it will, the writer just mentioned thinks, be found superior to almost every other, as the closeness of the upright pieces prevents the sheep or cattle from putting their heads through between them, and cropping the young hedge; an advantage which horizontal palings do not possess. For gardens it will likewise, it is conceived, be found both useful and ornamental, and infinitely better adapted to the training of fruit-trees and currants than the espalier-railings commonly used. It is seen in the plate at fig. 10.

Horizontal young wood-paling.—Young firs, or the thinnings, or weedings, of any other sorts of young trees, may be beneficially employed in this way. They may be had recourse to with great advantage upon estates where there are extensive woods, or where they are surrounded by belts or thriving plants; the thinnings of such woods, or belts, being highly valuable for making such palings, especially when the plantation consists chiefly of firs; the palings of young firs are of two kinds, either horizontal or upright. The horizontal resembles the jointed, dressed paling, described at fig. 9; but the upright is similar to the lath-paling, and is seen at fig. 11. In the representations that are here given, the young fir boughs, of which figs. 11. and 12. in the plate are formed, have their lateral branches cut off at the distance of about three inches from the trunks. This method has several advantages, as that of rendering them stronger than they can possibly be when the lateral branches are cut close by the trunk; the labour required to prune them is also less, and they make a better fence than such as are close trimmed, as the sharp projecting points prevent the sheep or cattle from leaning or rubbing upon them so much as in other cases. For rough purposes they answer perfectly well.

The upright paling of young firs, represented at fig. 12. however, in place of being made in the manner above described, is sometimes formed by driving the upright parts into the earth, and covering them at the top with a piece of flat fawn wood, through which holes have been previously bored with a large auger, to admit the sharpened points of the upright piles: this forms a very neat paling, and, when well secured with spurs, or rests, at the back, lasts a considerable length of time without the necessity of being much repaired.

Horizontal chain-fence.—This is a species of fence which is made by fixing a number of strong square posts, or piles, into the earth at regular distances, in the direction in which

FENCE.

the fence is to run; each of these piles has three strong staples, or iron hooks, drove into it on each side; one near the top, one within eighteen inches of the bottom, and one in the middle; to these staples, or hooks, chains are fastened and stretched horizontally, in the same manner as the pieces of wood are in a common horizontal wooden fence. When it is meant that the fence should be laid open for any temporary purpose, hooks are drove into the posts in place of staples, and the chains hung upon them; but where this is not wanted, the staples will be found the most secure method. In some cases the upright parts of this fence, in place of wooden-piles, such as have been described, consists of neat pillars of mason-work, with hooks or staples battened into them for fastening the chains to; these, when properly executed, look extremely well, and last much longer than the wooden posts. In a few instances the purpose of posts is answered very completely by large growing trees, into which hooks or staples are drove, for fastening the chains, as in gentlemen's avenues, public walks, &c. For the confinement of horses or cattle, a chain-fence will answer very well; and if the pillars are of stone, will be very durable, but will be found totally unfit for inclosures, where sheep, hogs, &c. are meant to be pastured; it is besides so very expensive, that it can never come into general use. In avenues, however, and public walks, and for stretching across rivers, and pieces of water where there are no flood-gates, and where no other fence can be made to complete the inclosure, they will be found preferable to every other contrivance that can be had recourse to. There is a fence of this sort represented at *fig. 1. Plate XXI.* There are a great many varieties of fences of this description, some being made very light, while others have great strength and weight. The chain is usually procured from the iron-monger, being sold at different prices by the pound.

Net-fence.—This is a method of fencing chiefly used in shrubberies and pleasure-grounds, and consists, like the last, of a number of square piles of wood drove or set into the earth, at regular distances, each of which has a couple of holes bored through it, one at top, and another at bottom, large enough to admit a rope of about twice the size of a man's finger; these ropes, after being drawn through the holes, are stretched the whole length of the fence, and well secured, and upon them a strong net is fastened, of a length and breadth suited to the fence, either by sewing or tying it at regular distances with strong cord or rope-yarn at top and bottom; it is farther secured below by one or more wooden hooks drove into the earth between each of the piles; this completes the fence; but to render it durable not only the piles, but also the net and ropes, should be covered with a coat or two of good oil-paint. When well finished this fence has a very pretty appearance, but is neither a durable nor useful one, as sheep and cattle readily entangle themselves in it, and tear and destroy it with their horns; indeed, in many instances the sheep get themselves so much entangled, that in struggling to disengage themselves they are either much hurt, or entirely straggled. In point of utility, the net fence has nothing to recommend it; but as it will in many instances give a neat finished look to pleasure-grounds, it may be worthy of a place among fences of these kinds. A net-fence is shown at *fig. 2. in the plate.* The netting employed in this way is of different sizes and weights, being sold in the rope shops by the pound.

Rope fence.—This is a fence of nearly the same kind as the former, that is, it consists of upright posts, drove into the earth at regular distances, with holes bored through them for the ropes to pass; in general they consist of three, and in some cases of four, courses of ropes, like the chain

fence. This can only be used for confining cattle or horses; for sheep they will be found quite incompetent: for stretching across rivers or pieces of water, as has been noticed when speaking of the chain fence, the ropes will be useful; or even for adding to the height of a stone, or turf-wall, especially the latter, into which if posts are drove at certain distances, and one course of ropes put through them, such an addition will render a very insufficient fence secure and valuable. One observation seems, Mr. Sommerville thinks, necessary upon the subject of this fence, namely, that the perforating of the posts for passing the ropes through weakens them considerably; notice has already been taken of a similar mischief in the jointed horizontal paling, or posts and rails framed, and a remedy pointed out, *viz.* that of fixing the cross bars or horizontal pieces to the upright parts by staples. In the rope fence this may be resorted to with equal advantage, as staples or ring-bolts drove into the wood answer every purpose, without impairing, in the smallest degree, the strength of the posts that are used. The appearance is not however so neat in this way, as where holes are made in the posts for the ropes. A fence of this description is shown at *fig. 3. in the plate.*

Flake, hurdle, or moveable fence.—This is a sort of fence which is seen at *fig. 4. in the plate, and 11. and 12. in Plate XXII.* It has hitherto been principally employed in cases where sheep or cattle are fed with turnips in the field, to divide a certain portion off with their food at a time, and in this way they are extremely useful, as the sheep or cattle, by having a given quantity of food allotted them at once, eat it clean up without any loss, which they would not do if allowed to range at large over the whole field. There are, however, many other purposes to which flakes may be applied with equal advantage. They form a ready method of division in all cases where small portions of grass land are to be fed down close with sheep, in order to render the herbage more fine; and likewise in arable lands under the folding system, where the improvement of them by the manure is chiefly the object. See HURDLE.

Osier, willow, or wattled fence.—This sort of fence is made by driving a number of piles of any of the different kinds of willow or poplar, about half the thickness of a man's wrist, into the earth, in the direction of the fence, and at the distance of about eighteen inches from each other. They are then twisted, or bound together at different places, with small twigs of the willows or poplars, as represented in the sketch. This kind of fence has some advantages peculiar to itself; it not only forms a cheap and neat paling, but if it is done either about the end of autumn, or early in the spring, with willows or poplars that have been recently cut down, the upright parts or stakes will take root, grow, and send out a number of lateral branches; and if pains are taken the following autumn to twist and interweave these branches properly, a permanent fence, so close as to be almost impenetrable, may be formed in two or three years. For the inclosing of marshy lands, or for completing any inclosure, where a part of the line in which the fence ought to run is so wet as to be unfit for the growth of thorns, or the building of a wall, the willow-paling will be found an excellent contrivance, and the use of it will render many inclosures complete, that could not otherwise have been formed. This mode of fence is seen at *fig. 5. in the plate.*

Growing tree fence.—This is a kind of fence which is made by planting beech, larch, or other sorts of trees in the direction of the fence, at about a yard distant from each other, more or less, as may be thought necessary; these trees should be protected by a common dead paling till they

are ten or twelve feet high, when they should be cut down to six feet, and warped or bound together with willows at top, and in the middle; the cutting off the tops will have the effect of making them push out a great number of lateral branches, which, if properly warped and interwoven with the upright part of the trees, in the manner described for the willow fence, will both have a beautiful effect, and will at the same time form a fine fence, which, in place of decaying, will grow stronger with time, and may with very little trouble be kept in perfect repair for a great length of time. In these cases sometimes the fences are formed by railings being nailed to the growing trees as posts, and then the living parts warped with them. A fence of this kind is shewn at *fig. 6.* in the plate.

Horizontal and upright shingle fences.—These are chiefly made of firs, coarsely sawn into deals, of from half an inch to an inch thick, and of different breadths, according to the diameter of the tree, pretty strong square posts or piles are drove or set into the earth, and the deals nailed horizontally upon them, in such manner that the under edge of the uppermost deal shall project or lap over the upper edge of the one immediately below it; the fence, when finished in this manner, will have nearly the same appearance as the bottom of a boat or cutter. This description will be well understood by those who have been in North America, where not only the roofs, but the walls of many of their houses, are made with shingles. When completed, this fence is nearly as formidable as a stone wall, though, as may naturally be supposed, it is much less durable. An upright fence is sometimes made with shingles, which, when properly executed, looks extremely well, and is indeed highly ornamental; this fence is made by fixing perpendicular posts in the earth, nailing three pieces of wood horizontally, and covering these with shingles placed perpendicularly; in this case the shingles are not above three inches broad, and the extremities of each are pointed at the top. Several fences of this kind are to be seen upon the road from Edinburgh to Glasgow, especially upon the property of sir W. Cunningham of Livingstone, Walter Campbell, esq. of Shawfield, and some others. These upright shingle fences are painted white, and have a very handsome appearance. It is seldom that inclosures of any considerable extent have been made with these shingle fences: for folds they answer extremely well, and can be shifted with as much ease as flakes from one field to another; they are also useful for temporary purposes in gardens, &c. and where turnips are eaten with sheep upon the field, these shingle fences will be found preferable to the common open flakes, from the shelter they afford to the sheep. These fences may be made in many situations with advantage, and are shewn at *figs. 7. and 8.* in the plate.

Warped paling fence.—This fence consists of slender pieces of wood drove into the earth, bent down in different directions, interwoven with each other, and their tops fastened together with a slender sort of eddering; this fence resembles the *chevaux-de-frise*, with this only difference, that in place of leaving the points standing up, as is the case with that part of fortification, they are bent down and tied together. When made of dead wood this fence is equally perishable with others of the same description; but when made of growing plants it will be found very lasting. It is seen at *fig. 9.* in the plate.

Thorn hedges are sometimes made in the chequered method, and have a curious, though not elegant appearance, while they are perfectly secure against most sorts of live stock when perfectly grown up. They are, however, liable to the objections of being more troublesome and expensive

in making, and at the same time apt to be much injured by the constant rubbing of the different parts of the plants against each other. They in this way much sooner fall into decay than by the other methods of forming and managing them.

Light open paling fence interwoven with thorns, or branches of trees.—This fence differs from the common nailed fence already described, only in being warped either with thorns or the branches of trees. When properly done it forms at once a very complete fence; but, like all fences made with dead wood, it will be found very perishable, and require many repairs. It has, however, an advantage, *viz.* that when properly executed, it is proof against the entrance of animals of any kind. It is shewn at *fig. 10* in the plate.

Wall fences.—These are constructed of different sorts of materials, but usually of earth, earth and stone, stone alone, or brick, and are of various kinds; especially in the stone wall sorts, as *open, dry, single, double,* &c. according to the nature and size of the stones, and the intended use of the fence. In England they are all commonly known by the name of *walls*, but in Scotland, the first sorts more frequently by the title of *dikes*. They are for the most part good fences, though some of them, as those of the earthy kinds, are not by any means durable, therefore should not be formed where other better sorts can be had recourse to. The stone wall fences are the most usual sort in mountainous stony situations, where shelter is not particularly requisite, and are commonly the most adapted to such exposed regions. They are likewise often met with in lower exposures, where the districts abound with such materials, as on the borders of rising grounds; but in such places their appearance is by no means pleasing.

By running *dry, or single stone walls* up in as *open* a manner as the nature of the stones will admit, the advantages of their being less apt to be thrown down by winds, and at the same time to their being sealed by sheep, are gained in some situations. In these cases they should only, however, be coped with loose stones.

Dry stone walls.—In the construction of *dry stone walls* it is in general essential that the stones be either taken from a quarry, or consist of the largest land-stones broken in such a manner as that they may have a good flat surface, in order that they may bind well; that they be built by masons; and well pinned; that they have as dry and deep a foundation as possible, in order to guard against frosts, &c.; that they be made wide at the bottom, and tapering upwards to about the breadth of ten inches, when the coping is to be applied; that the coping consist of materials that cannot be readily overturned or removed; as upon the manner in which it is finished much of the future value and durability of the wall will be found to depend.

It is observed that dry stone walls are sometimes erected by common labourers, with the round stones gathered from the fields, and coped with sod; in other cases they are made with quarried stones, upon which some pains have been bestowed to put them into proper shape; a third kind, known by the name of *Galloway dike*, and so denominated from the circumstance of its being originally used in that county. The first of these, *viz.* the wall or dike made with round or land stones by labourers, and covered with a coping of sod, is, it is said, a very indifferent fence. In most instances it is not only very ill constructed as to shape, being of one uniform thickness from top to bottom, but the stones, from their round figure, do not present a sufficient surface to each other, to bind and give stability to the building. This fence has long been known, and is still very common, in the remote parts of the country, upon estates where

the first rude essay is made in the way of improvement, and where masons cannot readily be had. In such situations it has a two-fold benefit; the surface is cleared of many stones that would otherwise have presented a considerable obstacle to its cultivation, and the field is at the same time inclosed; but though these objects are accomplished for a time, their benefit is not permanent, as the wall is perpetually tumbling down; even the cattle rubbing against it make considerable gaps in many places; in that way great trouble and expence are annually required to keep it in repair. A dry stone wall, coped with brick, is shewn at *fig. 11*; and at *fig. 12*, the same sort of wall covered with a coping of turf.

It is asserted, that when the stones with which dry walls are built are quarried, and done by skilful masons, broad at bottom, tapering gradually upwards, and finished at the top with substantial coping, the fence has a very neat appearance, and has been known to last thirty and even forty years without repairs. A good foundation is highly essential in the construction of this fence; from nine to twelve inches is the smallest depth that it should be below the common surface, especially if the soil is open and porous, and the largest and heaviest stones should always be laid undermost. In cases where the materials do not require to be brought from any great distance, a hundred yards in length, by six feet in height of such a wall, may be built for 1*8*l. or 20*l*. There is one other material point in the building of these sorts of walls, which is, that they be well kept together by the judicious placing of the longest stones.

It is customary in some parts of England to plant ivy both upon their dry-stone walls, and upon such as are constructed of stone and clay; this has a good effect, not only in point of appearance, but, after a while, it binds and strengthens them very considerably. There are several kinds of ivy, *viz.* the large and the small-leaved, the dark green and the variegated, all of which look well; those kinds, however, should have a preference that grow fastest, and have the greatest tendency to ascend. Particular care should be taken, we are however told, not to plant ivy in the immediate neighbourhood of young trees or hedges, as, next to moss, nothing can be more destructive to trees or hedge-plants than this.

It is noticed that where dry-stone walls are built, that which we have just described deserves a preference on account of its neatness and durability. It is not only much cheaper than one made with stone and lime, but is equally useful, looks as well, and admits of being practised in many situations, where lime is either exceedingly scarce, or not attainable but at an enormous price. In many cases it is common, after raising this wall to the wished-for height, to level the top of it with loose stones, and leave it in that situation without any coping or other security. The consequence is what might naturally be expected, the first person who attempts to climb over it, or the first horse or bullock that puts its head over the top, or attempts to rub itself against it, infallibly throws down a part of the stones, and in that way the fence is gradually destroyed; whereas, when a substantial coping of stone and lime is given, the wall is so completely bound together and consolidated at top, as to bid defiance to any common injury. The copings of turf and mud, so common in many places, are by no means entitled to approbation; for though they may for a short time secure the top of the building they soon decay, and cannot be procured but by paring and cutting off the adjoining surface; for these reasons, turf or mud copings are improper, even upon dry stone walls; upon those made with stone and lime, or stone

and clay, as we shall afterwards have occasion to notice, they are wholly to be rejected as useless.

Such persons as are inclined to raise fences of the *stone wall* description, should carefully examine those that have been built in their immediate vicinities, and afterwards determine upon the modes of construction and dimensions which may seem the most suitable and proper, under the different circumstances, consulting thereafter with proper workmen in respect to their building, having previously their estimates, as is the case in other sorts of erections of this nature.

Stone and lime walls.—With regard to stone and lime walls, in order to render them durable, they should be constructed in the manner above described for dry-stone walls: that is, have a good foundation, deep enough to prevent them from being hurt by frost, with a broad base, tapering gradually upwards. This fence, when properly executed, is, next to hedges, the most durable of any; it is, however, very expensive; and its superiority over the dry-stone wall is trifling in point of durability, as to render the latter the most eligible, it being greatly cheaper, and answering every purpose of a fence equally well. For the building of this wall, stones taken from the quarry are to be preferred to the common land-stones; for though a mason may be able to remedy, in some measure, the inequality of surface in land-stones, by mixing plenty of lime with them, yet experience proves, that walls made with such stones, notwithstanding every care on the part of the builder, are much less perfect, and last a much shorter time than where quarried stones are employed. This, like every other stone fence, should be secured at the top with a substantial coping of stone and lime; the best and most durable is, it is said, that which is made with stones of the flag kind, laid together in the form here represented *A*; the space between them being filled with a mixture of small stones and mortar. This coping, from its wedge-like shape, and the solid impenetrable surface which it presents to the weather, seems the best calculated of any for the preservation of the building. When a stone and lime wall is left without a coping, which is too often the case, the moisture finds its way readily into the heart of it; it is, besides, liable to all those accidents already mentioned in speaking of dry-stone walls, when they are left without a coping. When stone and lime walls are built, the season of the year at which the work is done is none of the least important considerations; for if they are erected either at a late period of the autumn, during the winter, or very early in the spring, the frost acting upon the moisture contained in the lime will separate and disunite its parts, and by that means destroy the cohesion of the building; the binding power of the lime, in such cases, is entirely lost, and when summer arrives it resembles dry sand mixed with the stones. Late in the spring, during the summer, or early in the autumn, seems to be the most proper time for building stone and lime walls; at any, or all of these periods, there is every prospect of the lime drying properly, and not the smallest risk of its binding quality being hurt by the effects of frost, or other causes of that nature.

Galloway dike, or wall.—The Galloway dike, as has been already noticed, owes its name to the circumstance of its being first used as a fence in that part of the country. It is now, however, very common in most parts of Scotland, and in some of the English counties. It is principally employed for inclosing high grounds that are depastured with sheep, for the confining of which it seems well calculated. From two feet to two and a half at the bottom, it is built in a regular, compact manner, with dry stones, in every respect.

FENCE.

respect the same as a dry-stone wall, with a broad base, tapering gradually upwards; the building is then levelled with a course of flat stones, resembling a coping in such a manner as that these flags, or flat stones, will project two or three inches over the wall on each side. Above these flat stones is laid a course of rugged round ones, placed upon each other in a way secure enough to give stability to the building, but at the same time so open as to leave a considerable vacancy between each; by which means a free passage is afforded to the light and wind, which blows through them with a violent whistling noise. This rough open part of the building is generally raised three feet above the regular part of it, gradually tapering upwards, till it terminates in a top of about nine inches broad, every course of the rough stones being smaller than that immediately beneath it. The tottering appearance is so well calculated to prevent sheep, cattle, or other animals from approaching it, that it is seldom indeed that any attempt is made to leap over it. This circumstance, together with the ease with which the stones are procured, in most situations where the Galloway dike is used, render it a valuable fence. The expence of erecting it will be very different in different situations, according to the ease or difficulty of procuring stones, the price of labour in the country, and other circumstances. In many cases where the fields to be inclosed are intiled with large stones, the removal of which ought always to be a previous step in every plan of improvement, the inclosure may be made for a trifle, merely for the expence of mason-work. In no instance can it be dear, and in most situations, where the confinement of the flock, or the partition of a crop, are the sole objects, this will be found to answer the purpose equally well, if not better, than more expensive fences. It has, however, one defect, it is observed, in common with all other stone fences, *viz.* that it neither shelters nor ornaments the country; indeed, in point of shelter, it is the most defective of any; for compact stone walls, of a proper height, are capable of affording considerable shelter to the grazing flock in stormy, inclement weather, an advantage which cannot possibly be expected from the Galloway dike, on account of its openness. On that account it appears much more eligible for the lower parts of the country, where the land is valuable, where little shelter is required, and where the confinement of the flock, or the protection of the crop, are the sole objects to be considered in the business.

The advantages of stone fences of every description are, it may be remarked, very considerable: they not only form complete inclosures at once, and by that means allow the proprietor to enter into immediate possession of every advantage that can arise from the inclosing of his fields, but by the little room they occupy, a considerable proportion of land is saved that would have been occupied by some other fences; and even that proportion of soil near the sides of stone walls, which is at present, for the most part, waste, admits of being profitably employed, either in raising grain, potatoes, or other vegetables; and the walls, as we have already observed, may be usefully employed in rearing of fruit-trees, or the different kinds of currants, gooseberries, &c. To these benefits we have, however, to oppose some defects. The best and most substantial fences of this description are perishable in a greater or less degree, according to the materials of which they are made, and the judgment shewn in their construction, and, after a certain time, require considerable attention and expence to keep them in repair: the shelter they afford to the flock, crop, or pasture, is also small, and in place of improving the scenery

they are injurious to it. This description of fence is shewn at *Plate XXII. fig. 1.*

Stone and clay walls.—In the construction of walls of stone and clay, the clay is used like lime, and is meant to answer the same purpose. It requires slender observation to convince intelligent persons, that a wall made with such materials, in the usual way, cannot but be an ordinary one; for if the clay made use of in building the fence has been very moist, the summer's heat will dry it so much, as to leave considerable chafms in the building; these chafms must necessarily deprive many of the stones of that support which they require, and in that way endanger the building. This, however, is not the only inconvenience with which this kind of wall is attended; the effect of the summer's sun upon the clay parches it so completely, that when the wet weather commences about the end of autumn, it absorbs the moisture like a sponge, and if it is overtaken by frost while in that state, the fabric swells, bursts, and tumbles down. Even with the very best coping that can be given it, a stone and clay wall must, it is remarked, always be considered as a very exceptionable fence, as, however well it may be defended at top, the moisture will penetrate at the sides; if it is left without a cope, however, or is only coped with mud or sod, the evil will be greater, as the moisture will, in that case, find a ready passage downwards, and in that way accelerate the destruction of the wall or fence.

And walls of stone and clay dashed with lime differ in no respect from that just now described, except in the harling or dashing that is given them. Where that operation is well performed, and at a proper season of the year, the coating of lime, by preventing the entrance of moisture, will add greatly to the durability, as well as beauty of the wall; so much so indeed, that some fences made in this way, when the clay was properly tempered, and did not contain too much moisture, and where a harling or dashing of lime was afterwards given, have been known to last nearly as long as walls made entirely from stone and lime. The durability of this, as well as the foregoing fence, however, depends upon its being properly coped or covered at the top with some proper material.

Dry stone walls lipped with lime.—These differ from the ordinary dry-stone walls in having about two or three inches of them on each side lipped with lime, which gives them the appearance of being built entirely with stone and lime. Where the external appearance of a fence is an object, something is gained by this practice; in point of real duration, however, they seem to possess very little advantage over the common dry-stone walls, which, when properly executed, last equally long with them.

Dry stone walls lipped and harled.—These are much the same, nothing more being added than a harling or dashing of lime after the other work is finished: this addition is to be considered merely as an improvement upon their appearance, and not as contributing to increase their utility, or render them more durable as fences.

Dry stone walls pinned and harled.—These are much the same; the mason only carefully pins or fills up all the interstices of the building with small stones, after they have been built in the ordinary way, and afterwards dashes or harles them over with lime. The pinning, by filling up every vacant space, and affording complete support to the stones in every part of the surface, adds considerably to the durability of the building, and the harling afterwards gives the whole a finished, substantial appearance, which renders them at once agreeable to the eye, and lasting as fences.

Dry stone walls, with light palings upon the top.—These are

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are sometimes made, and for particular purposes answer well, and have a handsome appearance when well executed, but they are expensive. This sort of fence is shewn at *fig. 2.* in the plate.

Brick walls.—These sorts of fences are seldom had recourse to for ordinary inclosures, except in situations where stones are extremely scarce; as is the case in many of the English counties, for pleasure grounds, or for garden walls. Where brick walls consist of bricks only, they are built either with the brick on edge, in bed, or across. When the wall is built with bricks on edge, they are laid up with the edge or narrowest part of each applied to the other; the thickness of the brick in such a case constitutes the thickness of the wall. When brick in bed is used, the bricks are laid flat, and the thickness of the wall is proportioned to the greatest breadth of the brick. When they are laid across, the thickness of the wall is then equal to the length of the brick that is employed for the purpose.

It may be observed, that the most valuable use to which bricks are applied, is either for facing walls built with coarse stones, for gardens, or for heightening old stone walls; for the first purpose they are an excellent article; and any wall fronted with brick is, for the purpose of rearing fruit trees, of equal value with one of the most expensive hewn stone. Where it is intended to heighten a stone wall that is too slender to bear a heightening of stone, bricks either in bed, or on edge, will answer the purpose very effectually, without rendering the wall top-heavy. It is to be noticed, however, that in every case, either where a wall is made entirely of brick, or heightened with it, there will be a necessity for strengthening it at the back with pillars at certain distances from each other, as represented at *figs. 3. and 4.* in the plate. These will add to the stability of the building, and, if properly executed, will render it equally durable with a stone wall. For hot walls they are very valuable, as they not only, by their numerous seams, allow the trees to be regularly and neatly trained, but are at the same time extremely convenient for shaping the flues that conduct the heat. Where the price of labour is low, and clay of a proper quality, together with fuel, can be easily obtained, bricks may be used with advantage for almost any purpose where stone is at present employed: we believe, however, that their use will be chiefly confined to the facing of garden walls, to the walls of hot-houses, to hot-walls, or the heightening of old stone walls; in all of which they will be very valuable, and will, at a small expence, answer the same purpose as stone that has been prepared by hewing. From the increased duties upon them they are now become, however, by no means a cheap material. A wall constructed with bricks is shewn at *fig. 5.* in the plate.

The copings of walls of this description are formed in various ways. In some instances they are made with common brick set up in such a manner as to form an angle upon the top; in others, with a sort of tiles resembling the letter Δ , flat below and angular above, with a border projecting a little over the wall on each side. In many parts of the kingdom this sort of coping is found to answer the purpose very effectually; in some cases it is, however, made quite flat, but which is disapproved of, on account of its not affording so ready a descent to the moisture, which is apt to hang upon it for that reason.

Frame wall.—It is a kind of wall which is constructed by the following method: a frame of deal boards, of a width and height suited to that of the intended fence, is formed and placed upon the line in which it is designed to be made,

the foundation having been previously dug in a proper manner. This frame is then filled with stones of all sorts, gathered mostly from the neighbouring lands; and, when filled in this way to the top, a quantity of liquid mortar is poured in amongst them, sufficient to fill up every interstice, the whole being suffered to continue in that state until it is supposed that the mortar has acquired a proper degree of firmness to give stability to the building, which, in the dry summer season, will not be longer than a day or two. The frame is then removed and placed a little farther on the same line, in such a way, as that one end of it may join immediately with that part of the work from which it has been removed. In this way the line of fence is gradually completed, which, when the lime has been well tempered, and the proper pains taken to incorporate it with the stones, presents a smooth uniform surface, and has the appearance of being a firm substantial fence.

Turf walls.—Fences of these kinds are common in most of the hills and upland situations of the kingdom, being found convenient for temporary purposes. They are frequently used for inclosing fields in particular districts, being had recourse to in an extensive manner: while, in others, they are employed for the forming of pens, folds, and other places for confining different sorts of live stock during the night season. In common they are made simply of turf, which is pared off from the adjoining surface, and used without any mixture of earth; but in other cases the wall consists of a facing of turf on each side, while the space between is filled up with loose earth.

For inclosing, when durability is required, this is a sort of fence that can never, however, be had recourse to with propriety, as, from the very moment it is finished, its decay commences, and no pains or attention will be able to keep it in repair, after it has stood two or three years: in very exposed situations, however, it may be useful as a protection for young hedges during the first three or four years of their growth; but, as a wall of this kind can in no instance be made without a great destruction of the adjoining surface, which, upon good land, is a serious loss, the protection of young hedges will be answered equally well by low stone Jikes, which, while they perfect the inclosure, will, at the same time, shelter the young plants, and clear the field of the stones it may be incumbered with. This sort of turf fence is shewn at *fig. 6.* in the plate.

Stone and turf walls.—These are also very common sorts of fences in many situations, where better and more durable ones could be made at equal, perhaps less, expence. In many instances, however, they are had recourse to from necessity, where lime is either very dear, or not attainable at any price. The stones used in the construction of fences of this kind are in general the ordinary land-stones; with these, and the turf taken from the adjoining surface, the walls are made, using alternate layers of each. For temporary purposes this sort of fence may be adopted in almost every situation, as it is reared at small expence, and the materials are every where to be met with almost without trouble; but in all cases where permanent fences are wanted this will be found very deficient and inferior even to the common turf-wall: for, by the intervention of stones between every layer of turf, the sod is dried, the plants die, the turf, as might naturally be expected, soon decays, and the wall crumbles down; whereas, when it is built entirely of turf, with a sloping bank of earth behind, the herbage continues growing, and the whole turf, of which the wall is made, soon consolidates into an uniform green sod, which, with proper care, will last a considerable length of time. A fence of the stone and turf kind is shewn at *fig. 7.* in the plate.

Mud-walls, with a mixture of straw.—These kinds of walls are very frequent in many parts of England, not only for surrounding their small inclosures and stack-yards, but also for constructing the walls of many of their farm-houses, cottages, and offices. In North Britain they are used also for similar purposes, and for sub-dividing houses into different apartments, for which purpose they answer equally well as lath and plaster, and are nearly as durable. They are a sort of *cab-dab* fences.

It may be remarked that, when either the outside walls, or the inside divisions of a house, are made of these materials, the custom is to take a small quantity of straw, and incorporate it with a sufficient proportion of clay; the straw in this case answers the same purpose as hair in plaster-lime. When a sufficient number of these are made, the work is begun, by laying a stratum at the bottom of the intended wall; when this is done, and the different pieces firmly kneaded or wrought together with the hand, a flat deal board is applied on each side, which being properly pressed and rubbed against the buildings in a horizontal direction, not only serves to consolidate the work, but gives it a degree of smoothness and uniformity: successive strata are added till the wall is raised to the intended height, taking care to taper it gradually upwards. Walls made in this way, if properly constructed, will last for many years, and if dashed or harled with lime, at a proper season of the year, will have an appearance no way inferior to such as are made with stone and lime, along with this addition to their appearance: the harling or dashing with lime if properly done, will, by preventing the access of moisture, render them much more durable. When walls of mud and straw are to be made, pieces of wood, properly joined and secured, should be set up in the direction in which the fence is to run. These should be in the form of a double paling, and calculated to answer the same purpose as the standard employed in making brick divisions in a dwelling-house: the upright parts should be placed in such a manner as to be immediately opposite to each other, and at a distance equal to the thickness of the intended wall. These standards will not only render the fence firm and more durable, but, at the same time, serve as a direction to the workmen in keeping it of a regular thickness and shape. In England, where stones are scarce, and in many of the counties not to be had, walls of this description are the *sine qua non* for many purposes, and when, properly constructed, last a considerable time; but in every instance where stones are procurable at a reasonable price a fence made with them is greatly to be preferred, as it is in general built with less trouble and expence, and is at the same time more firm and durable. At best it is, however, of a very perishable nature, and the great expence required to keep up such fences has long since taught both proprietors and occupiers that they are by much the most expensive of any. *Fig. 8.* displays a fence of this nature.

In the constructing of all sorts of stone walls, it is of essential consequence that they be carried up in a regular manner, which is best performed by having recourse to a proper plumbing frame. One which has been found to answer this purpose perfectly is represented at *fig. 9.* in the plate.

In the raising of both *single* and *double* stone walls, it is a matter of great importance to give them a proper *tapering* form upwards, or what the workmen call “*batter*,” which is gradually narrowing them as they rise in height. This is usually done in the proportion of about one inch to every foot in height on each side, which is distinctly shewn in the section of a dry stone wall given at *fig. 10.* in the plate.

It is a matter of very great importance to the proprietors and occupiers of land, that the fences of farms, whatever their nature may be, should be in a good condition, and well kept in repair, as without attention in these different respects serious injuries must be constantly sustained by them. The most convenient and easy method of effecting these ends is, probably, that of annually going over a certain extent of them, in proportion to the nature and size of the farm, as, by such a practice, there will never be more to be done in any one year than can be easily accomplished. See *INCLOSING of Land, and CANAL.*

FENCE-Month, (mensis prohibitionis, or mensis vetitus,) is a month wherein the female deer fawn; for which reason it is unlawful to hunt in the forest during that time.

It begins fifteen days before Midsummer, and ends fifteen days after, being in all thirty days.

There are also certain fence or defence months, or seasons for fish, as well as wild beasts, as appears by stat. Westm. 3 cap. 13. in these words:

“All waters, where salmon are taken, shall be in defence for taking of salmon, from the nativity of our Lady, unto St. Martin’s day. And likewise, young salmon shall not be taken or destroyed by nets, &c. from the midst of April, to the nativity of St. John Baptist,” &c.

FEN-CHOUI, in *Geography*, a town of China, of the third rank, in Tche-kiang; 25 miles N.N.W. of Yenchou.

FENCING, the art of defence, or of using the sword, to wound an enemy, and preserve one’s self from his attacks.

Fencing is one of the exercises learnt in the academies, &c.

The art of fencing is acquired by practising with foils, called in Latin *rudes*; whence fencing is also denominated *gladiatura rudiaria*.

Pyraud assures us, that the art of fencing is so highly esteemed in the East Indies, that none but princes and noblemen are allowed to teach it. These masters wear a badge or cognizance on their right arms, called in their language *esaru*, which is put on with great ceremony, like the badges of our orders of knighthood, by the kings themselves.

Montaigne informs us, that when he was a youth, the nobility all shunned the reputation of being good fencers, as something too subtle and designing, and apt to corrupt virtuous manners.

Fencing is divided into two parts, *simple* and *compound*. *Simple* is that performed directly and nimbly, on the same line; and is either *offensive*, or *defensive*. The principal object of the first is whatever may be attempted, in pushing, or making passes, from this or that point, to the most uncovered part of the enemy. The second consists in parrying, and repelling the thrusts aimed by the enemy.

The *compound*, on the offensive side, includes all the possible arts and inventions to deceive the enemy, and make him leave that part we have a design on, bare and unguarded, upon finding we cannot come at it by force, nor by the agility of the simple play.

The principal means hereof are feints, appeals, or appels, which consist in a sudden beat of your blade on the contrary side to that on which you join your adversary, and a quick disengagement to that side again, clashings, and entanglings, of the swords, half-thrusts, &c. and in the defensive, to push in parrying.

The proper attitude in fencing is to hold the head upright, though the body hath an inclination forward on a lunge, and all the weight rests on the left haunch when on guard.

The

The feet, hand, body, arm, and sword, must be to the line. For an explanation of other terms in this art, see the articles BEAT, CAVEATING, FLANCONADE, GLIZADE, LOCK, LURCH, THRUST, &c.

FEND, in the *Sea Language*, imports the same as *defend*. Hence the phrase *sending the boat*, &c. that is, saving it from being dashed against the rocks, shore, or ship's side. Hence also

FENDERS, any pieces of old cable-ropes, or billets of wood, &c. hung over the ship's side, to fend or keep other ships from rubbing against her; or to prevent her from striking or rubbing against a wharf or quay.

FENDER Bolts. See BOLTS.

FENDUE EN PAL, in *Heraldry*, a French phrase, applied to a cross, to denote it cloven down from top to bottom, and the parts set at some distance from one another.

FENEGUE-HOTUN, in *Geography*, a town of Chinese Tartary; 360 miles E.N.E. of Peking.

FENELON, FRANCIS DE SALIGNAC DE LA MOTTE, in *Biography*, the celebrated archbishop of Cambrai, and pre-eminently distinguished among his contemporaries, was descended from an ancient family, and born at the castle of Fenelon, in Querey, in the year 1651. The charge of his education, which, till his 12th year, was domestic, and prosecuted for some time in the university of Cahors, was afterwards undertaken by his uncle, the marquis of Fenelon, a man no less distinguished by his piety than by his valour. At an early age our Fenelon made a rapid progress in literature, and being designed for the ecclesiastical profession, he became a popular preacher in his 19th year. His uncle, dreading the pernicious influence of popular applause on a youthful mind, endued with singular sensibility, placed him under the tuition of M. Tronson, the excellent superior of the congregation of St. Sulpice, who guarded him by his admirable instructions and discipline from the danger to which he would otherwise have been exposed. Between the pupil and the preceptor, in this state of seclusion from the world, an attachment was formed which terminated only with their existence; and it appears from letters that are extant how highly he respected the guide and guardian of his earlier years, and with what grateful sensibility he acknowledges his uncle's wisdom and kindness in placing him in a situation so favourable to his improvement both in knowledge and piety. At the age of 24, Fenelon entered into holy orders, and began to exercise the most laborious offices of his ministry in the parish of St. Sulpice. During his residence in this school of genuine and elevated piety, for such it was at the period to which we refer, his ardent mind formed and cherished a design, which some may probably conceive to be romantic and extravagant; for it was nothing less than that of joining the mission to Canada, with a view to the instruction of the barbarous natives in the truths of the gospel. This project, however, being defeated by the authority of his uncle, the bishop of Sarlat, he soon afterwards solicited to be sent on a similar errand to the Levant; but this design was never executed. An occupation somewhat analogous was found for him by M. de Harlai, archbishop of Paris, who, apprized of his disposition and character, named him superior of the New-Catholics, and of the sisters of Magdalen of Traissnel, while he was yet only 27 years of age; an employment which was usually entrusted to ecclesiastics of mature experience, and who had grown old in the most delicate functions of the ministry. The object of this institution, in which the sisters were bound by no vows, was to confirm the new converts, and to supply instruction to those who were desirous of becoming proselytes. The recent conversion of M. de

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Turenne, and the well-known disposition of Louis XIV. had given fresh celebrity to this establishment; and, therefore, de Harlai was induced to look out for a distinguished person as its superior, and to fix on the abbé de Fenelon. His present situation, and the duties connected with it, coincided with his original views, and he engaged in the discharge of them with peculiar satisfaction. Without encountering equal dangers of a personal kind, the task which he had to perform was not less dangerous; "for it is," as he himself says, "often more difficult to triumph over error than idolatry, and to eradicate opinions which have been adopted as being more pure and correct, than to dispel superstitious extravagancies, which neither seduce the mind nor gratify self-love." About this time, in consequence of the recommendation of his uncle, the marquis, Fenelon formed those connections, to which were owing his future high elevation, and the singular persecutions and reverses which it was his destiny to undergo. He was introduced, among others, to the duke de Beauvilliers and Bossuet; the latter of whom directed his studies, and manifested every token of esteem for him; though he afterwards proved his most inveterate enemy. It was also about this period that the bishop of Sarlat resigned, in favour of his promising nephew, the canonry of Carance, worth from three to four thousand livres a year; the only preferment that was enjoyed by Fenelon till he reached the age of 44 years. Ten years of his life were occupied in superintending the community of female converts; and in this delicate situation he conducted himself not only irreproachably, but with the highest degree of probity and honour. At this time he was in the closest intimacy with Bossuet; and was recommended by him to Louis XIV. as a proper person to be employed in converting the Jesuits of Poitou and Saintonge. This mission formed a part of those odious measures by which this monarch was led to believe that he should annihilate protestantism in his dominions; and we cannot but regret that such a character as that of Fenelon should be implicated in this dishonourable business. His conduct, however, in the execution of it, furnishes cause for admiration. Before he embarked in this proselyting scheme of his sovereign, he petitioned, that the troops and all the trappings of war might be removed from the districts with in his mission. The request was granted, and he, together with his companions, who were selected from families of rank, proceeded to the scene of their labours. Great success seemed to attend them; the associates of Fenelon flattered themselves with encouraging prospects; but the more discerning Abbé was not to be deluded by false appearances; nor would the ingenuousness of his mind allow him to countenance imposture. He candidly states, that distrust, and considerations purely human, occasioned most of the conversions; and that it was to no purpose he had caused all the apparatus of war to be removed from the view of the terrified multitude, since the relations of violence committed in other provinces had filled them with alarm. "Were it proposed to them," he says in a letter to Bossuet, "to abjure Christianity and follow the Koran, you have only to shew them the Dragoons." Fenelon, seemingly suspecting that at least the immediate effects of his zeal and exertions were the reverse of beneficial, became weary of his employment; and he was in a little while recalled. Upon his return to Paris, he preached frequently, and cultivated an acquaintance with persons of known religious character; and by the graces of his elocution, and the gentleness of his disposition and manners, acquired increasing reputation. This indeed was a period of the greatest interest in the life of Fenelon. The duke of Burgundy, eldest son of the Dauphin, had attained an age

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which required the superintendance of a governor. Louis XIV. appointed to this office the duke de Beauvilliers, a nobleman eminently distinguished for his virtue and piety, and highly respected by the king, who entrusted him with the nomination of all the persons who were required to concur in the young prince's education. The duke, on the day preceding that of his own appointment, proposed to the king, and obtained his consent, that the Abbé de Fenelon should be preceptor. At this time, *viz.* September 1689, when the perions appointed to their respective offices in the education of the young prince commenced the fulfilment of them, Fenelon was no more than 38 years of age. Never, it is said, was an instance of union like that which reigned among the instructors of the duke of Burgundy. They had but one heart and soul, and the soul was that of Fenelon.

Fenelon was fully conscious of the importance of the charge that was committed to him; this was the education of the future head of a monarchy, which had reached the highest splendour:—the absolute master of twenty millions of men, whose happiness or misery would depend on the personal character of the sovereign. Nor was he unapprised that the nature of the youth, whom he was appointed to instruct, was extremely unpropitious. History represents the duke of Burgundy as displaying in infancy all the symptoms of a perverse nature;—invincible obstinacy, a revolting pride, irascible propensities, and the most violent passions, are described as its odious features; but they were joined with a great capacity for acquiring all kinds of knowledge. “He was born terrible,” says St. Simon, “his behaviour made all who beheld him tremble.” By various means, happily combined, by a continued series of appropriate and pertinent observations, by patience, gentleness, and unintermitting attention, the preceptor at length succeeded in gradually breaking the violent character of his pupil, and in calming his impetuous passions. Beauvilliers and Fenelon directed all their sollicitude and exertions to realize this design; they succeeded, and were remunerated for it; for history shews, that of all the princes, he who was the least flattered by his instructors, and to whom the most harsh and cutting truths were told in his infancy and youth, retained the most tender regard for the virtuous persons who presided over his education. Of the talents, fidelity, and assiduity of Fenelon, as a preceptor, we may form some judgment by the astonishing proficiency of the royal scholar. At the age of ten, we are told, the prince wrote Latin with elegance, and translated the most difficult authors with an exactness and a felicity which surprised the best judges; he was perfectly master of Virgil, Horace, and the metamorphoses of Ovid, and was sensible to the beauties of Cicero's orations. At eleven, he read Livy throughout, and began a translation of Tacitus, which he afterwards finished. The Abbé Fleury, attesting these facts, says, that his mind was of the first order, and that he was not contented with superficial knowledge, but sought to penetrate to the bottom of every thing; his curiosity was immense. Great pains were also taken with regard to his religious education; and one of the biographers of Fenelon closes the relation of various circumstances that respect the attainments of the young prince with asking, “What must we think of instructors who were able to store the mind of a youth of 14 with all that is essential in religion, whether we regard its doctrines or its history; with all that most enchants in mythology, and which supplies the principal subjects of literature and of the fine arts; and with all the leading facts of ancient and modern history? He had been taught with precision the elements of several other sciences. It was not easy, said the estimable and correct Abbé de

Fleury, to find in the whole kingdom, not merely a gentleman, but any man, better informed than the prince. At 18, his letters were cited for the ease and good taste which they displayed. This testimony was borne to them by Madame de Maintenon.” The accounts of the talents and attainments of the prince, we are told, surprised even Bossuet, who had a great distrust of such premature geniuses, and a secret jealousy of the rising fame of the preceptor; and he took an opportunity of satisfying himself by an interview and examination.

The services of Fenelon in the education of his pupil were rewarded, in 1695, with the splendid preferment of the archbishopric of Cambray, which included a dukedom. But this he accepted on condition that he should be allowed to devote nine months in the year to his see, and three to the princes; and at the same time he resigned a valuable abbacy. At the moment of his elevation to one of the highest dignities of the church, a storm was gathering which could not less than alarm his tranquil mind. The reputation of Fenelon, and the ascendancy which his attractive and commanding qualities seemed certain of obtaining, alarmed the jealous mind of Bossuet. The unsuccessful preceptor of the father could not hear with indifference the applause which all France bestowed on the preceptor of the son; nor listen without envy to the accents of gratitude which echoed from every corner of the realm to the man to whom the people owed the prospect of a wife and beneficent reign. Although Fenelon never refused submission to Bossuet in matters of religious doctrine, this would not suffice. The latter found, that if he did not pull down Fenelon, he must see himself eclipsed; and hence he became his unrelenting persecutor. The disgrace of Fenelon is the real object, but the interests of religion are the shallow pretence; no tie, human or divine, restrained the prelate of Meaux; but conscience, honour, decency, all were set aside, that the ruin of his rival might be accomplished. In order to effect this plan, Louis XIV. must act the part of an abject tool, and Madame de Maintenon be guilty of base treachery; venerable prelates must contradict their solemn acts, and degrade and dishonour themselves; the Abbé Bossuet, the prelate's own nephew, and another ecclesiastic, must circulate the grossest falsehoods and the foulest calumnies; the court must sacrifice, and throw on the wide world, most meritorious characters, in order to terrify Rome, and influence it in its judgment; the empty pompous monarch must bully the pope; and the see of Rome itself must be vilified, and pronounce a decision against its judgment, to insure a nefarious triumph to the bishop of Meaux over the archbishop of Cambray. A sentence of a tribunal, which his arts and practices had degraded at the expense of the costly sacrifices, already enumerated, issued against his adversary; but the tribunal of the public avenged the injustice; and the genius of Fenelon secured a victory to his innocence, in which distant empires, and succeeding generations have felt participation and joy.

The origin of these differences between the two prelates must be traced to the connection formed by Fenelon, at a preceding period, with Madame de Guyon, and to his having afterwards adopted and defended her peculiar sentiments. (See GUYON.) When they were first announced, Fenelon had conceived prejudices against them, but on his return from his mission into Poitou, he had the curiosity, on passing near Montargis, to pay a visit to M. Guyon, and to inquire into her course of life. The report he received was very favourable, and the statements that were made to him of her piety and charity removed his prejudices, and induced him to imbibe her mystical tenets. Indeed, Fenelon seems to have had an early taste for mystical devotion, and to have particularly

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particularly studied the writings of those who cherished it. On further acquaintance with M. Guyon, he was confirmed in this predilection. But when the "quietism" of this devotee excited attention, and became a subject of conversation and inquiry, Fenelon advised her, as it has been supposed, to submit her doctrine and conduct to the judgment of Bossuet, who is said to have treated her with great kindness, and to have gained her confidence to such a degree, that she put into his hands her printed works, and also a manuscript life, containing many extravagances; though she had never placed the same kind of confidence in Fenelon. Bossuet, however, being dissatisfied, he demanded to be judged by commissaries; and the bishop of Chalons, and M. Tronson, director of St. Sulpice, were added to the bishop of Meaux, in order to examine her case; and with them was afterwards associated Fenelon, on his elevation to the see of Cambrai. These commissioners met at Issy, the country-house belonging to St. Sulpice, and discussed the tenets of M. de Guyon: and as Bossuet was an entire stranger to the mystical writers, he desired Fenelon to supply him with a selection of them, and in order to aid his judgment, the archbishop of Cambrai furnished him with comments and remarks. These comments and remarks first excited the orthodox prelate's suspicion of the other's partiality to their principles and maxims. Indeed, Fenelon avowed and defended his doctrine of the disinterested love of God, without any reference to eternal happiness as a reward; while Bossuet contended that a reference to the reward was a specific motive to it, but hesitated to pronounce that Fenelon's notion was erroneous. After the conference at Issy, Bossuet had employed himself on a work which was intended to demolish "Quietism," and which he intitled "the State of Prayer." When M. Guyon was arrested, Fenelon resolved not to become a party to the publication of this work, though Bossuet had previously desired it, nor to give it his testimonial. He also induced Madame de Maintenon, the bishop of Chartres, and the cardinal de Noailles, to approve his refusal, on condition that he should publish a tract on the points in dispute, in which he should state his own opinion. This agreement produced the famous book which was the cause of all his troubles, *viz.* "The Explication of the Maxims of the Saints," 1697. With Bossuet for an enemy, and M. de Maintenon and the king averse to him, it was difficult for an honest man to write a treatise which should stand the test of orthodoxy; but having fulfilled an imprudent engagement, Fenelon submitted his composition to the cardinal of Noailles, the bishop of Chartres, M. Tronson, and other theologians of high authority, admitting all their corrections: and all these persons not only approved it, but some of them highly commended it. Thus fortified, the book was ushered to the public, and it must be owned that it met with universal disapprobation. Bossuet was his most malignant adversary, and stirred the king, not partial to Fenelon before this event, and the whole court against him. The prelates of Paris and Chartres, and the other divines who had given their sanction to the "Explication," joined in the cry against the book. The archbishop, thus overpowered by his perfidious friends and open enemies, was banished to his diocese. About this time his palace at Cambrai, with all its furniture and books, was consumed by fire. He sustained the loss with unexampled firmness and tranquillity: for when news was brought him of the catastrophe, he observed, "That it was better all these should be burned, than the cottage of one poor family." Bossuet persisted in his enmity, and determined to force Fenelon absolutely to retract the errors of the work which had

caused such an alarm and outcry. Fenelon, on the 27th of April, 1697, referred his publication to the judgment of the pope; and declining the conferences which Bossuet proposed, he adhered to his purpose of appealing to Rome. In the mean while his enemies pursued him with implacable violence; and he received a mandate from the king, dated August 1, 1697, commanding him to retire to his diocese, and there to remain. Every measure was adopted, which the malignity of Bossuet could suggest, for enforcing a sentence of condemnation at the court of Rome; till at length the reluctance of that court was overcome, and pope Innocent XII. was prevailed upon, in 1699, to issue a brief of censure against Fenelon's work, and 23 propositions extracted from it. The archbishop himself testified the most profound submission to the sentence of the holy see, read his own condemnation from the pulpit, and composed a "mandement" against his book. He even caused to be represented, for the exposition of the sacrament a sun borne by two angels, one of whom trampled under foot some heretical books, among which appeared the title of his own. This was almost, as a man of wit called his conduct on the occasion, "the coquetry of humility;" it had, however, all the appearance of sincerity, and his whole after-conduct was conformable to it. When the news arrived of the condemnation of his work at Rome, he was preparing to mount the pulpit; and to deliver a discourse suitable to the solemnity of the day, which was the festival of the Annunciation; but after a few moments of recollection, he changed his purpose, and made his discourse turn solely on the submission which is due to superiors. His numerous audience had been previously apprized of the fact; and the admirable presence of mind, the self-command, and the religious calm, which he displayed, fulfilled every countenance with tears of sympathy, respect, and admiration. So highly pleased was the court of Rome with the obedience of the archbishop of Cambrai, that the whole college of cardinals petitioned the pope to send a complimentary letter in his own name to the pious and venerable prelate; but the Abbé de Meaux no sooner heard of this design, than he caused the papal epistle to be frittered down to a few cold expressions of regard. So amiable, indeed, was the whole deportment of Fenelon, that a celebrated writer said of him, "I know not whether Fenelon was a heretic in asserting that God ought to be loved for himself, but I know that Fenelon deserved to be so loved." In his diocese he united the characters of a nobleman and of a Christian pastor. In the latter capacity nothing could surpass his simplicity of manners, his charity, his minute attention to all his duties, his fervent piety united to indulgence and moderation. He visited the cottages of the peasants in the most condescending manner, and administered consolation and relief in their distresses. When they were driven from their habitations by the alarms of war, he received them into his house, and even served them at his table. To one of his clergy, who assumed merit to himself for having abolished the Sunday dances of the peasantry in his parish, he said, "M. le Curé, let us not dance, but let us permit these poor people to amuse themselves; why should we hinder them from forgetting for a moment how wretched they are?" His hospitality was boundless, and bleued with the most genuine politeness. During the war his house and table were open to all officers, many of whom, when sick and wounded, he lodged and provided with every kind of necessary relief. Besides his constant hospitalities to the military, he performed a most munificent act of patriotism after the disastrous winter of 1709, by opening his granaries, and distributing gratuitously to the soldiers corn to the value of 100,000 livres.

We may reckon it among the most pleasing anecdotes of modern war, that the duke of Marlborough, and the other generals of the allies, when in possession of that part of Flanders, expressly exempted the archiepiscopal lands of Cambrai from all pillage or exaction, regarding them as devoted to the purposes of common beneficence. They frequently paid their respects to the worthy prelate, and always received from him the strongest impressions of esteem and admiration. Among the illustrious visitors who resorted to Cambrai to render homage to its venerable archbishop, was "The young Pretender;" and from the conversations of Fenelon with this prince, it appears that the prelate was a warm admirer of the British constitution. When he advises him, if he should ever regain the throne of his ancestors, never to constrain his subjects to change their religion, he says, "No human power can force the impenetrable intrenchments of the freedom of the mind. Violence can never persuade men, it only makes hypocrites. When kings interfere in matters of religion, instead of protecting her, they reduce her to slavery. Give to all, then, civil liberty; not as regarding every thing as indifferent, but as enduring with patience what God permits." Referring to the political constitution of the state, he asks, "Is not the sovereign sufficiently powerful? If we say that the king can do nothing without the parliament, is not a monarch happy who is at liberty to do all the good which he chuses, and has only his hands tied when he would do wrong? Every wise prince ought to wish to be no more than the executor of the laws, and to have a supreme council to moderate his authority;" with much more to the same purpose.

The French courtiers were afraid of being known to visit a person lying under the displeasure of their master. This was actually the case; and an incident had happened which placed an insurmountable bar to the restoration of Fenelon to court favour. Besides his delinquency in point of orthodoxy, Fenelon had been guilty of writing "Telemachus," a work which was denounced to the jealous monarch, Louis XIV. as a most daring satire on his reign. Indeed he had never heartily approved of his appointment to be the preceptor of the princes, regarding him rather as a "bel esprit," than a man of the world; and the maxims of Telemachus confirmed him in this opinion. Telemachus saw the light through the infidelity of a servant, who, judging highly of its value, took a copy for himself, while he was transcribing it by the archbishop's order. This MS. he sold to a bookseller; and thus was given to the public a performance that secured a degree of fame to its author which he did not anticipate, and involved him in sufferings which he did not merit. However, he stopped the impression of the work which was going on from a copy thus surreptitiously obtained; and, after the death of the duke of Burgundy, he burned every manuscript of the preceptor which he found among his papers. Besides the offence which Telemachus gave to the king, he had also offended beyond forgiveness Mad. de Maintenon, by his honest advice to the king, when consulted, not to marry her; advice which his majesty had the meanness to betray. The enmity of Louis, arising from these and some other circumstances, may be inferred from the pains which the duke of Burgundy was obliged to take, in order to renew his communications with his preceptor. After four years' silence from the period of the archbishop's disgrace at court, a correspondence began which terminated only with the death of the prince; no less honourable to himself than to his preceptor.

After the death of the first Dauphin, and the great change which consequently took place in the situation of the duke

of Burgundy, Fenelon conceived it his duty to address new counsels to his pupil. He is no longer Mentor, whose gentle and paternal voice teaches the young Telemachus how to reign in the small isle of Ithaca, but the pontiff armed with the power and the majesty of religion, who reveals, in the name of heaven, to the heir of a great empire the fearful duties imposed on him. While flattering courtiers and trembling ministers spoke only of his power, and the splendour of his supreme rank, Fenelon, in his sublime but austere lessons, traces great dangers and great duties. "It is time," says he, in a letter written to his pupil on this occasion, "to render yourself beloved, respected, and esteemed; to become the counsel of his majesty, the father of the people, the consolation of the afflicted, the support of the poor, the stay of the nation, the defender of the church, and the enemy of innovation. Let flatterers be kept at a distance, and no confidence be placed in them; let merit be distinguished, sought, anticipated, and employed; listen to every thing, but believe nothing without proof; and learn to excel all, since you are placed above all. Be the father of your people, and not their master. All must not be for one, but one ought to be for all, to ensure their happiness." The reputation of the pupil reflected the highest credit at this period on his preceptor; it spread from Versailles to the extremity of France; and Fenelon began to enjoy the fruits of his exertions and cares. Fenelon, at this seemingly auspicious period, had the satisfaction of considering that his counsels had never any other object than the prince's glory, and the good of the people whom he was to govern. In this great change of affairs, and which so materially affected the situation of Fenelon, he never diverted his thoughts to himself. However, the ambitious now courted the excellent prelate; and the spring of 1711 produced clear proofs of the change which had taken place. Cambrai became the road to every part of Flanders. Yet with all this attention on the part of courtiers, he conducted himself with so much modesty and so much prudence, that he did not awaken the royal jealousy; prone enough to be excited, and to take offence. As soon as the duke of Burgundy appeared in arms, and took a part in public affairs, the good archbishop became by turns a general, a diplomatist, and a minister; and discerning persons cannot fail to be highly struck with this amazing versatility, and with the excellent counsels which he imparted in each character. According to the plan of government, which he prepared for the consideration of his pupil, and the leading arrangements of which he drew up in the form of tables, enlistment into the army was to be voluntary, and the service was to be for five years.—All officers were to be discharged by principals, and none were to be allowed to serve by deputy.—No reversions of places were to be granted.—Each province was to have its states on the model of those of Languedoc; and the imposition of taxes was to be intrusted to these assemblies. The *gabelle*, and other oppressive taxes, were to be abolished, and such as were more equal to be substituted in the room of them. The *Estates-General* were to be revived, and to be assembled every three years. They were to have only the power of making representations, and the king was to decide. The courts of the feudal lands were to be abolished, and the suitors were to have recourse to the baillages. Commerce was to be free, &c. &c. Three months had scarcely elapsed after these plans had been sketched, when the premature death of the duke of Burgundy extinguished the sanguine hopes which had been so universally indulged. When Fenelon heard the afflicting intelligence, the only words which he uttered were, "all my ties are broken. Nothing now binds me to the earth." In a letter written soon after this

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stroke, he says, among other things, "God has taken away all our hope for the church and the state. He had formed this young prince, he had adorned him, he had prepared him for doing great good, he shewed him to the world, and immediately he has withdrawn him from it; I am struck with horror; and I find myself sinking without any bodily complaint. In weeping over the dead prince, my heart is torn to pieces, but I am alarmed for the living."

The succeeding removals of his friends and admirers, the dukes of Chevreuse and Beauvilliers, were additional blows to his feelings and expectations. Nevertheless, the declining state of the king's health, and the favourable sentiments entertained of him by the duke of Orleans, encouraged his hopes; all which were terminated by a fever, succeeding the accident of being overturned in his carriage, which proved fatal to him in January 1715. One of his last acts was that of writing a letter to the king, concerning the spiritual affairs of his diocese, which alone seemed to be his remaining concern. He expired in perfect tranquillity, deeply lamented by all the inhabitants of the Low-Countries, and especially by the flock committed to his charge. So well had he balanced his worldly affairs, that he died without money, and without a debt. The following portrait of Fenelon is given by the duke de St. Simon in his Memoirs; "He was a tall, lean, well-made man, with a large nose, eyes whence fire and sense flowed in a torrent; a physiognomy resembling none which I have elsewhere seen, and which could not be forgotten after it had once been beheld. It combined opposites; it had both gravity and amenity, seriousness and gaiety, and equally spoke the theologian, the bishop, and the nobleman. His prevailing expression, as well as that of his whole person, was sense, sagacity, grace, decorum, and especially elevation. It required an effort to cease to look at him. His manners were corresponding; they were marked with that ease which makes others easy, with that taste and air of good company which is only acquired by frequenting the great world. He, moreover, possessed a natural, sweet, and flowery eloquence; an insinuating, but noble and distinguishing politeness; a ready, clear, and agreeable elocution; a power of making himself understood upon the most perplexed and abstract subjects. With all this he never chose to appear wiser or wittier than those to whom he spoke, but descended to every one's level, with a manner so free and enchanting, that it was scarcely possible to quit him. It was this rare talent which kept his friends so closely attached to him, notwithstanding his fall; and which, during their dispersion, assembled them to talk of him, to regret him, to long for his return, and to unite themselves to him more and more." The principal works of Fenelon are as follow; viz. "Sur le Ministère des Pasteurs," and a treatise: "De l'Education des Filles," both printed in 1688, "Maximes des Saints sur le Vie interieure" 1697, already noticed as the ostensible occasion of his dispute with Bossuet; "Dialogues of the Dead," two vols. 12mo. "Dialogues on Eloquence in general, and on that of the Pulpit in particular, with a letter on Rhetoric and Poetry," 12mo.; the latter being addressed to the French academy, of which he became a member in 1693; "Philosophical Works, or Demonstration of the Existence of God by natural proofs," 12mo.; "Letters on different Religious and Metaphysical Subjects," 12mo.; "Spiritual Works," four vols. 12mo.; "Sermons," 12mo.; several pieces in favour of the bull Unigenitus and the Formulary. "The most touching charin," says M. d'Alembert, "of his works, is the sensation of peace and repose with which he inspires his reader; he is a friend who joins himself to you, who sheds his soul

into yours, who tempers, and at least for a time, suspends your troubles and afflictions." In his theology he seems to give greater scope to feeling than to reason, which sufficiently appears from his connection with Madame de Guyon, and his predilection in favour of "Quietism;" but if he inclined to mysticism, and thus seemed to deviate from the established system of his church, he does not appear to have made the least approach to protestantism. On the contrary, no one has more forcibly inculcated the danger of putting the scriptures into the hands of the people, (a fundamental tenet of popery,) than Fenelon has done in his "Letter to the Archbishop of Arras." Submission to the decisions of the holy see is likewise exemplified in his whole conduct as well as in his writings.

Indeed, Fenelon seems to have been one of those, who, either from early prepossessions, or from false reasonings upon human nature, or from an observation of the powerful impressions made by authority on the credulity, and a pompous ritual on the senses of the multitude, imagine, that Christianity, in its native form, is too pure and elevated for vulgar souls; and, therefore, countenance and maintain the absurdities of popery, from a notion of their utility.

Fenelon also wrote against the Jansenists; partly to please the court-jesuits, with views of conciliation, but principally, because their doctrine, which he termed "pitiless" and "overwhelming," was directly opposite to his own religious sentiments. "God," said he, "is to them only the "terrible" being; to me he is the "good" being: I cannot resolve to make him a tyrant who first fetters us, and then commands us to walk, and punishes us if we do not." He was, however, though inimical to their opinions, indulgent to their persons, and never permitted them to be persecuted; and when it was represented to him that the Jansenists were his avowed enemies; "that," said he, "is an additional reason for tolerating and pardoning them."

Of all Fenelon's writings his "Telemachus" was the most interesting and popular. It has been published in a great variety of forms, and translated into most modern languages. It is properly an epic poem in prose, and intended to be the institute of a prince, to which purpose it is admirably adapted: for never were purer, more useful, and more elevated maxims of public and private conduct offered to the heir of a monarchy. Louis XIV. could not have more severely satirized himself than by proscribing such a picture of wise and humane government, and of the evils proceeding from unjust ambition and ostentatious profusion. What were the author's views in composing this work appear in a memorial which he drew up after the death of Bossuet, his principal enemy, in order to dissuade his friends from attempting to restore him to court: "God is my witness that I wrote the condemned book solely for the purpose of rejecting the errors and illusions of Quietism; and as to Telemachus, it is a fabulous narrative in the form of an heroic poem, like those of Homer and Virgil, in which I have introduced the principal actions that become a prince who is destined to govern. I composed this work at an epoch in which I was honoured with marks of the king's confidence and favour; and I must not only have been the most ungrateful of men, but the most graceless, had I ever designed to introduce into it satirical and offensive portraits. I abhor the very thought of such an intention. It is true that I interwove in those adventures all the truths which are necessary for government, and all the faults which may be committed by the sovereign power; but I stated none of them so as to form portraits and characters; and the more the work is read, the more it will appear that it was my plan to do justice to my subject, without painting any

any individual in particular. The narration was composed in haste, in small parts at a time, and on different occasions; it affords much room for correction; and the printed copy is moreover not conformable to the original. Yet I have preferred the letting it remain imperfect and disfigured to printing it exactly as I wrote it. I thought only of amusing the duke of Burgundy, and of instructing him while I amused him, without ever obtruding the work before the public; and all the world is aware that its appearance was occasioned by the infidelity of one of my domestics. All the king's best servants know what my principles of honour and religion are, with respect to the sovereign, the state, and the country, and what a lively and grateful recollection I retain of his majesty's favours." Telenachus, as a work of invention, says Dr. Aikin, has great merit, and is read with pleasure for the beauties of its style, and the elegance of its fictions, by those who are little interested in its political lessons. Moveri. Mem. du Duc de St. Simon. Eloges Academ. par d'Alembert. Histoire de Fenelon, &c. par M. L. F. de Bauffet, late bishop of Alais, &c. 3 vols. 8vo. Paris, 1808. Mosheim's Eccl. Hist. vol. 5. Gen. Bio. Monthly Review, vols. 57, 58, 59.

FENERA, a small island in the gulf of Venice, near the coast of Istria. N. lat. $44^{\circ} 54'$. E. long. $14^{\circ} 8'$.

FENESTRA, in *Anatomy*, a name given to two small holes which appear in the cavity of the tympanum, and which are distinguished from each other by the epithets *rotunda* and *ovalis*. See EAR.

FE'NE'TRANGE, in *Geography*, a town of France, in the department of the Meurthe, and chief place of a canton in the district of Sarrebourg, seated on the Sarte, formerly the capital of a lordship of the same name, which being vested in the duchy of Lorraine, was ceded with it to France; 33 miles E.N.E. of Nancy. The place contains 1355, and the canton 9923 inhabitants, on a territory of $217\frac{1}{2}$ kilometres, and in 21 communes.

FENGELD, in our *Ancient Writers*, is used for a tax or imposition raised for repelling of enemies.

It comes from the Saxon *feind*, an *enemy*, and *geld*, *money*.

FENG-HOA, a town of Asia, in the kingdom of Corea; 25 miles W.S.W. of Ping-hai.

FENIT, in *Geography*, a small island on the western coast of Ireland, in the bay of Tralee, county of Kerry.

FENKI, a town of the kingdom of Corea; 36 miles N.N.W. of Long-konang.

FENNEL, in *Botany*. See ANETHUM.

FENNEL, in *Gardening*, the common name of a well known plant of the tall growing culinary kind. See ANETHUM.

There are three sorts of this plant, Common Fennel, Sweet-Fennel, and Finocchio.

Common fennel has a strong fleshy root that penetrates to a great depth in the soil, and which continues for several years. It is capable of being raised in moist soils and situations.

Sweet fennel does not rise so high in the stem as the common sort, and the leaves are more long and slender, and do not terminate in so many points. The seeds have greater length, and are more light in their colour. They are usually brought from Germany and Italy.

Finocchio has been long in cultivation in Italy as a salad herb, but is rather strong to the palate. It is said to have been brought from the Azonian islands. See ANETHUM and FINOCHIO.

FENNEL, in the *Materia Medica*. See ANETHUM *fa-niculum*.

FENNEL-flower, or, *Devil in a Bush*. See NIGELLA.

FENNEL-flower of Crete. See GARIDELLA.

FENNEL-giant. See FERULA.

FENNEL, Hog's. See PEUCEDANUM.

FENNEL, Scorching. See THAPSIA.

FENNEL, Sea. See CRITHMUM.

FENNY RIVER, in *Geography*, a branch of the Ganges, which discharges itself into the bay of Bengal. N. lat. $22^{\circ} 49'$. E. long. $91^{\circ} 33'$.

Another branch of the Ganges, which runs into the same bay, is called "Little Fenny river." N. lat. $22^{\circ} 51'$. E. long. $91^{\circ} 29'$.

FENNY-Stratford, a small decayed market-town in the hundred of Newport, and county of Buckingham, England, is situated on the road to Liverpool, (the ancient Watling street,) and is partly in the parish of Bletchley, and partly in that of Simpton. The town consists of one principal street on a rising ground, with a stone bridge over the river Lofield. The chapel, which is in Bletchley parish, having been dilapidated ever since the reign of queen Elizabeth, was rebuilt in 1724 by subscriptions, procured by the exertions of Browne Willis. Fenny-Stratford is 46 miles from London, and contained, according to the late return to parliament, 81 houses, and 469 inhabitants. It had from time immemorial a market on Mondays, which was confirmed by charter in 1609; being discontinued during the civil war, it was revived after the restoration. In 1665 this town was much depopulated by the plague, of which 139 persons died; the inns were shut up, and the road was for a time turned into another direction: this calamity also proved fatal to the market, which has never flourished, and has for many years fallen into disuse. Four fairs are annually held; a grant for one was procured in the year 1269, two others were established by the charter of 1609. An act of parliament was passed in 1790 for inclosing the hamlet of Fenny-Stratford. Lysons's *Magna Britannia*, vol. i. 4to.

FENTE', a town of Egypt; 15 miles N. of Abu-Girgê.

FENTON, EDWARD, in *Biography*, who flourished in the reign of Elizabeth, was descended from an ancient family in Nottinghamshire, where he had some property, which he sold, as did also his brother Geoffrey, being, it is said, more inclined to trust to their abilities, than the slender patrimony descended to them from their ancestors; and they were, says an accurate observer of mankind, among the very few of those who take such daring resolutions in their youth, without living to repent of them in their old age. The inclination of Edward led him to the choice of a military and active life, and he served some time with reputation in Ireland, but upon sir Martin Probisher's report of the probability of discovering a north-west passage into the South seas, he resolved to embark with him in his second voyage, and was accordingly appointed captain of the Gabriel, a bark of twenty-five tons, in which he accompanied sir Martin in the summer of the year 1577, to the straits that now bear his name, but in their return he was separated from him in a storm, and arrived safely at Bristol. In a third expedition, which proved unsuccessful, he commanded the Judith, one of fifteen sail, and had the title of rear-admiral: the miscarriage of this voyage had not convinced Fenton of the impracticability of the project; he solicited another trial, and it was, after much application, granted him, though the particular object of this voyage is not easily discovered; his instructions from the privy-council, which are still preserved, say, that he should endeavour the discovery of a north-west passage, and yet he is told to go by the Cape of Good Hope to the East Indies,

thence to the South seas, and to attempt his return by the supposed north-west passage, and not by any means to think of passing the straits of Magellan, except in case of absolute necessity. The truth appears to be, he had interest enough to be allowed to try his fortune in the South seas. He sailed in the spring 1582, with four vessels, and was making to Africa, thence he intended to sail to Brazil, in his course to the straits of Magellan, but having learnt that there was already a strong Spanish fleet there, he put into a Portuguese settlement, where he met with three of the Spanish Squadron, gave them battle, and after a severe engagement, sunk their vice-admiral, and returned home. Here he was well received, and appointed to the command of a ship sent out against the famous Armada. In some accounts of this action he is said to have commanded the "Antelope," in others the "Mary Rose," but his talents and bravery in the action are universally acknowledged, and it is certain he had a very distinguished share in those actions, the fame of which can never be forgotten while England remains, as we trust she ever will, a free and independent state. Little more is recorded of him than that he spent the remainder of his days at or near Deptford, where he died in 1603. A monument was erected to his memory in the parish church of Deptford, at the expence of Richard earl of Cork, who had married his niece. According to Fuller he died within a few days of his mistress queen Elizabeth, and he remarks; "Observe how God set up a generation of military men both by sea and land, which began and expired with the reign of queen Elizabeth, like a suit of clothes made for her, and worn out with her; for providence designing a peaceable prince to succeed her, in whose time martial men would be rendered useless, so ordered the matter, that they all, almost, attended their mistress, before or after, within some short distance, unto her grave." *Biog. Brit.*

FENTON, *Sir* GEOFFREY, brother to the above, being inclined to books rather than the bustle of a military life, became a learned and elegant writer, and an active, able statesman, privy counsellor, and secretary of state in the kingdom of Ireland. We find him a privy counsellor in the year 1581, under the patronage of Arthur lord Grey, then lord-deputy in that kingdom. He not a little strengthened his interest at court by his marriage with Alice, daughter of Dr. Robert Weston, the lord chancellor of Ireland; and it should seem that he required only an opportunity to display his talents to make his own way. When once he was fixed in his office of secretary, he rendered himself so useful to the governor, that none of the changes to which that government was subject caused any alteration in his situation; and he never failed to use his power and influence for the interest of his country. He took every opportunity of persuading the queen that the Irish were to be governed only by the rules of strict justice, and that the safety and glory of her government in that island depended on her subjects enjoying equal laws and protection of their property. The queen frequently sent for her secretary, Fenton, to consult with him on her Irish affairs, which were sometimes in a most difficult and alarming situation; this shews the high opinion the entertained of his understanding, though it often happened that when he was returned to his duty, the advisers of Elizabeth persuaded her to adopt measures the reverse of what Fenton had recommended. He was the means of extinguishing more than one rebellion, and of totally reducing the kingdom to submit to English government. In 1603 *sir* Geoffrey married his only daughter to Mr. Boyle, afterwards earl Cork, which proved to all parties a source of great satisfaction. At this period, *viz.* the ac-

cession of James I. to the throne, the zeal and high services of *sir* Geoffrey Fenton procured him the entire confidence of *sir* Arthur Chichester, the new lord deputy. He continued to hold his office in full possession of his credit and authority till October 1608, when he died at his house in Dublin, and was interred with every mark of respect in the cathedral church of St. Patrick, leaving behind him the character of a polite writer, an accomplished courtier, an able statesman, and true friend to his country. He was perfectly acquainted with the French, Spanish, and Italian languages, and his translations from them are supposed to have first brought him into the notice of persons of rank and consideration at court: the translations mentioned in the *Biographia Britannica* are, 1. An Epistle to the Pastors of the Flemish Church in Antwerp, written by Anthony de Carro, 1578; 2. An Account of a Dispute at Paris between two Doctors of the Sorbonne, and two Ministers of God's word, 1571; 3. Golden Epistles, from the Latin, French, and Italian, 1577; and, 4. The History of the Wars of Italy, by F. Guicciardini, in twenty books, 1599. *Biog. Brit.*

FENTON, ELISHA, was born at Newcastle, in Staffordshire, about the close of the 17th century. His father was a gentleman of considerable property; but Elisha being the youngest of twelve children, was destined to a profession, and was accordingly entered at Jesus college, Cambridge. His scruples respecting the terms of conformity precluded him from all expectations of academical honours and ecclesiastical preferment. He left the university with no other prospects than those which his literary talents could afford. At first he engaged in the humble employment of usher to a school in Surrey, and was afterwards master of the foundation school at Seven-Oaks, a school which at this time is in considerable repute, though probably diverted from the intentions of the founder. In 1710 he engaged as secretary to Charles, earl of Orrery, at Brussels, and tutor to his son. He had already given specimens of his talents in poetry, and when his engagement with lord Orrery had ceased, he obtained, through the recommendation of Pope, a situation with secretary Craggs, who, aware of the deficiencies of his own education, wished for a companion, a man of taste and learning, from whom he might acquire occasional instruction. He next undertook, for Pope, the translation of the first, fourth, ninth, and twentieth books of the *Odyssey*, for which he received the sum of 300*l.* His tragedy of *Marianne* rendered him more known; it was performed in 1723, with very great applause, and produced him 1000*l.* with which he was enabled to discharge a debt incurred during his attendance at court; "an instructive comparison," says his biographer, "between the patronage of the public, and that of a king or minister." Thus freed from an embarrassment, that probably hung heavy on his mind, we hear but little more of him as a writer. His exertions in this respect appear to have been more the product of necessity, than the spontaneous effusions of a mind delighted with the employment. He now undertook the domestic education of the son of lady Trumball, widow of *sir* William Trumball: afterwards he went with him to Cambridge, and then resided with the lady herself as auditor of her accounts. Thus easy in his situation, he had recourse to the press only for amusement. To an edition of *Milton's* poems he prefixed a life, written with candour and elegance. He then published a splendid edition of *Waller*, with notes; this was in the year 1729, and in the following year he died at Easthampstead, in Berkshire. His early death was brought on by want of exertion and indulgence. His pupil, lord Orrery, says of him, "Poor Fenton died of a great chair

chair and two bottles of port a-day;" but he adds in attestation of his character, "He was one of the worthiest and modellest men that ever belonged to the court of Apollo. Tears arise when I think of him, though he has been dead above twenty years." Fenton's poetry is little read now, but his "Ode to lord Gower" was pronounced by Pope to be exceeded by none in the English language, except Dryden's on St. Cecilia's day. His tragedy of Mariamne, founded on the story of Herod, as related by Josephus, maintains a respectable rank among dramatic compositions, though it is never acted. Johnson's Lives of the Poets.

FENUGREEK, in *Botany*. See TRIGONELLA.

FENUGREEK, in the *Materia Medica*. The seeds, which are brought to us from the northern parts of France and Germany, have a strong disagreeable smell, and an unctuous farinaceous taste, accompanied with a slight bitterness. An ounce renders a pint of water thick and slimy. To rectified spirit they give out the whole of their distinguishing smell and taste, and afterwards to water a strong flavourless mucilage. These seeds are never given internally; their principal use being in cataplasms and fomentations, for softening, maturing, and discharging tumours; and in emollient gylsters. They were also an ingredient in the "oleum e mucilaginis" of the shops; but this has no longer a place in the pharmacopœia. Lewis, Woodville.

FENY, in *Geography*, a town of China, of the third rank, in Kiaug-hi; 20 miles E. of Yuen-tcheon.

FEO, FRANCISCO, in *Biography*, a Neapolitan composer, and one of the best masters of his time. He may be numbered among the illustrious composers who had immortalized the Neapolitan school, and established its supremacy over all other nations. Its fire, fancy, energy, and expression, and the accuracy of its style, are the characteristics of his composition. No one conducted an orchestra in a superior manner to Feo, who flourished about the year 1740.

FLODAL, FEODALIS, or *Feudalis*, of or belonging to a feud, or fee. See FEE, FEUD, and FEUDAL.

FEODALITY, the fealty paid to the lord by his feudal tenant. See FEALTY.

FEODARY, FEUDARY, or *Feudatory*, an officer anciently made and authorized by the master of the courts of wards. 32 Hen. VIII. cap. 26.

His office was to be present with the escheator, at the finding any office of lands; and to give evidence for the king, concerning the tenure, and the value thereof: to survey the land of the ward after the office found, and rate it. He also assigned the king's widows their dowers, and received the rents of ward's lands. This office is taken away by stat. 12 Car. II. cap. 24.

FEODATARY, or FEUDATARY. See FEUDATARY.

FEODER, a measure for liquids, used throughout Germany. See MEASURE.

FEODITAS, in *Old Writers*, is sometimes used for *fideltas*, or *fealty*, which see.

FEODUM, or FEUDUM, the same with *feif*, or *fee*.

FEOFFMENT, derived from the verb *feoffare*, or *infeudare*, to *enfeoff*, to give one a feud, in *Common Law*, is the most ancient method of conveyance, and signifies a gift or grant of honours, castles, manors, messuages, lands, or the like corporeal or immovable things, to another in fee-simple; that is, to him and his heirs for ever, by the delivery of seisin, and the possession of the thing given. See FEE, and LIVERY.

When this is done by writing, it is called the *deed of feoffment*.

In every feoffment the giver is called the *feoffer*, or *feoffor*, and he that receives, the *feoffee*.

The proper difference in our law between a feoffer, and a donor, is, that the feoffer gives in fee-simple; and the donor in fee-tail. Litt. l. 1. c. 4.

This conveyance is now but very little used, except where no consideration passes, as in case of trustees of lands for a corporation, &c. It is still, however, a formal, valid, and effectual mode of conveyance; but of late years it has been almost entirely superseded by the conveyance by *lease and release*, which see.

FEORME. See FARM.

FEOU-CHAN, in *Geography*, a town of China, of the third rank, in Chan-hi; 20 miles E.S.E. of Pin-yang.

FER de *Fourchette*, *croix a fer de fourchette*, in *Heraldry*, is a cross, having a forked iron at each end, like that formerly used by soldiers to rest their muskets on; by which it is distinguished from the cross fourche; the ends whereof turn forked; whereas in this the fork is fixed on the square ends.

FER de *Moulin*, q. d. *iron of the mill*, is a bearing in heraldry; supposed to represent the iron ink, or ink of a mill, which sustains the moving mill-stone.

FERABOSCO, ALFONSO, the *Younger*, in *Biography*, is said to have been born at Greenwich of Italian parents. He seems to have acquired considerable weight in this country, more from his name and the reputation of his father than real merit. However convinced he may have been himself of his superior abilities, we have our doubts concerning the genius, at least, of this author, though he had the poets and dilettanti all on his side; as his compositions that have come under our inspection seem wholly unworthy of a great professor. The "Ayres," which he published in London, 1609, with an accompaniment for the lute, contain as little merit of any kind as we have ever seen in productions to which the name of a master of established reputation is prefixed: these he dedicated, with no great humility, to prince Henry, the eldest son of James I.

Three herald minstrels, cyceled Ben Jonson, T. Campion, and N. Tomkins, proclaimed the high worth and qualities of these Ayres in three encomiastic copies of verses, prefixed to the work; but these friendly bards, who praise not with a very sparing hand, seem to have less exalted ideas of the author's merit and importance than himself; "For," says he to the prince, "I could now, with that solemn industry of many in epistles, enforce all that hath been said in praise of the faculty of musique, and make that commend the worke; but I desire more, the worke should commend the faculty: and therefore suffer these few Ayres to owe their grace rather to your highness judgment, than any other testimonies. I am not made of much speech; only I know them worthy of my name; and therein, I took paines to make them worthy of yours.

Your highness most humble servant,

Alfonso Ferabosco."

Four of these Ayres are inserted in Burney's General History of Music, vol. iii. The late accompaniment to which is more thorough base, which the chords implied by the figures placed over the base by the editor wholly comprehend.

FERÆ, in *Zoology*, the third order in the MAMMALIA class of animals, or those which suckle their young by means of lactiferous teats: the order is distinguished by having six sharpish fore-teeth in the upper jaw, and tusks solitary. The genera comprehended in this order are *Phoca*, *Canis*,

Canis, Felis, Viverra, Mustela, Ursus, Didelphis, Talpa, Sorex, and *Erinaceus*, which see respectively.

FERÆ *Nature*, in our *Law*, signify birds or beasts that are wild, in opposition to such as are tame; such are hares, foxes, wild geese, or the like, wherein no man may claim a property, unless under particular circumstances, as where they are confined, or made tame, &c. 2 Co. 293. See **GAME**, and **PROPERTY**.

FERAH, or **FARRIE**, in *Geography*, a town of Persia, in Segestan; 90 miles N.N.E. of Zareng. N. lat. 33° 0'. E. long. 62° 22'.—Also, a river of Persia, which runs into lake Zere, at Neubendum, in Segestan.

FERAHAM, a town of Persia, in the province of Irak; 72 miles E.N.E. of Nehavend.

FERALIA, in *Antiquity*, a feast held by the Romans, on the 21st of February, in honour of the dead, or of the *Dii Manes*. Vide *Mem. Acad. Inscript. tom. i. p. 4*.

Varro derives the word from *inferi*, or from *fero*; on account of a repast carried to the sepulchres of those to whom the last offices were rendered on that day. Festus derives it from *ferio*, on account of the victims sacrificed. Vossius observes that the Romans called death *fera*, *cruel*, and that the word *feralia* might arise thence.

Macrobius, *Saturn. lib. i. cap. 13*, refers the origin of the ceremony to Numa Pompilius. Ovid, in his *Fasts*, goes back as far as *Æneas* for its institution. He adds, that on the same day a sacrifice was performed to the goddesses *Muta*, or *Dumb*; and that the persons who officiated were an old woman, and a number of young girls who attended her. This feast sometimes continued for several days; and at its termination friends and relations kept a feast of peace and love, for settling differences and quarrels among one another, if any such existed.

FERAN, in *Geography*, an island in the North Pacific ocean, near the S. W. coast of Quadra and Vancouver's island, about 16 miles in circumference. E. long. 234° 17'.

FERANZA, a town of Naples, in the Basilicata; 4 miles N.W. of Acerenza.

FERASTAK, or **FERESTACK**, a town of Egypt; 14 miles S.S.E. of Faoué.

FERBANNA, a town of Africa, in the kingdom of Bambouk, 40 miles N.W. of Bambouk. N. lat. 13° 45'. E. long. 9° 58'.

FERBANNA Tenda, a town of Africa, in the country of Dentila, on the W. bank of the river Falême, 65 miles S.W. of Bambouk. N. lat. 12° 46'. W. long. 12° 6'.

FERBAR, or **FERLEBR**, a town of Great Bucharia, on the Gihon, opposite to Amu.

FERCULA, or **FORCULA**, a town of Africa, and principal place of a district, in the country of Tafilet; 50 miles W. of Sugulmassa. N. lat. 31° 40'. W. long. 4° 36'.

FERD-WIT, or **FERD-Wite**, in our *Ancient Customs*, a formulary, by which the king pardoned manslaughter committed in the army.

The word is formed of the Saxon *ferd*, *army*, and *wite*, *punishment*.

FERDFARE, from the Saxon *ferd*, *army*, and *fare*, *journey*, in our *Old Writers*, is used for being discharged from going to war.

FERDINAND I., in *Biography*, emperor of Germany, second son of Philip, archduke of Austria, by Joanna of Castile, was born in Spain in 1503, and being educated in his native country became a greater favourite with the Spaniards than his elder brother Charles V. He was encouraged to expect the regency of Arragon from his grand-father Ferdinand the king, who was persuaded to alter his last will in

favour of another. The young prince shewed symptoms of discontent at the change; and, being brought to Madrid, he was kept under the vigilant eye of cardinal Ximenes. Some time afterwards, he was sent to Germany to visit his grand-father Maximilian. Here he married Anne, daughter of Ladislaus, king of Hungary and Bohemia, and Charles immediately settled on him both Austria, and all the domains appertaining to that house in Germany. When his brother-in-law, Lewis, was slain at the battle of Mohatz, in 1526, Ferdinand laid claim to, and obtained, the crowns of Hungary and Bohemia. Through the influence of his brother, then emperor, he was elected king of the Romans in 1531, notwithstanding the opposition of the Protestant electors of Saxony and Brandenburg. Hungary, in the mean time, was invaded by the Turks, with the count of Scopus at their head, who eventually gained possession of a great part of the country. Ferdinand thought it advisable to treat, and to allow the count all he had acquired, with the title of king of Hungary, during his life, but at his demise it was to revert to himself. At his death, however, a great part of the nation recognized his son by the name of king Stephen. Ferdinand now attempted to enforce by arms the performance of the treaty, but Solyman, the Turkish emperor, joined the Hungarians, defeated the forces of Ferdinand, and seized a great part of Hungary for himself. After this, Ferdinand submitted to pay him a tribute for the portion he still held. His attempts to extend his prerogatives in Bohemia, and render its crown hereditary, together with the progress of the reformation in that country, having occasioned an armed confederacy against the royal authority; Ferdinand, at the head of a body of imperial troops, dispersed it, and disarming the people, reduced them to greater subjection than before. He treated the city of Prague with great rigour, and abolished its ancient privileges. In 1551 he invaded Transylvania, and obtained possession of it by the resignation of queen Isabella, mother of Stephen; this province was, however, soon wrested out of his hands by Solyman, who recovered it for Isabella in 1553. Charles, as we have seen, obtained for Ferdinand the title of king of the Romans, but now, on account of his boundless ambition, he was desirous of transmitting the imperial crown to his own son Philip. Afterwards, indeed, he committed the management of his German affairs almost entirely to Ferdinand, who opened the diet of the empire at Augsberg in 1555. In this, toleration was granted and confirmed to Protestants, and the peace of religion was for a time established. Charles again attempted to persuade his ambitious brother to renounce the succession in favour of Philip, but his intreaties were of no avail; he therefore, in 1556, executed a deed of resignation of the empire, and at the diet of Frankfort, in February 1558, Ferdinand was unanimously declared emperor. The pope, Paul IV. refused to acknowledge the resignation of Charles, and succession of Ferdinand, because the content of the holy see had not been previously obtained. His successor Pius IV. did, however, recognize the new emperor. In his character of emperor, Ferdinand attempted to reconcile the Protestants to the Catholic church; his endeavours were unavailing, but he was successful in securing the succession to his son Maximilian. It is highly to his credit that he preserved the public peace of the empire, made a truce with the Turks of eight years, and terminated a dispute between the kings of Denmark and Sweden. He died at Vienna in 1564, leaving behind him four sons and eleven daughters. Ferdinand was undoubtedly ambitious, but he was justly famed for his remarkable equity, prudence, munificence, and unwearied application to business. He ever piqued himself on a rigid

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observance of his word and gave a striking instance of his punctuality in that respect, by bestowing a favour on an officer, who, after the promise, had proved himself unworthy of it. "I owe," said the monarch, "a greater respect to my word, than to the merits of him to whom I pledged it." Robertson Ch. V.—Univerf. Hist.

FERDINAND II. emperor, grand-son of the preceding, son of Charles, archduke of Stiria, by Mary of Bavaria, was born in 1578, and elected king of Bohemia in 1617, and king of Hungary in the following year; but the religious disputes in Bohemia having caused a revolt, Ferdinand was deprived of the kingdom soon after the death of his cousin, Matthias, by whose influence he had been originally chosen. He was, however, at the same time, appointed to the succession of the empire, and in the character of emperor he found it necessary to form a Catholic league, in order to oppose that of the Protestants who supported the elector Palatine. That unfortunate prince was completely defeated at the battle of Prague in 1620, in consequence of which Bohemia was obliged to submit to its former master. The leaders were put to death, and the exercise of the Protestant religion was entirely suppressed. Ferdinand carried his resentment against the elector so far as to put him to the ban of the empire, and to invade the Palatinate, which, by means of his general, count Tilly, he entirely conquered, and then transferred the electoral dignity to Maximilian, duke of Bavaria. He was now become so formidable to the Protestant party, that a league was formed against him in the north of Germany, headed by Christian IV. king of Denmark. Ferdinand, however, triumphed over all his enemies, and then turned his attention to the affairs of Italy, where the death of Vincent, duke of Mantua and Montferrat, had left a disputed succession. The Austrian troops invaded and took Mantua, while their allies, the Spaniards, took Casal, which was defended by the French. In the confidence which these successes inspired, the emperor took the most hostile measures against the Protestants; these in their turn applied to Gustavus Adolphus, king of Sweden, who was not only brave, but the professed enemy of the house of Austria. A league was formed, to which the king of France acceded, and almost before the emperor was apprised of his danger, a war broke out, which reduced the house of Austria to the greatest extremities, but he was enabled to make peace in 1635 with the elector of Saxony and most of the Protestants. In the following year, at the diet held at Ratisbon, the emperor procured his son Ferdinand to be elected king of the Romans, and in February 1637 he died in the fifty-ninth year of his age, after an anxious and unquiet reign of eighteen years. By the performance of several vows which he made against the Protestants, he acquired the appellation of the Apostolic Emperor. He is much applauded by Roman Catholic writers, but his conduct as emperor has little claim to praise. Mod. Univer. Hist.

FERDINAND III. emperor, son of the preceding, was born in 1608, and succeeded to the empire on the death of his father: he happily tranquillized the interior of Germany, but had the mortification to perceive that the flames of war continued to rage with unabated fury on the frontiers, and that the calamities of the people were prolonged by the abilities of the generals employed. These distinguished themselves by their gallant conduct, and the hostile sovereigns, depending on unfailling resources in their commanders, were but little alarmed by occasional defeats. Hostilities were consequently carried on with vigour, and the ill-fated inhabitants of Germany still groaned beneath the yoke of oppression. Various attempts were made to negotiate, and at length, in 1648, the peace of Munster was

concluded, which has served since as the political basis of the Germanic constitution. By this treaty the king of Sweden acquired a large part of Pomerania, with the dignity of prince of the empire: the king of France became landgrave of Alsace, and the Lutheran and Calvinistic religions were placed upon an equal footing of authority with the Roman Catholic. A variety of other conditions were agreed on relative to the states and princes of Germany, which were received into the fundamental law of the empire. The pope opposed that part of the treaty which allowed the religious claims of the heretics, but his remonstrances were disregarded. The emperor procured the election of his eldest son to the dignity of king of the Romans, in 1652, but that prince's death not long after left the succession undetermined. Ferdinand himself died at Vienna, in 1657, at the age of 49. He was reckoned a mild, humane, and generous prince, attached to religion, a friend to literature, and liberal to those who served him. Mod. Univer. Hist.

FERDINAND I. king of Castile and Leon, the first in whom those crowns were united, was son of Sanchez III. king of Navarre, and of Nugua, heiress of Castile. He was crowned king of Castile, in right of his mother, while his father was living. He married Sancha, daughter of Alphonso V. king of Leon, whose brother Bermudo, when come to the throne, engaged in war with Ferdinand, and invaded Castile. Bermudo was slain in a battle in 1037, and Ferdinand was acknowledged king of Leon in right of his wife. He was now the most powerful monarch in Spain, but he conducted himself with so much moderation towards his various subjects, that he obtained their unanimous attachment. He made war on the neighbouring Moors, and pushed his conquests into Portugal, as far as Coimbra, of which he became master in 1045; making at the same time the kings of Toledo and Saragossa his tributaries. Garcias, his brother, was king of Navarre, and being at this time extremely ill, Ferdinand paid him a visit, but finding that a plan was laid to seize his person, he retired in disgust. The next year Garcias visited him on a like occasion, and was actually detained prisoner: he found means, however, to evade the vigilance of his keepers, and a war ensued between the brothers, in which Ferdinand acted on the defensive. Garcias was killed, and Ferdinand is said to have used the most extreme moderation after the victory, and to have abstained from injuring his nephew, the young king of Navarre. But the queen, desirous of enriching a new church at Leon with the bodies of two virgin martyrs, interred at Seville, caused Ferdinand, without provocation, to make an incursion into the Moorish territory, the inhabitants of which he compelled to do him homage, and to comply with his religious requisition. In the mean time his son Don Sanchez, acting as an ally to the king of Saragossa, defeated Ramiro, king of Arragon, in a great battle. Rodrigo, better known by the name of Cid, commanded under Sanchez on this occasion. After this, in an assembly of the states, he declared his intention of dividing his kingdoms among his three sons. The consequence of this imprudent policy was a revolt of the Moorish dependent kings of Toledo and Saragossa, who refused tribute, and attempted to shake off the yoke. Ferdinand marched against them with a powerful army, but a sudden indisposition obliged him to return to Leon, where he died in the autumn of 1065, leaving a high character for civil and military talents, and for an unblemished private life. Mod. Univer. Hist.

FERDINAND III. king of Castile and Leon, son of Alphonso IX. king of Leon, and Berengara, infanta of Castile, was born in 1200. On the death of the king of Castile,

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tile, in 1217, the right to the crown was recognized by the states to belong to Berengara, his sister, who resigned it to her infant son Ferdinand, whom she caused to be inaugurated in the cathedral, amidst the acclamations of the people, but his father, the king of Leon, marched suddenly an army into Castile, with a view of seizing the regency; he was, however, obliged to retreat. In 1219, the young king Ferdinand was married to Beatrice of Suabia, daughter of the emperor Philip, after which he was engaged for several years in war with the Moorish princes, his neighbours, from whom he took a number of fortresses. In 1230, the king of Leon died, and by his last will divided his dominions between his daughters, which had nearly produced a civil war; for while a part of the states adhered to the infant's cause, the rest, who were the majority, declared in favour of Ferdinand. At length the ladies, in consideration of an ample pension, resigned their rights to their brother Ferdinand, who thus accomplished the re-union of the kingdoms of Castile and Leon, which have never since been separated. Ferdinand concluded a treaty with the king of Portugal, and continued to pursue his plan of reducing the Moors. After a series of enterprizes, most of which were crowned with success, as well by land as by sea, he took Seville in 1248, and in the following year gained possession of all the remaining Moorish towns and fortresses as far as the sea. He next projected the invasion of Africa, but a dropsy put an end to his design, and, in 1252, terminated his life. He had shewn great regard, during his life, to what was then called religion, and he died with all the demonstrations of profound piety and humility, which are inculcated by the Catholic religion, and was, by his subjects, immediately regarded as a saint, though he was not canonized at Rome, and admitted to their calendar till 1671, during the reign of Clement X. He left a large family, and was succeeded by Alphonso X. surnamed "the Wise." See ALPHONSO, or ALONZO X. vol. i. Mod. Univer. Hist.

FERDINAND IV. son of Sancho, succeeded his father in the year 1295, and was solemnly inaugurated in the cathedral church of Toledo. His mother assumed the regency during the minority, and governed with moderation and prudence, though she was much harassed by contending claims, particularly by those of Henry, uncle to the deceased king, who made loud demands for the regency. At length Ferdinand took the government into his own hands, and was married to the infant of Portugal. Henry died without issue, after having rendered himself obnoxious to the greater part of the nation. His estates were all seized by the crown, and so little respect was paid to his memory, that even the rights of sepulture were neglected till the queen interfered, and expressed her intention of following his remains to the tomb. "Let his funeral," said she, "be suitable to his rank, for we ought to remember his birth and forget his faults." War was carried on between Castile and Arragon for some time, and when peace was concluded, Ferdinand resolved to renew the war against the Moors, and urged the expediency of that measure with success, so that the states of Valladolid consented to defray the whole expence of the campaign. A numerous army was assembled by the infant Don Pedro, on the frontiers of Andalusia, and the city of Alcáideta was quickly invested. Upon the arrival of the king at this place, he received information that two persons, of the name of Carvajal, were in custody, and stood charged with the murder of Don Juan Alonso de Benavides. He immediately ordered the prisoners to be thrown from the summit of a rock, without even the form of a trial, though they assured him, in the

most pathetic manner, of their innocence, and even offered to give the most irrefragable proofs of it. When the savage sentence was about to be executed, the sufferers, conscious, perhaps, of their innocence, summoned Ferdinand to answer for his injustice, within thirty days, at the tribunal of God. This appeal had such an effect on the king, that he sickened and died on the last day of that period, which happened in the year 1312. Mod. Univer. Hist.

FERDINAND V. surnamed "The Catholic," son of John II. king of Arragon, was born in 1452, and married, in 1469, Isabella of Castile, sister of Henry IV., at whose decease, in 1474, he was declared king, and Isabella queen, of Castile and Leon. The new sovereigns were proclaimed amidst loud acclamations; and the fidelity of their subjects enabled them to defeat all the designs of their enemies, and to obtain quiet possession of the crown, though not till the event of a civil war had decided in their favour. Ferdinand's father dying in 1479, he succeeded to the crown of Arragon, and thenceforth the kingdoms of Arragon, and those of Castile and Leon, which comprehend all Spain, except Granada, held by the Moors, became inseparably connected and united. Ferdinand and Isabella governed with great prudence, but rather like independent sovereigns than as man and wife; they were not unfrequently jealous of each other in their administration, though they generally acted upon the same principles, and forwarded the same purposes. While they took great pains in giving vigour to their government, and tranquillity to their people, an intemperate zeal led them to introduce that infernal engine of torture, the court of inquisition, into their dominions. It was said, indeed, that it was only intended to take cognizance of the frequent apostacies among Jewish and Mahometan pretended converts, and therefore regarded as a measure equally conformable to the interests of policy and religion. This, however, was but a state trick, for it was soon discovered that it was a court authorized by the pope to decide upon the liberty, fortune, and life of any individual who should be accused of holding heretical opinions, or of expressing any contempt for the ceremonies of the church, without being allowed to offer a defence, or even to be confronted with his accuser. Two thousand persons are said to have suffered death under the savage Torquemada, the first inquisitor general, and a multitude of Jews and Mahometans quitted the country with precipitation to elude a similar fate. To this horrible engine of torture may be imputed all the degradation to which Spain has submitted since that period. The sovereigns who introduced the inquisition little contemplated the miseries they were bringing on their country, or they would have shuddered at the idea; they were in their nature moderate and humane, and at all times caused civil justice to be administered with equal scales without regard to rank or condition. In 1481 they attacked the Moors, and after a war of ten years reduced their kingdom of Granada, and thus the whole of Spain was said to be completely Christian, without perhaps a single individual understanding what was implied by the epithet. Isabella next, for Ferdinand was now become a very secondary sovereign, in the fervour of religious zeal, attacked and expelled the Jews from her dominions. Fortunately for these miserable outcasts of society, they have always been ready to follow a Christian maxim, when persecuted in one city, or state, to flee to another. When Isabella had swept from her dominions all heretics, she had leisure for a project more honourable to her memory; she took a chief concern in fitting out Columbus for the grand expedition, which bestowed a new world on Spain, so little meriting the high honour. (See AMERICA, COLUMBUS, &c.) Another act of this

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reign must not be overlooked; the conquered Moors were at first tolerated in their religion, but it was now determined that, by force, or persuasion, or pious fraud, they must be converted; a short time, in which much blood was shed, proved the absurdity and impracticability of the plan, and Ferdinand compromised the matter by allowing these unhappy people to retire to Barbary, a measure which tended to preserve the peace of the country, but which was injurious in a high degree to its industry and population. The decline of agriculture and manufactures in Spain is dated from this period. In 1502 the archduke Philip, with his wife Joanna, at the desire of Isabella, visited Spain, and were acknowledged by the states of Castile as successors to the crowns of Castile and Arragon. Upon intelligence of a rupture between the emperor and the court of France, the archduke resolved upon returning into his own dominions, notwithstanding the remonstrances of the king, and the entreaties of his wife. He left Madrid on the 19th of December, and gave a fresh cause of offence to his father-in-law, by concluding a treaty with the king of France. In march Donna Joanna was delivered of a son, who was baptized by the name of Ferdinand, but the consequences of her delivery deranged her mind, a circumstance that sunk so heavily in the mind of Isabella, as shortly to bring her to the grave. This event took place in 1504; and though by her will she appointed Ferdinand to the regency of Castile during the minority of their grandson Charles, afterwards the emperor, yet Philip took measures to oblige him to resign in his favour. He enjoyed his power but a short time, dying in Sept. 1506; and his wife being utterly unable to perform the duties of government, the regency was therefore again an object of contest, and the competitors were the emperor Maximilian and Ferdinand. About the close of 1511 Ferdinand sent the duke of Alva, with a small army, to demand a passage through the king of Navarre's territories into France, and, on the rejection of his request, made himself master of Pampluna, and the greatest part of the kingdom; this was supposed to add great lustre to the Spanish crown, and to augment the fame of Ferdinand's admirable policy. He now fell into a languishing habit of body, and a deep melancholy seemed to settle on his mind, which admitted of no diversion, and baffled the skill of the most able physicians, but which nevertheless subsided in a measure when business required his attention. He was still as anxious as ever after power; unwilling even at the approach of death to admit a thought of relinquishing any portion of his authority; he removed from place to place, in order to fly from his disorder, or to forget it, but in vain;

————— “no more than from himself can fly
By change of place.”

He died January 23, 1516, being in the sixty-fourth year of his age. He left his daughter Joanna heiress of all his dominions, and afterwards they were to descend to the grandson Charles. Ferdinand had acquired a high reputation for policy and the art of government, but he was regardless of any engagement: provided it interfered with a new design; he even made his fidelity a subject of boast and merriment. Still, where religion was out of the question, he displayed towards his own subjects much moderation and equity. He was beloved by the lower orders, whom he protected from the oppression of the nobles, and took means to break the power of the feudal nobility. *Modern Univer. Hist.*

FERDINAND VI. son of Philip V. by his first wife Mary of Savoy, was born in 1713, but did not succeed his father till the year 1746, at which time Spain, in union with

France, was engaged in war with England, the empire and their allies. On this occasion he displayed the humanity of his temper by various acts of clemency and beneficence, and at the same time continued to support that system of policy which was the basis of the family compact of the house of Bourbon. He readily joined in the peace of Aix-la-Chapelle in 1748, by which one of his brothers was seated on the throne of the two Sicilies, and the other acquired the duchies of Parma, Placentia, and Guastalla. He gladly employed the return of tranquillity in promoting the internal prosperity of his country; he corrected abuses in the management of the revenue, abolished the burthenome tribunal of the nunciature, reformed the regular clergy, re-established the marine, and encouraged commerce, manufactures, and agriculture. Occupied in these useful and beneficent designs, he refused to join the French court, in 1754, in a new war with England, and disgraced his minister, who endeavoured to change his measures. In private and domestic life his virtues shone with peculiar lustre, and his conjugal attachment was so sincere, that he found it impossible to dispel the deep melancholy which resulted from the loss of his beloved consort. He died in August 1759, when he was succeeded by his brother Charles III. *Mod. Univer. Hist.*

FERDINAND, king of Portugal, was born in 1340, and succeeded his father in 1367. He was extremely handsome, very courteous, cheerful, and liberal; but his levity and fickleness produced the most disastrous consequences to his government and people. He had refused, during his father's life time, a proffered marriage with the daughter of Peter the Cruel, king of Castile; and at his accession sent to compliment Henry count of Trastamere, who had expelled Peter from the throne; yet on the death of Peter he assumed to himself the title of king of Castile, and entered into a war with Henry. Ferdinand, though he had made a league with the king of Arragon, and had actually married by proxy his daughter Leonora, was induced by the mediation of the pope to make peace with Henry, with the condition of marrying his daughter Leonora; but a third Leonora coming in his way, he was led to break his former engagements and marry her. This alliance caused a revolt at Lisbon, and proved the source of much mischief and dissension during his reign. He entered into an alliance with John of Gaunt, duke of Lancaster, who had a claim on the crown of Castile in right of his wife, and engaged in a new war with Henry. In this contest Portugal was overrun, and part of the city of Lisbon was taken and burnt, together with the fleet, and Ferdinand was reduced to make peace again. Misunderstandings between the English and Portuguese, and the natural fickleness of Ferdinand, caused a sudden treaty to be concluded between the two crowns of Portugal and Castile, with a stipulation that the English troops, who had come out to the aid of Ferdinand, should be mutually sent home. Soon after Ferdinand gave his only daughter Beatrice in marriage to the king of Castile, on condition that her children, or her husband, in case she died without issue, should succeed to the crown of Portugal. The nation would not, however, consent to this agreement; they felt their own interest concerned, and spurned the proposal with indignation. Ferdinand was now in weak health, and had other causes of chagrin, besides public disappointment; he sickened, and bore a long and painful disease with much resignation, and died in the sixteenth year of his reign. *Mod. Univer. Hist.*

FERDINAND I. king of Naples, natural son of Alfonso V. king of Arragon, was rendered legitimate by the decree of pope Eugenius IV. and ascended the throne

of Naples on the death of his father, in 1458, and was crowned in the following year. The country was soon involved in a civil war, by the interference of some discontented barons, who demanded John of Anjou as their king. John readily seconded their views, entered the kingdom, and gave Ferdinand a signal defeat, which caused him to be deserted by the greater part of his subjects. He, however, recovered himself, and defeated his adversary at Troia, and, by his subsequent conduct, restored tranquillity to the kingdom. He employed the years of peace in those internal improvements which render a country great and respectable, in the encouragement of learning, arts, and manufactures, and in obtaining for the laws that degree of respect which commands obedience. He assisted pope Sixtus VI. in his designs against Florence, where he had projected the ruin of the family of the Medici. Lorenzo, however, with a magnanimity worthy of him, repaired in person to Naples, and threw himself into the power and under the protection of Ferdinand. This liberal and candid conduct prevailed on the king to conclude an alliance with the Florentines, without consulting the pope. In 1480 the Turks seized on Otranto, but it was recovered by his son Alonzo. To this son, who was totally unfit for government, Ferdinand committed the care of the empire, which excited so much discontent, that pope Innocent VIII. found means to encourage a revolt which threatened the safety of the throne. Ferdinand, in his turn, excited disturbances against the pope in the ecclesiastical state, which brought about peace. Pardon to the barons was one of its conditions; but this part of the treaty was shamefully violated, and many were put to death for their share in the rebellion. Soon after, Charles VIII. king of France, prepared to invade Naples, and Ferdinand, conscious that he had no claim upon the affections and loyalty of his subjects, was much alarmed. He took measures of defence, but in the midst of his cares he was seized with a fit of apoplexy, of which he died in 1494, at the age of seventy-one, leaving his crown to his son Alphonso. The stain of tyranny adheres to his name, but it is allowed that he possessed, in several points, the true wisdom of a sovereign. He was author of many useful laws, was the restorer of the university of Naples, to which he introduced several eminent scholars, and was the author of a volume of orations and epistles. *Mod. Univ. Hist.*

Ferdinand de Cordova, flourished in the fifteenth century, and has been celebrated in subsequent ages for his great learning and almost universal genius. He understood all the oriental languages, as well as Greek and Latin. He was an adept in canon and civil law; in mathematics, medicine, and theology. He is said to have committed to memory the works of the most famous scholars and jurists, and those of Aristotle, Hippocrates, Galen, and Avicenna. To these mental acquirements he added a perfect knowledge of martial exercises, he played upon all musical instruments, and is said to have excelled in singing and dancing. He was at Paris in 1445, commanding the applause and admiration of that metropolis; and, on account of his wonderful powers he was regarded as a foreer, or even as the antichrist. It is not known either when or where he died. Some works on theology and law have been attributed to him. *Moreri*.

Ferdinand de Jesus, a Spanish monk, was born in Andalusia, and embraced the monastic life at Granada in the year 1588. He was a great proficient in the different branches of sacred and profane literature, and was so eloquent, that he obtained the name of "Chrysolom," or "Golden Mouth." He became a celebrated teacher of

theology and morals in the different towns of Spain, and left behind him numerous writings, which are highly esteemed in that country, where his memory is still regarded as well for his piety as for his extensive learning. *Moreri*.

Ferdinandus, Epiphanius, a physician of Messagna, in the territory of Otranto, where he was born October 2, 1569. He cultivated the study of the Latin and Greek poets at an early age, and wrote elegant verses in both these languages. In 1583 he went to Naples with the intention of going through the courses of philosophy and medicine, and remained there, with the exception of six months in the year 159, when all strangers were compelled by the viceroy to leave the territory, until the year 1594, when he received the degree of doctor in medicine and philosophy. He then repaired to his native place, where he settled himself in the practice of his profession, and remained to the end of his life, notwithstanding several honourable offers of distinction from several seats of learning. The duke of Parma, in particular, pressed him to take the professorship of medicine in the university of his city; and the same invitation was given from the university of Padua. He died in 1638, in the sixty-ninth year of his age.

This physician composed a considerable number of treatises, but only the four following are known, as having been printed. 1. "Theoremata Medica et Philosophica," Venice, 1611. 2. "De vita proroganda, seu juvenute conservanda et senectute retardanda," Naples, 1612. 3. "Centum Historiarum, seu Observationes et Casus Medici," Venice, 1621; a treatise which relates to most of the diseases of the body, and is distinguished by considerable erudition. It has been several times reprinted in Germany and Holland. 4. "Aureus de Pelle Libellus," Naples, 1631. *Mangerius. Bibl. Eloy.*

Ferdusi, a celebrated Persian poet, flourished about the year 1020. He was originally only a simple peasant, but, having discovered a natural genius for poetry, he became a disciple of Asfedi, and soon so far surpassed his master as to obtain the admiration of the East. His principal work was entitled "The History of the Kings," containing a narrative, in verse, of the acts of the ancient sovereigns of Persia. It is said to have contained sixty thousand distichs, for each of which he obtained, of the reigning king, the reward of a piece of gold. It is now so much valued, that copies usually sell for more than one hundred crowns. *Moreri*.

FERE, LA, in *Geography*, a town of France, in the department of the Aisne, and chief place of a canton in the district of Laon; situated in a marshy soil, near the river Sarre, which joins the Oise. The adjacent country may be inundated. It was very strongly fortified by cardinal Mazarine, but afterwards dismantled; 16 miles N.E. of Paris. The place contains 2,604, and the canton 14,334 inhabitants, on a territory of 195 kilometres, in 26 communes. N. lat. 49° 40'. E. long. 3° 20'.

FERE-Champenois, a town of France, in the department of the Marne, and chief place of a canton in the district of Epernay; 12 miles E.N.E. of Sezannes. The place contains 1,880, and the canton 7,042 inhabitants, on a territory of 210 kilometres, in 21 communes.

FERE-L'Archeveque, a town of France, in the department of the Aisne, and chief place of a canton in the district of Chateau-Thierry; 10 miles N.N.E. of this place. The town contains 1,884, and the canton 9,883 inhabitants, on a territory of 275 kilometres, in 24 communes.

PEREBE, GEORGE, in *Geography*, a dilettanti musician, who distinguished himself in our country at a barbarous period for every species of secular music. This gentleman was master of arts of Magdalen college, Oxford, 1595. *misiter*

nister of Bishop's-Cummings, Wilts. ; he was a native of Gloucestershire, and well skilled in music. Antony Wood, in the "Falli Oxon." vol. i. col. 150, has given a curious account of him, which we shall insert in his own words. "This person did instruct divers young men of his parish in that faculty (music) till they could either play or sing their parts. In the year 1613 queen Anne, the royal consort of king James I., made her abode for some weeks within the city of Bath, purposely for the use of the waters there. In which time he composed a song in four parts, and instructed his scholars to sing it very perfectly, as also to play a lesson or two (which he had composed) on their wind instruments. On the 11th June, the same year, the queen, in her return from Bath, did intend to pass over the Downs at Wendesdyke within the parish of Bishop's-Cummings, of which Ferebe having timely notice, he dressed himself in the habit of an old bard, and caused his scholars to be cloathed in shepherd's weeds. The queen, having received notice of these people, she, with her retinue, made a stand at Wendesdyke, whereupon these musicians drawing up to her, played a most admirable lesson on their wind instruments, which being done, they sung their lesson of four parts with double voices, the beginning of which was this :

"Shine, O thou sacred shepherd's star
On silly shepherd swaynes, &c."

which being well performed also, the bard concluded with an epilogue, to the great liking and content of the queen and her company. Afterwards, he was sworn chaplain to his majesty, and was ever after much valued for his ingenuity."

FERELE, in *Geography*, a town of Sweden, in Helplingland; 45 miles W.N.W. of Hudwickwall.

FERENTARII, or FERENDARII, among the Romans, were auxiliary troops, lightly armed; their weapons being a sword, bow and arrows, and a sling; which were much less cumbersome than a buckler, battle-axe, pike, &c.

The name seems to have been derived a *ferendo auxilio*; these being auxiliary forces; though Varro thinks they might be so called, because the sling and stones *feruntur, non tenentur*.

We have also mention of another sort of ferentarii, whose business was to carry arms after the armies, and to be ready to supply the foldiers therewith in battle.

Lydius uses the name ferentarii for the *cataphracti equites*, i. e. cavaliers armed cap-à-pée.

FERENTINO, in *Geography*, a town of Naples, in the Capitanata; 11 miles S.S.W. of St. Serviero.—Also, a town of the Popedom, the see of a bishop, immediately under the pope, containing 6 churches and 3 convents; 3 miles N. of Alatri.

FERENZA, a town of Naples, in the Basilicata; 4 miles N.W. of Acerenza.

FERES, a town of European Turkey, in the province of Thessaly; 12 miles W. of Zeiton.

FERET, a town of European Turkey, in Romania; 36 miles N.N.W. of Gallipoli.

FERETORY, in *Hagiography*, the shrine or moveable chest in which the body or the bones of some person of eminent sanctity was deposited in ancient churches. Such feretories were generally ornamented with silver, gold, and precious stones.

FERETRUM, among the Romans, the bier used in carrying out the bodies of the dead; which duty was performed by the nearest male relations of the deceased: thus sons carried out their parents, brothers their sisters, &c. See BURIAL.

FERG, FRANCIS PAUL, in *Biography*, a landscape painter, born at Vienna in 1689, where he studied under different masters. In 1718 he left Vienna, and went to Dresden and Bamberg in company with Alexander Thiele, in whose landscapes he inserted the figures and animals. He afterwards visited England, where, not meeting with the encouragement he had found elsewhere, he became involved in his circumstances, and, according to report, was found dead at the door of his lodgings, exhausted by cold, want, and misery.

The style of Ferg was in imitation of Wouvermans, but has neither the richness nor truth of the latter; his finishing is remarkably neat, and his scenes pleasing, but his colour is generally faint, and often mealy; still, his pictures will always please those who are gratified with practicals, and have taste to admire neatness and delicacy in execution. His pictures are usually small. He etched well in aquafortis, and his prints are eagerly sought for by the curious. He died in 1740 aged 51.

FERGA, ST. in *Geography*, a town of Arabia, in the province of Hedjas; 75 miles S.S.E. of Medina.

FERGANA, a province of Great Bucharia, situated on the river Seir or Sihon. It is mountainous, and abounds in mines of gold, silver, copper, iron, and coal. Andogan is the capital. N. lat. about 40° to 42'. E. long. 65 to 70°.

FERGUS, a river of the county of Clare, Ireland, which forms a large estuary full of islands at its junction with the Shannon. This river dips under ground in some part of its course. Ennis, the county town, is on this river, and has a small port at Clare, which is situated a few miles lower on it. This river is navigable from the Shannon river up to Clare, near Ennis.

FERGUSON, JAMES, in *Biography*, a practical philosopher and astronomer of distinguished reputation, was born in a humble station at Keith, a small village in Scotland, in the year 1710. At a very early age he gave evidence of extraordinary genius; for he learned to read by merely listening to the instructions which his father communicated to an elder brother, and by him he was also taught to write. He was afterwards sent for about three months to the grammar school at Keith. His taste for mechanics appeared when he was only about 7 or 8 years of age, and by means of a turning lathe and a knife, he constructed machines that served to illustrate the properties and uses of the lever and of the wheel and axle. Of these machines, and the mode of their application, he made rough drawings with a pen, and wrote a brief description of them. At this time his knowledge was so imperfect, that he conceived himself to have made some original discovery. Unable to subsist without some employment, he was placed with a neighbouring farmer, and occupied for some years in the care of his sheep. In this situation he commenced the study of astronomy, devoting a great part of the night to the contemplation of the stars, while he amused himself in the day-time with making models of spinning wheels, mills, and other machines which he had an opportunity of observing. By another farmer, in whose service he was engaged, he was much encouraged in his astronomical studies, and enabled, by the assistance that was afforded him in his necessary labour, to reserve a part of the day for making fair copies of the observations which he roughly sketched out in the night. In making these observations he lay down on his back, with a blanket about him, and by means of a thread strung with small beads, and stretched at arm's length between his eye and the stars, he marked their positions and distances. This kind

kind master recommended him to some neighbouring gentlemen, one of whom took him into his house, where he was instructed by his butler in decimal arithmetic, algebra, and the elements of geometry. Deprived of the assistance of his preceptor, he returned to his father's house; and availing himself of the information derived from "Gordon's Geographical Grammar," he constructed a globe of wood, covered it with paper, and delineated upon it a map of the world; he also added the meridian ring and horizon, which he graduated; and by means of this instrument, which was the first he had ever seen, he could solve the problems in that treatise. His father's contracted circumstances obliged him again to seek employment; but the service into which he entered was so laborious as to affect his health, and injure his constitution. For his amusement in this enfeebled state he made a wooden clock, and also a watch, after having once seen the inside of such a piece of mechanism. His ingenuity obtained for him new friends, and employment suited to his taste, which was that of cleaning clocks, and of drawing patterns for ladies' needle work; and he was thus enabled not only to supply his own wants, but to assist his father. Having improved in the art of drawing, he was induced to draw portraits from the life, with Indian ink, on vellum. This art, which he practised with facility, afforded him a comfortable subsistence for several years, and allowed him leisure for pursuing his favourite studies. From Scotland he removed to London in 1743; and being recommended to several scientific persons, he was treated with kindness and friendship; and encouraged to publish some curious astronomical tables and calculations, and to commence a course of lectures in experimental philosophy, which he repeated in various parts of the country. In the year 1754 he published "A Brief Description of the Solar System, to which is subjoined an Astronomical Account of the year of our Saviour's crucifixion," 8vo.; and also "An Idea of the Material Universe, deduced from a survey of the Solar System," 8vo. In 1756 he published, in one volume, 4to. a larger work, entitled "Astronomy explained upon Sir Isaac Newton's principles, and made easy to those who have not studied Mathematics."

About this time he was also introduced to his present majesty, then prince of Wales, and had the honour of delivering lectures to him, for which he received several presents; and after his accession to the throne Mr. Ferguson obtained a pension of 50*l.* a-year. In 1760 he published his "Lectures on Subjects in Mechanics, Hydrostatics, Pneumatics, and Optics, with the use of the Globes, the art of Dialling, and the calculation of the mean times of New and Full Moons and Eclipses," 8vo.; this work, and also his "Astronomy," have passed through several editions both in 4to. and 8vo.; and of the former, a new edition, with several valuable additions, has been lately published by Dr. Brewster of Edinburgh. His "Plain Method of determining the Parallax of Venus by her Transit over the Sun, and thence, by Analogy, the Parallax and Distance of the Sun, and of all the rest of the Planets," first published in 1761, was annexed to the 4th edition of his "Astronomy," 1770, 8vo. In 1762 Mr. Ferguson was elected a fellow of the Royal Society, and excused the payment of the usual fees and contributions. During the same year he published, in 8vo. "Astronomical Tables and Precepts for calculating the true times of New and Full Moons, and shewing the method of projecting Eclipses, from the creation of the World to A.D. 7800; to which is prefixed a Short Theory of the Solar and Lunar Motions." In 1767 he published "Tables and Tracts relative to several Arts and Sciences," 8vo.; and a "Supplement to the Lectures on Mechaics,

Hydrostatics, &c.;" which is annexed to the second edition of that work. His "Young Gentleman and Lady's Astronomy, familiarly explained in ten Dialogues," was published in 1768, and re-printed in the following year, under the title of "An Easy Introduction to Astronomy, for Young Gentlemen and Ladies." His "Introduction to Electricity," 8vo. appeared in 1770; and in 1773 "Select Mechanical Exercises, shewing how to construct different Clocks, Orreries, and Sun-dials, on plain and easy Principles, &c." 8vo. with an account of his life prefixed, written by himself. In 1775 he published "Two Letters to the Rev. John Kennedy, containing an Account of many Mistakes in the Astronomical part of his Scripture Chronology, and his abusive treatment of Astronomical Authors," 8vo. which were followed by a "Third Letter" on the same subject. In that year appeared his last work, entitled "The Art of Drawing in Perspective, made easy to those who have no previous knowledge of the Mathematics," 8vo. Mr. Ferguson also communicated several papers to the Royal Society, which were printed in the Philosophical Transactions. He died, after long labouring under the infirmities of a feeble constitution, in the year 1776. From the above detail it must appear that he was a man of extraordinary genius, particularly in mechanical inventions and contrivances. He was distinguished also by an unaffected and perspicuous mode of communicating his ideas both in his lectures and his printed works. His knowledge of pure mathematics, however, was very limited and superficial; and our readers may be surprised when they are informed, upon the authority of Dr. Hutton, that he could never demonstrate one proposition in Euclid's elements. His judgment was clear, his application indefatigable; his disposition was humble, meek, and benevolent, and his manners were distinguished by a simplicity and courtesyness, which engaged the esteem of all who knew him. The compiler of this article can testify, from personal knowledge, that he possessed these several qualities in an eminent degree. His whole life, as it has been justly said, exemplified resignation and Christian piety; and "philosophy seemed to produce in him only diffidence and urbanity, a love for mankind, and for his maker." Account of his Life, &c. above referred to. Nichols's Anecdotes of Mr. Bowyer. Hutton's Math. Dict. Gen. Biog.

FERHAD, in *Geography*, a town of Persia, in the province of Khorasan; 40 miles S.E. of Nesselapour.

FERIA, a town of Spain, in the province of Estremadura, situated on a mountain near the Guadiana; eight miles N. of Badajoz.

FERIÆ, among the Romans, were holy-days, or days wherein they abstained from work. The word *feriæ* is usually derived a *ferendis victimis*, on account of the victims killed on these days. Martinus says, that *feriæ* were so called *velut in gratias, dies sacri, holy days*. Others observe, that all days in general, though they were not feast-days, were anciently called *festæ*, or, as Vossius reads it, *festis*; whence, according to that author, was formed the word *feriæ*.

The *feriæ*, or *dies ferati*, were observed and distinguished chiefly by rest; whereas the feasts, or *dies festi*, beside a cessation from labour, were celebrated with sacrifices and games; so that there were *feriæ*, which were not feast-days; though authors frequently confound the *feriæ* and *festi*. Otho confound the *feriæ* with the *dies nefasti*, or *non-court-days*.

The Latin *feriæ* amounts to the sabbath of the Hebrews. The Romans had divers kinds of *feriæ*, public and private, stated and occasional; their names, at least those of

the principal, are *æstivales*, or summer *feriæ*; *anniversaria*, yearly *feriæ*; *compitalitiæ feriæ*, of the streets and cross-ways; *conscriptivæ*, votive *feriæ*, which the magistrates promised every year; *denicales*, for the expiation of a family polluted by the death of any one; *imperativæ*, or *indictivæ*, those occasionally decreed by the magistrate; *Latiniæ*, the Latin *feriæ*, instituted by Tarquin the Proud, for all the Latin people, amounting annually, says Dion. Hal. to forty-seven nations, being celebrated on mount Alba, in memory of the peace concluded by Tarquin with the people of Latium. These *feriæ Latiniæ* were either ordinary or extraordinary. They continued at first only for a day; but after the expulsion of Tarquin a second day was added, and a third after the reconciliation between the plebeians and patricians; and in process of time they were prolonged to four days. At these feasts a bull was sacrificed, and each town contributed a certain quantity of meat, wine, and fruits. *Mæstis feriæ* were those of harvest; there were also *paganales feriæ*, or *paginalia prævidentiæ*, which were what we properly call the vigils, or eves of the feasts; *privatæ*, or *privatiæ*, those peculiar to the several families; as the *familia Claudia*, *Emilia*, *Julia*, &c.; *publicæ*, those observed by all in general, or for the public weal; *semitine*, those held in seed-time; *pativæ*, those kept constantly on the same day of the year; *Saturnales*, whereof we shall speak in their place; *Sulorum feriæ*, or *quærnaliæ*, the *feriæ* of fools, held on the seventeenth of February; *victoria feriæ*, those of victory, in the month of August; *vinetivales*, those of the vintage, from the twentieth of August to the fifteenth of October; *Vulcani feriæ*, those of Vulcan, which fell on the twenty-second of May. See FEAST.

FERIÆ was also used among the Romans for fair-days; because it was their custom to hold their fairs on the *dies feriati*, or holidays. Struv. Synt. Antiq. Rom. cap. ix. p. 425, 443, &c.

FERIA is still retained in the Romish breviary, though in a sense somewhat different from the *feriæ* of the ancients; being applied to the several days of the week, beginning with Sunday; provided none of those days be a feast or fast-day. Thus, Monday is the second *feria*; Tuesday the third, &c.

The word *feria*, in this sense, is doubtless borrowed from the ancient *feria*, a day of rest. Accordingly, Sunday is the first *feria*; for anciently all the days of Easter-week were accounted festival days, by a decree of Constantine; whence those seven days were called *feriæ*; Sunday being the first, Monday the second, &c. And this week being then accounted the first of the ecclesiastical year, they afterwards accustomed themselves to call the days of the other weeks after the same manner, *first*, *second*, *third*, &c. *feriæ*. Though others will have it, that the days of the week were not called *feriæ* from the people's resting, that is, on account of being obliged to abstain from servile works; but to advertise the faithful, that they ought to abstain from sin. See Durand, De Off. Div. lib. viii. cap. 1.

These are the *ordinary feriæ*; but besides these, they have *extraordinary*, or *greater feriæ*; viz. the three last days of Passion-week; the two days following Easter day, and Whitsunday; and the second *feriæ* of Rogation.

FERIAL DAYS, *dies FERIALES*, or *FERIÆ*, among the Ancients, signify holidays, or days vacant for labour, and pleading.

But in the stat. 27 Hen. VI. cap. 5. and in Fortescue, De Laudibus LL. Angliæ, ferial days are taken for working days. S. Sylvester ordained—"Sabbati & dominici diei nomine retento, reliquos hebdomadæ dies feriarum no-

nine distinctos, ut jam ante in ecclesia voraci exoptant appellari." So that ferial days are properly all the days of the week, except Sunday.

FERJEE, in the dress of the Egyptians, is a sort of skirt worn over another garment, and made either of black woollen, or of other coloured cloth furred; this by the more genteel people is left open before. It somewhat resembles a night-gown.

FERING, in *Geography*, a town in the duchy of Stiria; 14 miles N. of Racksburg.

FERINO, ST. a town of Italy, in the department of the Adda and Oglio; 5 miles W. of Breno.

FERIO, in Latin treatises on music, implies, I beat, I strike, in marking the measure; it is at the down part, or beginning of a bar, when the hand or foot comes down, as the signal for the commencement of a measure, though in the middle of a note. See SYNCOPATION.

FERISON, in *Logic*, a mood of the third figure of syllogisms. In this mood the first proposition is an universal negative, denoted by the vowel *e*; the second a particular affirmative; and the third a particular negative, signified by *i* and *o*.

FERLING, in our *Old Statutes*, is used for the fourth part of a penny. Assis. paris & cerevis. 51 Hen. III.

FERLINGATA TERRA, in our *Old Writers*, according to Blount, is the same as *ferlingus terra*, which lord Coke on Lyttelton says, was a quarentine, or thirty-two acres of land. But according to the authorities quoted by Du Cange, Gloss. Lat. vœc. Quarentena, it contained but forty perches.

FERM, FIRMA, in *Law*. See FARM.

FERMACO, in *Geography*, a small island in the Grecian Archipelago, about 10 miles from the coast of Natioha. N. lat. 37° 17'. E. long. 27° 1'.

FERMANAGH, a township of America, in the county of Pennsylvania, having 1505 inhabitants.

FERMANAGH, a county of Ireland, in the province of Ulster, formerly subject to the old Irish family of Maguire, and called *Maguire's territory*. It was forfeited at the time of Tyrone's intended rebellion in the reign of James I. and was one of those counties distributed to undertakers, on the plantation of Ulster, for a particular account of which important measure, the reader is referred to the general article IRELAND. Fermanagh is bounded on the north by the county of Donegal; by Tyrone and Monaghan on the east; by Cavan on the south and south-west; and by Leitrim on the west. The boundaries are not marked by nature, excepting the lakes, which partly separate it from Leitrim, and some hills on the borders of Tyrone and Cavan. It extends 34 Irish (43 English) miles in length, and 26 Irish (33 English) miles in breadth. Its area is 283,400 acres, or 448 square miles, (455,298 English acres, or 719 square miles;) a very considerable portion however of this area is occupied by lough Erne, which extends from north to south of various breadth, and completely severs the county into nearly equal parts. The number of houses, according to the last official return published, was 11,983, which, at 6 to a house, would give a population of 71,900. The number of parishes is only 18, fifteen of which, containing 23 churches, are in the diocese of Clogher, and three parishes, with as many churches, are under the see of Kilmore. This county is in general hilly, but it is only on the confines of Tyrone, and in the western division adjoining Leitrim that it can be called mountainous. There is indeed no part of it which is not capable of cultivation; but at present many of these rising grounds are rough and boggy, and merely afford a coarse pasturage to

herds of young cattle, from rearing which the farmers derive a principal source of profit. Indications of coal have been discovered in many parts of the western district of this county, and in one place in particular, within a mile of lough Erne, there is supposed to be a very valuable colliery, but the time has not yet arrived for turning to account these mineral treasures. Amongst the other substances already discovered in it, manganese and fuller's earth are mentioned. These, however, are not so valuable as the limestone, and different kinds of marles which are found in it, and are used as manure. On lord Enniskillen's estate, west of lough Erne, are quarries of a grey, or brown and white marble, beautifully veined, and of a very fine grain. The farms are in many parts small, to accommodate the linen-weavers, and the same spirit of industry is found here, as in the adjoining counties. Mr. Young, nearly 30 years ago, found them improving in their circumstances, and living more comfortably than in most other parts of the island; and the neighbourhood of Enniskillen, on the eastern side, is in particular a well-inhabited, and well-cultivated county. Lough Erne, which is supposed to occupy 45,000 acres, and the river Erne, by which its superfluous waters are conveyed to the sea, have been already described in former articles of this work. (See ERNE.) There are two other lakes comparatively small, but by no means of inconsiderable length; one called Melvin, and the other Macnean. Lough Macnean lies between the counties of Fermanagh, Cavan, and Leitrim, and communicates with lough Erne; lough Melvin is in the northern part, and a small stream flows from it to the sea. The only town deserving notice is Enniskillen, already mentioned. (See ENNISKILLEN.) Fermanagh returns three members to parliament, two for the county, and one for the town of Enniskillen. Young's Tour. Beaufort's Memoir, &c.

FERMAT, PETER DE, in *Biography*, was born in the year 1590, and became, by his talents and acquirements, counsel of the parliament of Toulouse, in France. He was one of the ablest lawyers of the age in which he flourished: was a good poet, and well grounded in classical and modern learning, intimately conversant in antiquities, and a profound mathematician. His works were collected and published at Toulouse, in 1679, in 2 vols. folio, under the title of "Opera varia Mathematica." These contain Diophantus's Treatise on Algebra; a method for the quadrature of all sorts of parabolas; a treatise on the maxima and minima; with many smaller pieces, and his correspondence with the most celebrated geometers of his time. Fermat was as much distinguished by his integrity and impartiality in the character of a magistrate, as by his great learning and knowledge. Moreri.

FERMAT, in *Geography*, a town of Asiatic Turkey, in Carmania; 12 miles S. W. of Akshehr.

FERME a *Ferme*, in the *Manege*, signifies to exercise in the same place without stirring or parting.

FERMENT, of *fervere*, to boil, in *Physics*, any body, which being applied to another, produces a fermentation therein; or, any thing capable of exciting an intestine motion in the parts of another; and of swelling or dilating the same.

Thus, the acid in leaven is a ferment which makes bread rise or swell. And the moisture in hay is a ferment which heats, and makes it smoke. Thus also, rennet is a ferment which curdles and breaks milk; and barn, or yeast, is the ferment that sets wort a working, &c.

Those things are called ferments in an illusive sense, which, when added to the liquor, only correct some fault therein, and by removing some obstacle to the fermentation, forward

it by secondary means; as also such as being added in time of fermentation, make the liquor yield a large proportion of spirit, and give it a finer flavour; all these additions have the name of ferments among our distillers, but improperly. The primary use of ferments is, to save time, and make dispatch of business, while they only occasionally and accidentally give a flavour, or add to the quantity of the spirit; and accordingly all fermentable liquors may, without the least addition, only by a due application of heat, be brought to ferment more perfectly, though it will be more slowly than with the addition of any ferment. The general ferments used on these occasions are the flowers and faces of fermentable liquors generated, thrown up, or deposited, during the time of the fermentation in that liquor, or after the end of it. There are two of these ferments, procurable in large quantities, and at a small price; these are beer-yeast, and wine-lees. A prudent and artificial management of these, might render the business of the brewery for distillation, as in the business of the malt distiller, &c. much more easy and advantageous. It has always been found a great difficulty to procure these ferments in proper quantities, and preserve them always ready for use; and this has been a great discouragement to the business, and hence some have been obliged to contrive artificial ferments, or to form mixtures or compounds of particular fermentable ingredients; but this has been attempted without any great success, all these mixtures falling short even of the common bakers' leaven in their use.

When the proper sort of ferment is pitched upon, the operator is next to consider its quantity, quality, and manner of application. The quantity must be proportioned to that of the liquor, to its tenacity, and the degree of flavour it is intended to give, and to the dispatch required in the operation. From these considerations he will be able to form a rule to himself; but till such a rule is formed, or, in order to the forming of it, proper trial will shew how much suffices for the purpose. The way is to begin with a little, and to add more occasionally, the weight of the whole being noted beforehand; so that on weighing the remainder, after the proper quantity is taken away, it will be found how much exactly has been used out of it for the business.

Among the several ingredients of which fermentable liquors are made for the service of the distillery, treacle requires more ferment than almost any other. This is not wonderful on a just consideration of the nature of the subject, since the manner in which that concrete juice is made, must render it greatly unfit for fermentation afterwards, though the original product of a vegetable juice very much disposed to it in its own nature. The strength of the fire used in the sugar making, and its long continuance and almost immediate contact, and the lime and other alkalies used in refining the sugar, that is, in making the treacle, do so condense, indurate, and scorch the body of this juice, and absorb its acid, that it is scarcely to be expected that it should ferment at all, even with the addition of jalap, or other powerful saline and acid or acrid stimulators, which tend to break the viscous and adust connections of the particles.

The greatest circumspection and care are necessary in regard to the quality of the ferment, if a pure and well-flavoured spirit be required. It must be chosen perfectly sweet and fresh, for all ferments are liable to grow musty and corrupt; and if in this state they are mixed with the fermentable liquor, they will communicate their nauseous and stinky flavour to the spirit, which will scarcely ever be got off by any subsequent refining. If the ferment be sour, it must by no means be used with any liquor, for it will

communicate its flavour to the whole, and even prevent its rising to a head, and give it an acetous, instead of a vinous tendency. When the proper quantity of a suitable and well-conditioned ferment is got ready, it must be put to the fermentable liquor in a state barely tepid, or scarcely lukewarm. The best manner of putting them together, so as to make the fermentation strong and quick, is this. When the ferment is solid, it must be broke to pieces, and gently thinned with some of the warm liquor; but a complete or uniform solution of it is not to be expected or desired, as this would weaken its efficacy for the future business. The whole intended quantity being thus loosely mixed in some of the lukewarm liquor, and kept near the fire, or elsewhere in a tepid state, free from too rude commerce of the external air, more of the insensibly warm liquor ought at proper intervals to be brought in, till thus by degrees the whole quantity is set at work together.

When the whole is thus set at work, and secured in a proper degree of warmth, and kept from a too free intercourse with the external air, it becomes as it were the sole business of nature to finish the operation, and render the liquor fit for the still. In this easy manner the whole end of fermentation would be answered. But during the whole course of the operation, there are several other things that may be added with some particular view, as either to increase the quantity of spirit, or give it some agreeable flavour. These additions may sometimes require some alteration in the general method laid down above, though upon the whole it is right. *Shaw's Essay on Distilling.* See ADDITIONS.

FERMENTS in the Earth. It is very probable, that the natural ferments in the earth may be of more consequence than is generally supposed, and tend to elucidate many things, which at present appear very mysterious. The different fruitfulness of different spots of the same sort of land may be owing to this, as also the different temperature of air at the same time in places very little distant from one another. The effluvia sent up by some of these, not only dissolve snow that falls on them, but even melt it in the air as it approaches, and cause it to fall in rain, not in snow. And often in two places within a mile or two of each other, there shall be a disparity of heat and cold no way else to be accounted for, since there is often no difference of shade or shelter.

In Scotland there are large tracts of land, where the ferment is so strong, that the earth sets a person up to the ankles as he walks; and generally, at about a foot depth under this, there is found a stratum of pebbles, so close rammed together, that they seem an artificial causeway. This land, though of no greater depth than a foot, is found very rich for garden plants, and even for fruit-trees. *Phil. Trans. N° 110.*

FERMENTARIUM, or FERMENTACEUM, a denomination which those of the Latin church have given to the Greeks, on account of their consecrating and using leavened or fermented bread in the eucharist.

As the Greeks call the Latins *azymites*, the Latins, in return, call them *fermentarii*.

FERMENTATION. The important process by which saccharine solutions are converted into intoxicating liquors, is one of the most complicated in chemistry, and the precise cause of this change is as yet very imperfectly known. In the present article we shall notice the conditions requisite to fermentation, the appearances that occur during the process, and the essential product of it, reserving for the articles **SPIRITS, Distilled,** and **WINE,** some further particulars.

The only two substances indispensably requisite to the formation of a fermentable liquor are water and sugar.

No vegetable juice will ferment that is not sensibly sweet, and from which a portion of sugar may not be extracted by chemical means. The strength of vinous liquors (other circumstances being the same) is in direct proportion to the quantity of sugar contained in them before fermentation. The addition of sugar to the weakly fermentable juices will enable them to produce a strong full-bodied liquor, and the very essence of this process is the disappearance of the sugar, and the consequent production of alcohol.

With regard to the water, it does not appear how far this is an active ingredient in vinous fermentation, though it is fully ascertained that a particular degree of dilution is necessary to this process: this consistence exists naturally in the juice of grapes, in the saccharine sap of many trees, and of other spontaneously fermentable liquors; and if these very liquors be deprived by gentle evaporation of a considerable portion of their water, the residue will not ferment till the requisite consistence is restored by the addition of a fresh portion of water. On the other hand, if a saccharine mucilage is too dilute, the fermentation is very languid and imperfect.

But pure sugar and water alone will not ferment, and therefore some other substance is also requisite. To this point the attention of chemists has been often directed, but hitherto with but little success; indeed, the general result of the experiments that have been made is, that several substances, very different in their other properties, will answer almost equally well as a ferment. Must, or the recent juice of the grape, contains, beside sugar and water, a quantity of vegetable acid, chiefly the tartareous, and one or more substances obscurely described under the names of mucilage and extract. Each of these is requisite to the fermentation of must; for if any one is abstracted the process will not take place. A warm temperature is also requisite to fermentation. This varies according to the natural fermentability of the materials, and their bulk. Thus, grape-juice will readily begin to ferment at the temperature of about 65°, and the process is strong and vehement at 75° or 80°. The expressed juice of the sugar-cane is so excessively prone to fermentation, that in the climate of the West Indies the process would begin in ten minutes, or a quarter of an hour; and hence, as fermentation is the destruction of the sugar, it is necessary, in making sugar, to counteract this tendency in the expressed juice as speedily as possible, which is effected merely by bringing it to a scalding heat. A low temperature, as that of freezing water, is equally efficacious in preventing or arresting the progress of fermentation, so that all domestic processes of this kind are performed within doors, or near a fire, and in the large way chilling must be particularly avoided; but as the act of fermentation produces a considerable heat, the liquor within the vessel being several degrees warmer than the surrounding air, large masses are of course less affected by the external cold, and will ferment at a lower temperature.

The first signs of fermentation are, a gentle intestine motion, the rising of small bubbles to the top of the liquor, and a whitish turbid appearance. This is soon followed by the collection of a froth, or head, consisting of a multitude of air-bubbles entangled in the liquor, which, as the process advances, rise slowly to a considerable height, forming a white dense permanent froth. A very large portion of the gas also escapes, which has a strong, penetrating, agreeable, vinous odour. The temperature of the liquor at the same time increases to several degrees above that of the external air, and continues so during the whole of the process.

Sooner

FERMENTATION.

Sooner or later these appearances gradually subside; the head of the foam settles into a dense froth, and on turning it aside, the liquor beneath appears much clearer and nearly at rest, having deposited a copious sediment, and from being viscid and saccharine is now become vinous, intoxicating, thinner, and of less specific gravity.

The process of fermentation, however, does not terminate suddenly, but goes off very gradually, the liquor continuing to work or throw up foam, to clarify, to attenuate, and more completely to lose its sugar, which at last can no longer be discerned by the taste, or detected by chemical analysis. The vinous liquor, when complete, if of sufficient strength and well fermented, will now keep for a great length of time in vessels secured from the air, and undergoes comparatively little farther alteration, except in becoming more perfectly limpid by the deposition of an additional quantity of sediment.

The gas of fermenting liquors has been long known to consist for the most part of carbonic acid; it will, therefore, extinguish a candle, destroy animal life, convert caustic alkalis into alkaline carbonates, and the like. But, beside the carbonic acid, it has been proved by Scheele to hold in solution a sensible quantity of alcohol, and Proust has detected in it a portion of azot. Mr. Collier (Manchester Trans.) has further shewn that in this gas are contained all the requisites for vinous fermentation. He passed the whole of the gas from a ninety gallon fermenting tun into a cask of water, and divided the liquor thus impregnated into three parts, of which one being immediately distilled, afforded a small quantity of alcohol; to the second was added some yeast, by which a new fermentation was excited, and the subsequent product of distilled spirit was nearly doubled, and the third being suffered to ferment a longer time, produced some vinegar.

The attenuation of liquors, or the diminution of their specific gravity by fermentation, is very striking. This is shewn by the hydrometer, which swims much deeper in fermented liquor than in the same materials before fermentation. Much of this attenuation is, doubtless, owing to the destruction of the sugar, which, dissolved in water, adds to its density, and to the consequent production of alcohol, which, on the contrary, by mixture with water, diminishes the density of the compound. The extract, or mucilage, also appears to be in some degree destroyed by fermentation, for the gelatinous consistence of thick liquors is much lessened by this process: the destruction of this principle, however, is by no means so complete as of the sugar, many of the full-bodied ales, for example, retaining much of their original clamminess and gelatinous density even after having undergone a very perfect fermentation.

It has been doubted whether the alcohol of vinous liquors exists in them ready formed, or in some intermediate state, requiring the boiling heat of distillation for its complete development. It is not easy to fix upon an unexceptionable mode of deciding this question. It has been argued by L'abboni, in favour of alcohol being a product, and not an educt from wine, that wine cannot be again formed by adding the distilled alcohol to the residue left behind in the retort: he also affirms, that if a small portion of alcohol is added to wine, it may be separated again almost entirely by carbonate of potash, but that this salt will not separate any alcohol from wine in its natural state. This last fact, however, only shews that the union of the alcoholic with the other parts of the wine, is too strong to be broken by simple affinity, without the assistance of heat; and, as to the former, it is highly probable that the boiling heat operates some change on the other constituents of wine, the effect of

which cannot be done away by the mere return of the spirit that has been driven off. This opinion, therefore, though by no means improbable, requires further confirmation.

The production of alcohol seems to be one of the last effects, or the completion of the process of fermentation; for if the liquor is distilled while yet in a state of high fermentation, it will not yield a drop of alcohol.

The atmospheric air seems to have no share whatever in vinous fermentation, for it will take place full as well inclosed as in open vessels, provided space is allowed for the great expansion of the materials, and the copious production of gas. Indeed Mr. Collier found, by direct experiment, that more spirit is procured by close than by open fermentation. In three separate experiments, in each of which an equal quantity of wort and yeast were fermented, under circumstances precisely similar, with the single exception, that in one the vessel was open, and in the other closed, (the gas having no exit but through a tube dipping in water,) he found, on distilling each fermented liquor, and drawing off the same bulk of spirit from each, that that from the close vessel was constantly of less specific gravity, and, therefore, richer in alcohol than the other. Where the spirit from the open vessel was 74 degrees below proof, that from the close vessel was 56 degrees; where the former was 83, the latter was 65; and where it was 103, the other was 93.

The theory of vinous fermentation is still involved in great difficulty, on account of the very compound nature of the substances employed, and their great tendency to decomposition in various ways and proportions.

The results of Lavoisier's experiments should not pass unnoticed, though it is obvious that much too great simplicity is attempted in the explanation of a process which every circumstance shews to be very complicated. The simple point to which the experiments of this able inquirer tend, is (setting aside all other agents) to explain how sugar becomes converted into carbonic acid and alcohol, which, after all, is the characteristic phenomenon of vinous fermentation.

The entire products of sugar, yeast, and water, fermented in close vessels, are stated to be carbonic acid, alcohol, and water, together with a small portion of acetic acid, and from these facts the following theory is deduced. Sugar is composed of eight parts hydrogen, 64 oxygen, and 28 carbon, and the process of fermentation effects a change merely in the arrangement of the constituent parts of the sugar, converting one portion into carbonic acid, and the other into alcohol; and hence (as carbonic acid contains only carbon, with a large proportion of oxygen) the portion which is left must contain all the hydrogen, part of the carbon, and a very small proportion of oxygen: or, in other words, by this new arrangement of the ingredients of the sugar, one portion, namely, the carbonic acid, is totally deprived of hydrogen, and overloaded with oxygen, while the other portion, namely, the alcohol, abounds in hydrogen, and is deficient in oxygen, the carbon being divided between the new products in nearly an equal proportion with regard to their respective quantities.

No theory more plausible than the above has, perhaps, hitherto been offered to the general phenomenon of vinous fermentation, though it is very defective in many essential parts, and even does not correspond with the alleged composition of alcohol, given by the same chemist in another part of his enquiries.

The great question remaining for future enquirers to determine is, what the substance or circumstance is, which disposes sugar to ferment: for it has been proved that sugar will not of itself begin this spontaneous change into carbonic acid

FERMENTATION.

acid and alcohol; though, when once begun, the process will probably go on without further assistance.

It has been already mentioned, that both extractive matter and an acid are present in every known instance of vinous fermentation; and, for any thing that appears to the contrary, both of them are necessary, though the requisite quantity of each is very small compared to the sugar; therefore the strength or body of the fermented liquor is in direct proportion to the quantity of sugar alone, and there is good reason to suppose that the extractive matter and the acid are only accessory ingredients, though still essential, as being those without which the vinous decomposition of sugar cannot be effected.

It has been supposed that it is the *vegeto-animal* extract, as it has been called, which exists in the fermentable juices of vegetables, that causes the first change in the sugar. The precise nature of this *vegeto-animal* matter is not very well known: it may be supposed to be similar to the gluten of wheat, but intimately combined with the saccharine mucilage, and hence extremely susceptible of spontaneous change. The chief, if not the only, proof of its existence in many of these combinations, is the production of a quantity of ammonia during its decomposition by heat, which alkali is almost always *formed* by the action of fire, and indicates in the substance which yields it the presence of azot.

Some of the commonest fermenting ingredients, as the sweet infusion of malt, technically called wort, it is well known, will hardly enter into fermentation without the addition of *yeast*; and hence chemists have sought in this substance for the principle which gives the first impulse to the fermentation of sugar.

The analysis of yeast presents a vast variety of ingredients, the chief of which are the carbonic, acetic, and malic acids, mucilage, sugar, and gluten. Of these the latter is in the largest proportion, which would seem to give much weight to the opinion of the great share which the azotic ingredient has in inducing fermentation.

Yet Mr. Henry found by a series of very interesting experiments, that malt infusion might be made to enter into complete fermentation by impregnating it with carbonic acid prepared from chalk and sulphuric acid, and the liquor thus fermented gave a yeast which made perfect bread, gave alcohol by distillation, and vinegar by further keeping. The wort itself undoubtedly contained all the ingredients of yeast, since this substance was produced during the fermentation, but the experiment is decisive to prove that no addition of azotic extract is required to begin fermentation in materials naturally fermentable, though, when once begun, the yeast, as fast as it was produced, must have assisted in the fermentation then going on. The evidence for the necessity of an acid to begin fermentation is therefore more decisive, but it is still doubtful whether any particular one is required, or whether there are not several which will answer the purpose. In Mr. Henry's experiments the acid employed was the carbonic, and, from the arrangement of the apparatus, probably a small portion of sulphuric was also carried in along with it. But in grape juice there is no proof of the existence of carbonic acid ready formed, though the tartaric, malic, and other vegetable acids contain within themselves the ingredients of carbonic acid, and are chiefly and ultimately resolvable into this acid. Yeast will even induce fermentation after it is pressed and dried into solid cakes, (a practice not uncommon, as it will keep for a great length of time in this form,) but after this operation it can hardly contain any carbonic acid ready formed, though with abundant tendency to produce it by

the first mutual action of its constituent parts. Many interesting enquiries therefore remain to be carried on before we can have a full and satisfactory theory of the important process of vinous fermentation.

FERMENTATION, *Acetous*. See ACETOUS ACID, and VINEGAR.

FERMENTATION, *Putrid*. See PUTREFACTION.

FERMENTATION, *Bituminous*, in *Geology*, denotes a particular change, which, according to the opinion of Mr. James Parkinson, (*Organic Remains*, vol. i. p. 184.) "is peculiar to vegetable matter placed in such situations, as not only exclude the external air, and secure the presence of moisture, but prevent the escape of the more volatile principles, and which terminates in the formation of those substances called bitumens." This author, after giving a concise, but luminous account of the *saccharine*, the *vinous*, the *acetic*, and the *putrid* fermentation, to which most vegetable substances are progressively liable, by the modified admission of atmospheric air, thus proceeds: "But if, instead of being thus exposed to the influence of the air, a mass of dead vegetable matter be accumulated in such situations as allow of the admission of water, but in which the compactness of the superincumbent stratum of earth, not only excludes the external air, but the disengaged gaseous matters are prevented from escaping, the bituminous fermentation takes place, and bituminous matters are formed in various degrees of maturity and purity, according to the stage at which the process may have arrived, or the extraneous matters which may have been admitted." Our author, however, admits, that a complete history of all the phenomena which occur during the whole of the operation cannot possibly be expected to be made out, but the proofs of its existence must be obtained by inference, and from analogy on comparing it with the other species of fermentation; and he thus continues: "the substance, then, which I conceive to be entirely dependent on, and actually the product of, this process, is bitumen; a substance which manifests, upon examination, all those properties which might, *a priori*, be expected to be found in a body constituted under the particular circumstances which I have presumed to have directed its formation.

"In the first stage of the vinous fermentation, we perceive that a considerable portion of the more volatile parts of the mixture is dissipated, and that it is only by the careful preservation of the remainder that the accomplishment of this process is effected. In the acetous fermentation this escape of the volatile parts is continued through the whole of the process, and occasions the great difference which exists between the two products. In the first of these species of fermentation, carbon, that principle which always seems to affect that mode of combustion, observable in ignited charcoal, where flame is not present, is, we have remarked, dissipated in very large quantities, by which its dose in the mixture must be considerably diminished; whilst, should hydrogen even be supposed to escape in a similar proportion, still, from the decomposition of the water, sufficient of this principle (which I will call the principle of inflammability) will be yielded, to give the spirituous and very inflammable product which we find to be the result of this process. In the latter of these species of fermentations, in which the dissipation of the volatile matters is carried to the utmost extent which the degree of temperature will admit, the mixture seems to be deprived of almost the whole of its hydrogen; except, perhaps, just so much as is left in combination with the colouring principle, and the water, whilst the oxygen is attracted, nearly in the same proportion, by the carbon from the atmosphere, and from the very considerable

considerable dose of this acidifying principle; and, from some peculiar modification of their union, the product, *vinegar*, results, possessing a high degree of acidity, but not the least degree of inflammability.

“ We will now examine the changes which may be expected to result from the decomposition of vegetable matters placed in subterranean situations, and considering these, with the properties which are possessed by the supposed product of the bituminous fermentation, we shall be enabled, especially by recollecting what has been just said of the other species of fermentation, to determine whether it is right to admit of the existence of such a species of fermentation or not.

“ Secured on every side by the surrounding earth, the mass of vegetable matter is preserved, at it were, in a well-closed vessel; hardly any escape being permitted to any of its more volatile particles, nor any admission of extraneous matters allowed, except of such as are introduced with the water which may insinuate itself by soaking through the interstices of the earthy particles, composing the several strata which inclose it.

“ It is decreed, that a strong disposition to separate, and to unite in another order, shall secure the necessary decomposition of dead organized matter, which, according to the economy of nature, is but to possess a short and transient cohesion. Agreeable to this law, this mass of vegetable matter, now deprived of the energy of vegetable life, must undergo some change; but from the closeness of its preservation, it cannot admit that escape of the gaseous matters on which the commencement of the vinous, acetous, or putrid fermentations depend: another process is therefore instituted. The hydrogen, carbon, and oxygen are disengaged from their former attachments, but being prevented from flying off in a gaseous state, are obliged again to unite, and to enter into new combinations.

“ Under these particular circumstances a substance may be expected to be formed, containing a considerable portion of these principles so abundant in vegetable matter. In this respect, there undoubtedly may be discovered a remarkable agreement between the supposed product of this fermentation, and the hypothesis by which its formation is attempted to be explained; since, in all bituminous substances the abundant existence of these three principles has been sufficiently proved by analysis.

“ In this, as in every other species of fermentation, a considerable difference may exist, as to the degree of perfection to which the process may proceed, and of course, as to the degree of perfection which the product may possess.

“ Thus I expect to shew, that, according to length of time, exclusion from the air, and the existence of other favourable circumstances, will these bituminous substances be found in their several approaches to that state, to which the law of nature seems to have particularly destined them.

“ Peat, that combustibile and inflammable substance, generally found in considerable masses at a little depth beneath the surface of the earth, possessing chemical properties essentially different from every other substance which has not derived its existence from the same origin, appears to be the first product of this kind of fermentation, and to have been formed in situations not favourable to the rapid completion of this process. The celerity with which this process is accomplished must depend on the closeness with which the gaseous principles are secured; but it should be considered, that such peat-bogs as are, comparatively, but of modern formation, are covered by a coat of vegetable mould, in an humid state, of no considerable degree of thickness, and therefore the escape of the more volatile

principles, and the admission of atmospheric air, are only partially prevented; the process must therefore be carried on with much less effect, than in those cases which will be hereafter mentioned, where vast masses of vegetable matters have been suddenly buried under a considerable thickness of earthy deposition.

“ The abundance of hydrogen, carbon, and oxygen, in peat, is demonstrated by its analysis. By the early analysis of Schooekius we learn, that it yields an oil much resembling the oil of amber, with an acid liquor. Monf. Fourcroy relates, that, on exposing peat to the action of heat in a distillatory apparatus, a yellow or reddish fetid water is obtained, an oil of a most disagreeable odour, with carbonate of ammonia, and carbonated hydrogen gas, also smelling most disagreeably; a coal being left, which is frequently pyrophoric, and which yields, after incineration, muriate and sulphate of soda and of pot-ash, mixed with the phosphate and sulphate of lime, and with the oxyds of iron and of manganese.

“ The prevalence of hydrogen in this substance is fully displayed by the foregoing analysis, since not only enough exists for the formation of this peculiar oil, but a considerable quantity of this principle is also disengaged in a gaseous form; the agreement, therefore, between this substance, and what might, *a priori*, have been supposed, would be the product of a vegetable matter placed under these particular circumstances, appears to be evident. The original mode of existence which belonged to this substance is sufficiently marked by the great quantities of vegetable substances which are found in it, which have not suffered such an alteration, as to hinder the immediately tracing them to their true origin. That this substance has been subjected to the influence of the two circumstances, which seem essential to this peculiar fermentation, the presence of moisture and subterranean situation, must appear so plain from the state in which the peat mosses are found, that, on this point, not a word need be added. Peat, therefore, I presume, we may regard as a vegetable secondary fossil; having been formed from vegetable matter, changed in its nature and properties by a certain fermentation, which had been carried on in the mineral regions.”

The further prosecution of this theory by our author, in order to account for the formation of amber, and jet, &c. are too long for our purpose, but are well worthy the perusal of those who wish to become acquainted fully with this subject.

FERMENTED LIQUORS are esteemed great antidotes to putrefaction; accordingly the abstinence from them is assigned as one cause why the Turks are more subject than other people to the plague, and other contagious distempers. It is likewise observed, that beer, wine, and spirituous liquors, coming more into general use, has been one great means of suppressing putrid diseases. See Pringle's *Observ. on the Diseases of the Army*, p. 286. 294. and Macbride's *Ess. ess.* 3. See **ANTISEPTIC**, **CHOWDER**, and **SPRUCE beer**, and **WORT**.

FERMO, *Ital.* as canto fermo, or plain-chant, in *Ecclesiastical Singing*, is used in opposition to canto figurato, or figurative song. Rousseau was of opinion that the Roman, or Gregorian chant, is a precious relic, though much disfigured, of the ancient Greek music, which, after having passed through the hands of the barbarians, has not lost all its first beauties. Enough remains still to make it far preferable for the use to which it is destined, to that effeminate and theatrical, or flat and mawkish music, which has been substituted to it in some churches, without gravity, without

tafte, propriety, or respect for the place which they dare thus profane.

Canto fermo is written only on four lines in the Roman missals, and only two clefs are used, the base clef of F, and the clef of C, which are moveable, and only one flat upon B, and two kinds of notes, the long and square note, to which a tail is sometimes added, and the breve in the lozenge form, but all black. These are called Gregorian notes, supposed to have been invented or adopted by St. Gregory, the first pope of that name. St. Ambrose, archbishop of Milan, is said to have invented the Ambrosian chant, or at least to have brought it from Antioch, and to have established it in his church at Milan, a considerable time before the pontifical reign of Gregory, who perfected it, and gave it the form which it still preserves at Rome, and in other churches where the Roman chant is still practised. See *PLAIN Chant*, *AMEROSIAN Chant*, and *GREGORIAN Notes*.

FERMO, in *Geography*, a city of Italy, in the marquisate of Ancona, situated near the coast of the Adriatic; the see of an archbishop, erected in the year 1589, by pope Sixtus V. It contains 10 churches and 16 convents; 26 miles S. S. E. of Ancona. N. lat. 43° 6'. E. long. 13 44'.

FERMOR, WILLIAM, in *Biography*, count Von, a celebrated Russian general, was born at Pleskow, on the 28th of September, 1704. He was educated for the military profession, and entered the army as a common bombardier in the year 1720, and was so rapidly promoted, that, in the year 1729, he became adjutant-general to count Von Munnich. At Dantzic he formed an acquaintance with Frederic William, king of Prussia, who conferred upon him the order of la Generositè. He greatly distinguished himself in the Turkish war of 1736, and was promoted to the rank of general, and commandant of Zolberg. In 1746, he was appointed inspector of building; and the imperial palace, a master-piece of art, was built under his direction. In 1755, he was made commander-in-chief, and shortly after, for his conduct in Prussia, he was raised to the dignity of a count of the empire by Francis I. In the following year he fought the celebrated battle of Zorndorf, with Frederic II. king of Prussia. Being satisfied with the reputation he had gained, he requested leave to retire, and though this was granted him, he was called again into active service, and was finally made governor-general of Smolensko, and member of the supreme senate. After this he rebuilt some towns; when he again retired, resigning all his employments, and died in 1771, on his estate of Nicutau, where he had erected an elegant church. Gen. Biog.

FERMOSELLE, in *Geography*, a town of Spain, in the province of Leon; 30 miles W. S. W. of Zamora.

FERMOY, a very handsome and flourishing market and post-town of the county of Cork, Ireland, which affords a striking instance of what may be effected by the exertions of an individual. Less than twenty years ago Fermoy was a miserable village, with a long narrow bridge over the fine river Blackwater, and one of the last places at which a traveller would think of stopping for refreshments of any kind. At present it is a regularly built town, with a large barrack for two regiments of infantry, and another for cavalry adjoining to it on the opposite side of the river. The bridge has been widened; a church of elegant construction, and well situated, a large school-house, a market-house, and a sessions-house, which also serves occasionally for an assembly room, and theatre, have been built, and there are two good inns, with some of the best post-carriages to be met with in Ireland. There are also an extensive porter brewery, a flour-mill, a woollen manufactory, a bank, and several

respectable shops. This change has been effected by the exertions of John Anderfon, esq. who purchased the greater part of the old village, and has made Fermoy an object of admiration and astonishment to those who remember what it was, and who know what Irish towns in general are. To the same individual the fouth of Ireland is indebted for mail coaches and the improvement of the roads. Fermoy is on the road from Dublin to Cork, being 107 Irish miles from the former, and 17 from the latter of these cities.

FERN, in *Agriculture*, the name of a most troublesome weed, which it is very difficult to destroy where it has a deep soil to root in. The best method of killing it in grass lands is, probably, by cutting it often while it is in its green and most succulent state, as in the spring or the beginning of summer. The fern thus cut, when full of sap, and left to rot upon the ground, tends greatly to improve the soil, by rendering it more mellow, or if it be burnt when so cut, it will yield a much greater quantity of saline matter than any other sort of vegetable.

This is, however, a wasteful practice, and by no means so good as that of collecting it and stacking it up, for the purpose of littering the fold-yards during the time that cattle are kept in them, as by such a method, a large stock of valuable manure may be accumulated, the fern retaining the moisture and liquid animalized matters better than straw, by which means it becomes in a state fit for manure much sooner than is commonly supposed. Besides, it forms an excellent warm litter for the live-stock in such situations.

In tillage lands the best method of eradicating this plant is by repeated deep ploughing, so as to effectually break the deep matted roots of it, which, often in the more mellow loamy soils, strike to the depth of several feet. When they are once well broken, they readily decay in the ground, and add to its fertility.

Fern is commonly met with in breaking up waste lands where the soil is of the friable, hazel, loamy quality.

The ashes of this plant become an excellent manure for all the lighter sorts of soil when employed as a top-dressing. See *MANURE*.

FERN Web, in *Rural Economy*, is a term applied to a kind of small insect of the chaffer sort, which is highly injurious to the early blossom of the apple-tree.

FERNS. See *FILICES*.

FERN, *Common Male and Female*, in *Botany*. See *POLYPODIUM*.

The common female fern is a very mischievous and troublesome weed to the farmers, being very difficult to destroy, where it has any depth of ground to root in. Its roots will often penetrate to eight feet deep, and spreading a great way, they will rise again to the surface, and send up new plants at a considerable distance. In grass land, the best way of destroying them is mowing the grass three times a year, in spring, in May, and in August. Dung and ashes are very good manure for lands which abound with them; but the best of all things for destroying them is urine. Fern cut up when the sap is in it, and laid to rot upon the ground, is a very good manure for land, and will mellow it to as to prevent its binding. Trees planted where fern grows, are observed to thrive very much, even though it be upon a hot gravel; the reason of this is, that the fern shades the roots, and keeps them moist and cool. Mortimer's Husbandry, p. 316.

Scotch sheep put into laud where there is much fern growing among the grass generally destroy it in a little time, partly by their dung and urine, and partly by treading it down.

The root of the male fern is greatly recommended by medical

dicul writers, as a cure for rickets in children. Some also give it in powder, against worms; and it has the same virtues against the stone and gravel, with the rest of the genus of capillary plants, ascribed to it. It was frequently prescribed by the ancients in diet drinks, for removing obstructions, and in chronic cafes of all kinds, but is much disused at present. Lemery, *Dict. des Drog.*

All the species of fern, and other vegetables, which carry their seed on the back of their leaves, as moonwort, and the like plants, possess the same general virtues of drying and strengthening the viscera, especially the spleen.

FERN, *Flowering.* See OSMUNDA.

FERN, *Common or True Males.* See ASPLENIUM.

FERN, *Males.* See HEMIONITIS.

FERN, *Sweet.* See SCANDIX.

FERN-ashes. The poor people in many parts of the north of England use ashes of fern instead of soap for washing their cloaths; they cut the plant green, and then burn it to ashes, and make them up into balls with water; they dry these in the sun, and keep them ready for use.

The ashes of the common female fern produce a very singular phenomenon in the common way of treating them and their salt. If a large quantity of these ashes be procured, and the salt to the quantity of several pounds extracted from them in the common way, it will succeed better than in smaller quantities. The greater part of this salt being dried, if the remainder, which is more moist, be exposed to the air to receive some of the vapours of it, this will soon become fluid, or an oil, as it is more improperly called, per deliquium. The rest of the lixivium, which will be very heavy, and of a deep blood-red, or claret-colour, being set by in a glass-vessel untopped for five or six months, there will be found at the bottom of the liquor a very large quantity of salt precipitated to the thickness of about two inches on the bottom of the vessel. The lower part of this will have all the foulness, and appear discoloured; but the upper part will be extremely pure and white. From the surface of this part there will grow up a number of plants, in appearance standing erect, and at small distances from one another. These are only the last crystallizations of the subsiding or separating salt, but they have a regularity that is very surprising; they vary considerably in size and weight, but are all of the same shape, exactly resembling so many plants of the common unbranched fern, sending out a great number of regular leaves on each side the stem. These ramifications of the salt will remain many weeks in this perfection, if the vessel be not stirred: but they are so tender, that the least motion destroys them, and they after this never form themselves again. *Phil. Trans. N^o 105.*

FERN-oil, in *Pottery*, a name given by our merchants who have been in China to a sort of varnish, which the Chinese use in their porcelain manufactories. It is also called lime-oil, and is a thing so easily made, that it would be worth attempting what might be done with it, in our imitations of the porcelain. They make it in this manner: they take a large quantity of fern well dried, and spreading a covering of it over a piece of ground sufficient for the quantity of oil they intend to make, they lay upon this a coat of large lime-stones, newly calcined into lime; on these they sprinkle with the hand a small quantity of water just to slake them. They cover this bed of lime with another of fern; and so on, till they have raised it to eight or ten feet high; they then set fire to the fern, this burns away in a little time, and leaves a mixture of the lime and its own ashes. This mixture is laid in the same manner between beds of more fern, and burnt again. This operation is repeated five or six times. *Observ. sur les Coutum. de l'Asie.*

When the last calcination is finished, the mixture of lime and ashes is carefully gathered up, and thrown into large vessels of water, and with every hundred weight of it they put in one pound weight of kekio: they stir the whole together; and when the coarser part has subsided to the bottom, they take off the finer, which swims at the top in form of a fine cream, and putting it into another vessel of water, they let it subside to the bottom by long standing: they then pour off the water, and save the residuum in form of a thick oil.

This they mix with the oil of stone, prepared by powdering and washing in the same manner a particular sort of stones, and with this they cover all the vessels that they intend to varnish. The fern ashes have a very great share in the advantage that this oil has over our common varnishes; and the Chinese tell us, that they once instead of fern used the wood of a tree, called se-ki, and they suppose that the superiority of the old porcelain over the present, is owing to the use of this tree instead of the fern: but it is now too scarce among them. The new manufacture which was established at Bristol excels every thing, that has been done of the like kind, in the beauty of the varnishing; and it is said, they have founded their advantage on an imitation of this and the Chinese oil of stone. These two oils, as they are called, are always mixed together; and they must be carefully preserved of the same degree of thickness, or else all the varnishing will not be even.

FERNS, *Petrified*, in *Natural History*, are a kind of fossil plants found in the strata accompanying coal, and bearing some resemblance to ferns. Mr. William Martin, in his "*Petrificata Derbiansia*," describes and figures three kinds of these, as found in the Derbyshire coal strata, and in iron-stone nodules; these he denominates phytolithi, silicites striates, silicites auriformis, and osmundæ regales, the latter in compliance with the practice of former writers, but seems himself to doubt the identity of any of the three with recent plants of any kind. In Parkinon's *Organic Remains*, letter 45, &c. of vol. i., a recital of much which has been written on this subject will be found, accompanied also with doubts of such pretended identity: also, in W. Martin's "*Outlines of the knowledge of Extraneous Fossils*," pages 63, 64, 84, &c.

FERN, in *Geography*, a town of Scotland, in the county of Angus or Forfar; 6 miles W. of Brechin.

FERNAMBUC. See BRAZIL *Word.*

FERNAMBUCO, in *Geography*, also called *Olinda*, a captaincy or province of Brazil, lying along the coast of the Atlantic, and abounding in sugar, cotton, Brazil wood, cattle, and hides.

FERNAMBUCO, or *Olinda*, as it was called by the Dutch, the chief town of the fore-mentioned province, the see of a bishop, suffragan of St. Salvador; and having a small inconvenient harbour on the coast of the Atlantic. By the Portuguese this town is called Pernambuco. *S. Lat. 8° 15'. W. long. 36° 16'.*

FERNANDEZ, ANTHONY, in *Biography*, was born at Coimbra in 1558, admitted in early life a member of the order of Jesus, and having completed his studies to the satisfaction of his superiors, had the degree of doctor of divinity conferred upon him by the university of Evora, where he delivered lectures on the scriptures of the Old and New Testament with considerable reputation. His talents rendered him an object fit to be sent out on a mission to the Portuguese settlements; he went to Goa, where he obtained much respect as superior of his order in that city. On his return to Europe he devoted his time to the duties of the pulpit, and to write commentaries on the bible. His principal

principal publications are "Commentaries on the Visions of the Old Testament," in folio: and "A Commentary on Isaiah." Moreri.

FERNANDEZ, ALPHONSO, was born at Palencia, in Leon, in the year 1572; and appointed preacher-general to the Dominican order of monks in 1618. As an author he wrote "An Ecclesiastical History of his own Time;" "A Treatise on the Benefits conferred by his Order on the kingdom of Spain by the institution of the Inquisition;" "Annals of the Town and Church of Palencia;" these with a "History of the Devotion of the Rosary," were published in the Spanish language. He published other works in the Latin tongue, and was employed in compiling ecclesiastical annals of Spain, which with other works have been published since his death. Moreri.

FERNANDEZ, Juan, in *Geography*, an island in the southern Pacific ocean, first seen in 1563, and so called from its discoverer, is of an irregular shape, about five miles long, and between one and two broad. It is distant from Chili about 110 leagues. This island has been frequently described by the navigators of the Pacific, and particularly in the account of Anson's voyage: it was a place of resort for refreshments, especially antiscorbutic vegetables, with which it abounds; and the freebooters of former times made it a place of resort for the rendezvous of their forces, or the division of their spoil. At a convenient distance from the coast of Peru, unsettled and unfortified, abounding in almost every requisite for re-fitting, re-victualling, wooding, and watering, it became not only a desirable station, but was long an unsuspected or despised retreat. The Spaniards, however, at length directed their attention to it, and in 1766, or 1767, made a settlement upon it. In the latter year captain Carteret on his voyage round the world, upon opening Cumberland bay, was surpris'd to find the island in possession of the Spaniards, who had built a fort, on which the Spanish colours were flying, and some cannon mounted. Many cattle were seen on the hills, and about 20 houses in different parts of the island. Carteret had no communication with the shore, but failed immediately for Masafuero. In the year 1792, it was visited by lieutenant John Mofs of the royal navy, who then commanded a ship in the southern whale and seal fishery. He approached it on the west side, and came abreast of the north point; but, unapprized of its having been settled by the Spaniards, he proposed to catch fish, and to examine if it afforded safe anchorage. But hauling his boat round the N. W. point, he found the place fortified, and saw a small village in the valley. His request, presented to the governor for leave to anchor and to fish, was not formally granted; however, keeping his boat out of the way of the guns, he caught as many fish as served the whole ship's company. From him we learn, that in making the island from the westward, it appears elevated at the N. end, and slopes away towards the south, with a remarkable inlet, or large rock, detached about half a mile off the S. point. At a distance the whole island appears like an entire rock; but on nearer access the intersecting vallies discover themselves, and display a fine scene of verdure, being covered with wood. The west side affords no anchorage, nor any landing place, the cliffs rising almost perpendicularly from the sea. When abreast of the N. W. point, the first valley or landing-place opens, where there is anchorage in 14 fathom water, but in an exposed situation. Here the Spaniards have a guard-house and one gun. About half a mile to the E. N. E. is the great bay, (Cumberland bay of the Buccaneers,) which is land-locked from E. to N. W. by W.; but there is no anchorage in less than 40 fathoms, till within half a cable's length of the shore.

The town or village is very pleasantly situated in a fine valley, between two high hills. A battery of five guns is placed just round the W. point of the harbour, and commands the road; though it is possible to land clear of the reach of any gun. This battery is built of loose stones, piled up breast-high, and forming embrasures, without mortar, or any kind of cement. On the left of the valley, on a little eminence, another battery was then constructing of masonry, with two faces, having 14 embrasures in each, one face pointing to the anchorage, and the other flanking the village; five guns were mounted on that side which faces the road, and one in the other. According to the report of the commandant, the whole force on the island in January, 1792, consisted of six soldiers, and 40 of the settlers armed and trained. Captain Mofs, though not allowed to refresh his crew, saw great numbers of goats on the sides of every hill, and regretted that he could not relieve his crew, who were disordered with the scurvy, and which would have been speedily corrected by the fresh venison, fish, and vegetables to be found there. Towards the close of the year he touched again on the island, and was politely accommodated by the governor with a plentiful supply of sheep, vegetables, milk, and craw-fish, and two bullocks. In the town there are about 40 houses, and several in different parts of the island. Every house has a garden, with arbours of grape-vines, forming a delightful shade. Figs, cherries, plums, and almonds appeared all green, and abundance of potatoes, cabbages, onions, thyme, and other vegetables and herbs; but none of them in perfection, as a sort of grub is said in a great measure to destroy the kitchen gardens. From other accounts it appears, that the southern part of the island is precipitous and barren; but there are some hills of a red-earth, approaching to vermilion. The soil of the northern part is loose and shallow, so that very large trees soon perish for want of root, and are easily overturned. The dress of the women in this island is very singular: they wear a petticoat which reaches only a little below the knee, and which is spread out by a hoop at the bottom to a great distance round them, leaving the legs entirely exposed; they wear their hair long, plaited into 40 or 50 small braids, which hang straight down the back. This dress is also that of the ladies of Peru and Chili. In every house captain Mofs was presented by the women with *mate*, the infusion of the herb of Paraguay, which they suck up through a pipe or tube, that serves more than one person, and is handed about from one to another. The women are in general handsome, and every house swarmed with children. As Juan Fernandez and Masafuero may be mistaken one for the other, by strangers, both lying in the same latitude, we may observe, that the N. end of Juan Fernandez is highest, while Masafuero is lowest to the north. Besides, a small island lies off the S. end of Juan Fernandez. These two islands lie 80 miles from each other. Juan Fernandez, according to the observations of captain Mofs, lies in S. lat. 33° 40'. W. long. 80 30'.

× FERNANDO DE VORONHA, an island of the Atlantic, distant between 60 and 80 leagues from the coast of Brazil. Its surface is mountainous and unequal, but mostly covered with wood and herbage. The high part of one mountain, nearly in the middle of the island, is distinguishable from the rest; it is called "Campanario," or the Belfry, from its resemblance to a church tower, and it very much leans, or overhangs, to the east. The island nowhere exceeds two leagues in extent.

According to Don Ulloa, to whose description of it captain Cook refers in the second volume of his second voyage, (p. 278.),

× !!!
between 60 & 80.

(p. 278.), this island has two harbours, capable of receiving ships of the greatest burden; one on the N. side, and the other on the N. W. The former is, in every respect, the principal, both for shelter and capacity, and the goodness of its bottom, but both are exposed to the N. and W. winds, though these winds, particularly the north, are periodical, and of no long continuance. He farther says, that you anchor in the north harbour, (called by Cook a road,) in 13 fathoms water, one-third of a league from shore, on a bottom of fine sand; the sea and hill above-mentioned bearing S. W. 3° southerly. This road seems to be well sheltered from the S. and E. winds. The water in this island is brackish, and very scarce; and sometimes no rain falls for two or three years. In consequence of this deficiency of moisture, more than from the nature of the soil, which produces every species of grain, and fruits common in hot climates, the plants wither and die, and the most fertile parts of the island, unless when they are softened by the humidity of the clouds, become as arid and barren as rocks. The Portuguese, however, say, that in the interior parts of the island there is no want of water, that is clear and wholesome. In the inland part of the island there is a Portuguese town, in which the parish priest and governor reside; and it has several forts constructed of stone, which are spacious and well provided with artillery, and garrisoned by soldiers, who are partly regulars, sent from Fernambeau, relieved every six months, and partly transports sent from that mart of Brazil, which supplies them with provisions and other necessaries. The harbour or roads abound with various kinds of fish, and from December to April the shores of the whole island are covered with the eggs of turtles. S. lat. 3° 53'. W. long. 32° 34'.

FERNANDO-PO, or **FERNAND PAO**, an island of Africa, in the Atlantic, near the coast of Benin, about 20 leagues in circumference; the land lies high, and the soil is fertile in manioc, sugar-canes, rice, fruit, and tobacco: the inhabitants are rude and uncivilized. This island seems destitute of any good harbour, and very much abandoned to the goats and seals: but the Spaniards retain the nominal possession. N. lat. 3° 20'. E. long. 10° 45'.

FERNANDO, *St.* a town of South America, in the province of Tucuman; 150 miles W. of St. Jago d'Elteros. S. lat. 28°. W. long. 68° 16'.—Also, a town of South America, in the province of Cumana.—Also, a town of Spain, in Galicia, near the W. coast; 37 miles W. of Orense.

FERNAO, or **FERNANDO VELOSO**, a river of Africa, which runs into the Indian sea. S. lat. 14° 10'.

FERNEBO, a town of Sweden, in the province of Gestrucia; 25 miles S. of Gaste.

FERNEL, JOHN, in *Biography*, a physician of the sixteenth century, and a member of the faculty of Paris, greatly distinguished by his learning and talents. According to the best authority, for there is some contradiction among his biographers, Fernel was born at Clermont, in the year 1497. He received the greater part of his education at a grammar-school of that place, under the eye of his parents; for it was not until the nineteenth year of his age that his ardent thirst after knowledge led him to procure the permission of his father to prosecute his studies in Paris. He distinguished himself so greatly among his fellow-students in philosophy, that, after having taken the degree of master of arts, he was requested to undertake the professorship of Dialectics in his college (St. Barbe's.) This led him to a serious and profound course of study, in order to the prosecution of which he renounced all society and recreation;

and his labours were only arrested by a quartan ague, with which he was seized, and which compelled him to fly to his native province for the restoration of his health. On his return to Paris, when he had determined to choose medicine for his profession, the narrowness of his father's finances compelled him to take some measures for subsistence during his study of that science; and he taught philosophy in the chair of the college of St. Barbe, and was admitted to the degree of bachelor in medicine (the duties of the professorship not impeding his studies) in 1528. In the year 1530, at the age of 33, he arrived at the doctorate, and settled in Paris. His passion for the mathematics, even after he married in 1732, had nearly proved ruinous to his family; when he listened to the advice of his father-in-law, and resumed the study and practice of medicine, becoming at the same time a teacher of that science in the College de Comouailles in 1536. He soon obtained a most extensive fame, and a laborious practice, in which he was unusually successful, inasmuch that he had scarcely time for his ordinary repairs, and often took his meals without sitting. He was distinguished among his brethren by his boldness in presuming to question the dogmas of Galen, in which the most implicit and bigotted confidence was universally placed. In 1542 he was put upon the establishment of the Dauphin, Henry, and was made personal physician to that prince soon after he came to the throne. He had hoped by this change of life to obtain leisure for the prosecution of his favourite studies; but the wars which Henry II. carried on with the English and Spaniards compelled him to march at the head of his army, and Fernel followed him. But even amid the agitations of a military and restless life, at the age of sixty, Fernel seldom passed a day without writing. It was in one of these marches that he commenced his treatise on Fevers, which was indeed almost completed, when the king retook Calais from the English on the 1st of January, 1558. On his return from this expedition, Fernel followed the court to Fontainebleau, taking with him his wife, who, being hitherto accustomed to a quiet and stationary life, and chagrined at this separation from her family and connections, fell into a fever, in the course of a few days, which terminated fatally, on the 20th day of the disease. The shock which this blow gave to Fernel was so great, that in twelve days afterwards, he was himself seized with a similar fever, which carried him off on the 26th of April, 1558, in the sixty-second year of his age, to the universal regret of the metropolis.

The titles of the works of Fernelius, as he is called in his Latin treatise, are, 1. "Monasphærium partibus constans quatuor, &c." Paris, 1526. 2. "De Propositionibus, libri duo," *ibid.* 1528. 3. "Cosmo-theoria Libros duos complexa," *ibid.* 1528. 4. "De naturali parte Medicinæ, libri septem," *ibid.* 1532. 5. "De vacuandi ratione, liber," *ibid.* 1545. 6. "De abditis rerum causis, libri duo," *ibid.* 1548. This work underwent nearly thirty subsequent editions. 7. "Medicina, ad Henricum II. &c." 1554. This collection has been still more frequently reprinted, with some changes of the title. 8. "Therapeutices universalis, seu medendi rationis libri septem," Lugduni, 1659. 9. "Consiliorum Medicinalium liber," Paris, 1582. Many times reprinted. 10. "Februm curandarum methodus generalis," Francfort, 1577. A posthumous work. 11. "De Luis veneræ curatione perfectissima liber," Antwerp, 1579. Edited by Giffelin, a physician of Bruges. Some other parts of his works have been translated, or edited separately since his death. Eloy remarks, that as many things taken from the Arabian writers are found in the works of Fernel, and as the elegant Latinity in which he

has repeated them is generally admired, the following bon mot has been applied to him: "Facies Arabum melle Latinitatis condidit."

FERNELIA, in *Botany*, so named by Comnerfon, probably in honour of some one of his countrymen or acquaintances, but it does not appear from whom. Juss. 199. Lamarck t. 67. f. 1. Class and order, *Tetrandria Monogynia*. Nat. Ord. *Rubiaceae*.

Gen. Ch. Cal. Perianth superior, of four equal teeth. Cor. of one petal, funnel-shaped; tube the length of the calyx; limb spreading, in four equal broad segments. Stam. Filaments four, very short, inserted into the top of the tube; anthers erect, oblong, furrowed, half as long as the limb, at length recurved. Pist. Germen inferior, globular; style thread-shaped, the length of the stamens; stigma obtuse. Peric. Berry crowned with the calyx, of two cells, the partitions not reaching quite across, but their central part is (according to Jussieu) supplied by a receptacle bearing the seeds. Seeds numerous.

Ess. Ch. Corolla of one petal, funnel-shaped, superior. Anthers nearly sessile, in the mouth of the corolla. Berry of two cells, with many seeds.

Obf. This genus differs from *Catephia* in its short filaments and the place of their insertion. How far it is distinct from *Randia*, (now made a *Gardenia*;) except in number, which is of small or no importance, may admit of much doubt. Jussieu allows their fruit to be similarly constructed. We merely notice it here for future consideration.

Two species are described.

1. *F. buxifolia*, Lamarck, Encycl. v. 2. 432. Illust. 287. "Segments of the corolla obtuse. Berry globose." A much-branched shrub or tree, found in the island of Mauritius, where it is called *Bois de Buis*, or *Faux Buis*, False Box, from the resemblance of its leaves to common Box. It has no thorns. The flowers are whitish, axillary, two or three together, on short, simple, silky stalks, with a bell-shaped, toothed bractea, like a second calyx to each. Corolla scarcely half an inch long. Berry the size of a black currant. Lamarck reckons two varieties; but these appear to us merely the same plant, gathered at two different seasons of the year, that in fruit having larger leaves.

2. *F. obovata*, Lamarck, Illust. 287. t. 67. f. 1. "Segments of the corolla acute. Berry oval." Native of the same country, according to Lamarck, from whom alone we have any knowledge of this species. What he has associated with it in his plate, is an altered copy of *Petesia Lygislum* from Brown's Jamaica, t. 3.; but has set this right in his letter-press.

FERNERA, in *Geography*, a town of Germany, in the principality of Culmbach; 12 miles W.S.W. of Culmbach.

FERNES, a cape, and also a bay on the W. coast of Eda, one of the Orkney islands. N. lat. $59^{\circ} 2'$. W. long. $2^{\circ} 43'$.

FERNEY, a small, regular, well built town, pleasantly situated near the lake of Geneva, with a handsome seat, celebrated for being the residence of Voltaire, at the intersection of two high-ways, the one leading from Switzerland to Lyons, and the other from the Franche-Comte to Geneva.

FERNITE, a town of the duchy of Stiria; eight miles S.E. of Gratz.

FERNS, a small post town in the county of Wexford, Ireland, which is a bishop's see, united to Leighlin. For an account of the united bishopricks, see LEIGHLIN. The bishop's residence is at a handsome and convenient palace lately erected in Ferns. This town is 54 miles south from Dublin. Beaufort's Memoir.

FEROE, or **FAROER**, *Islands*, are situated in the North sea, between N. lat. $61^{\circ} 15'$ and $62^{\circ} 21'$; and with regard to longitude, the town of Thorshern lies $19^{\circ} 15' 15''$ W. from Copenhagen, and $9^{\circ} 47' 45''$ E. from Teneriffe. They are eighty-four miles distant from the coast of Norway on the eastern side, and forty-five miles from the Shetland isles towards the south-west. It is not improbable, that the free-booters, who at one time infested most of the northern seas, first discovered the way to these islands, where they introduced sheep, in order to supply them with provisions in their frequent cruizes. In the time of Harald Harfager, king of Norway, that is, in the ninth century, these islands were inhabited by some discontented Norwegians, who for a long time supported themselves by piracy and occasional incursions into their original country, Norway. These people, it is reasonably supposed, were first subjected to the Norwegian dominion by king Hagen Adelstein, but they soon threw off the yoke, and maintained their freedom, till they were again reduced to obedience by king Magnus the Good; after which period these islands belonged to Norway, till they became a part of Denmark by the union of the two crowns. Christianity was introduced into these islands soon after its establishment in Denmark, A. D. 1000; and they were thought worthy of a particular bishop, who was appointed to reside in the island of Stromoe. The Norwegians are supposed to have given them the name of Feroe, from the number of sheep which they found in them; *faar*, in Danish, signifying sheep, and *oe* an island; others, however, conceive, that the name is derived from *fier*, feathers, an article with which they have always abounded; or from *fjar*, or *fiam*, far distant. These islands are in number twenty-two, seventeen of which are inhabited. They occupy in a direction from N. to S. fifteen miles; extend in breadth from E. to W. ten miles; and contain altogether nearly $23\frac{1}{2}$ square miles. They consist of a group of steep rocks or hills, rising from the sea, chiefly of a conical form, and placed for the most part close to each other, some of which proceed with an even declivity to the shore; but the greater part of these declivities has two, or three, or more sloping terraces, formed by projecting rocks, and covered with a thin stratum of earth, which produces grass. Close to the sea, however, the land in general consists of perpendicular rocks, from two to three hundred fathoms in height. The highest of these hills is Shællins, in the southern part of Nordstromoe, being two thousand two hundred and forty English feet high. The hills lie so close to each other, that they are separated merely by a brook or rivulet; and between them there are no vallies of any extent. In the higher ground, however, between their summits, are a few dales, covered with wretched grass. The rocks in general consist of trap, much intermixed with feld-spar, glimmer and small grains of zeolites. No certain traces of any crater or signs of volcanic eruptions are found here; nor does there seem to be any pumice-stone or lava, unless basaltes, of which there are several columns, belongs to that kind of production. The Feroe islands contain a great many streams and rivulets, which are generally fordable and furnish trout. Trout is also caught in some fresh water lakes between the hills. After rain these hills present a number of water-falls, the most remarkable of which is Fofaa, between Qualvig and Halderfvig, in Nordstromoe. These islands abound also in springs, which are of two kinds, cold and warm; of the latter, the most remarkable is Vermakiede in Oitarve. The Feroe islands which are inhabited are seventeen, and form seven parishes: their names are

Fugloc, Swinoe, Videroe, Bordoe, Komoe, Kalfoe, Ostarve, Stromoe, Kolder, Haitoe, Nolfoe, Vaagoe, Myggenæs, Sandoe, Skuve, the greater Dimon, and Suderoe. Bordoe is separated by a narrow channel from Videroe, and is little more than $2\frac{1}{2}$ miles long, and at its greatest breadth $1\frac{1}{2}$ mile. It has seven villages. For the other islands, see their respective articles. In these islands there is no want of good harbours and anchoring places; but there is some difficulty in obtaining pilots. The currents round and between the islands are rapid and strong, especially three days before and three days after new and full moons. There are several whirlpools at some distance from the shores. The surf which prevails round these islands is very remarkable, and in winter and the early part of spring it exhibits a wonderful and awful spectacle. As the Feroe islands lie in the latitude of 62° north, the sun, during the three summer months, is scarcely four hours beneath the horizon, so at that time there is no night; at least there is light sufficient for enabling a person to read and write. But in winter the days are so much shorter, and would be exceedingly dark, if the deficiency of light were not in some measure supplied by the morning and evening twilight. The heat, notwithstanding the high latitude, is more temperate in summer, and the cold less severe in winter than in the more southern provinces of Denmark; the sea round the coast never freezes; and the cause of this mildness of the winter is the vicinity of the sea. The weather in Feroe is never uniform, and the barometer is exceedingly variable. These islands have lain under the imputation of being foggy and unhealthy; but though the first charge may be true, the second is not so well founded. The winds and hurricanes in the Feroe islands are so violent among the hills and rocks, as to inspire the traveller with terror. Thunder is not so common as in Denmark; but the northern lights are often seen, particularly in the winter. These islands are at present almost entirely destitute of wood, but this does not appear to have been formerly the case. Attempts have been made at different times to introduce wood, by planting bushes and trees of various kinds, but they have been for the most part attended with little success. The black cattle here are small, and little or no trade is carried on in this article. The cows are much neglected and ill fed; and of course yield little milk. The Feroe heifers are small, with thick drooping heads; they are generally of a fox colour, and some few are almost black. Little attention is paid to them. Sheep, of which one peasant will sometimes possess two or three hundred, are the principal riches of these islanders; their flesh affords them food: their wool clothing; and of the remainder, after their own wants are supplied, they manufacture articles of commerce. The sheep remain out summer and winter, without ever being housed; and on this account many of them are lost. Domestic cats are common, some of which become wild; and dogs are very useful to the peasants, as they assist them in the care of their sheep. It would extend this detail too much to enumerate the variety of their fowl and fish. Geese were formerly more abundant than they are now; but these islands have various kinds of ducks, the most remarkable of which, on account of its valuable production is the eider duck. See *EIDER-DOWN*.

One great source of subsistence to these islanders is the sea fowl which abound on the coast, and which are caught either by dragging them out of their holes, or by another method, for which a bird-pole, with a peculiar apparatus, is employed. The operation is singularly adventurous, and attended with danger, among the high and steep rocks, which the bird-takers climb, or from which they are suspended by ropes. The catching of seals is also of great importance to the in-

bitants of these islands. The fishery at Feroe, however, is much declined; at one time fish was an important article of food and of commerce; but these have now almost entirely deserted the coast. The kinds of fish caught in salt water are the turk, halibut, and cod. The whale fishery is periodical, and does not now take place so often as formerly; but where it is carried on it produces great advantage to these islands. Small whales come to Feroe in shoals of from one hundred to one thousand; and when it is considered that each fish in general yields one cask of train oil, which sells for nine rix-dollars, the value of one fishing will amount to from nine hundred to one thousand rix dollars, besides the benefit which the natives derive from the fish itself, which, if not employed for making oil, affords agreeable and wholesome food. See *WHALE-FISHERY*.

In Feroe there are no frogs, toads, lizards, snakes, or serpents, and no amphibious animal of any kind.

The natives of Feroe are, in general, handsome and well-made. In the colour of their hair there is considerable variety. Their complexion exhibits a healthful mixture of red and white, acquiring a brownish cast in hot summers, whilst they are employed in procuring turf. Their features are never disfigured by the small-pox, for this disease has not yet become endemial in these islands. The natives of the Southern islands, though their whole extent be only 15 miles, are of less stature, have round faces, speak precipitately, and appear to be much livelier in their actions; whereas the natives of the Northern islands are in general taller, have more lengthened countenances, speak slower, and are much graver in their whole deportment. The women are, for the most part, exceedingly pretty and well-proportioned; many of the people are inclined to be phlegmatic; but they possess great sensibility. They are of a religious disposition; and when, on a Sunday, they cannot have the benefit of a clergyman's services, they meet in church, sing psalms, hear the service read by one among themselves, and also a sermon. They are peaceable among themselves; affable and friendly in their disposition; and also, according to their means, hospitable, kind and benevolent. They are also honest in all their dealings with one another, and humane and compassionate towards strangers. The language of Feroe consists, in great part, of old Danish, or rather Norwegian words; which, by a corrupted pronunciation, has assumed a foreign appearance. However most of the inhabitants of these islands understand the Danish language, in which the Christian religion is taught. This account of the Feroe islands we have extracted, in an abridged state, from the *Athenæum*; in which periodical publication an anonymous writer has made copious extracts from the communications of a Danish clergyman who resided in them several years, and who had the best opportunity of acquainting himself with their situation, nature, and extent, as well as with their productions, and the manners and customs of the inhabitants.

FEROENSIS MARCA, in *Natural History*, a name given by some authors, to a muddy earth, found principally in the fissures and caverns of Rome, and called by the generality of later naturalists, a garnet mineral, and the best; and by the ancients, terra, or creta teleutensæ. See *Teleutensæ*.

FEROKABAD, in *Geography*, a town of Hindostan, on the coast of Malabar; 15 miles S. of Calicut.

FEROL, a sea port and good harbour, in Persia, on the coast of the Persian ocean, in the archipelago of India, 70 miles S. S. E. of Truxillo, S. lat. 10. W. long. 70. 20.

FEROLIA, in *Botan. Aëth. Græc.* suppl. 7. t. 372. Jul. 342, *Tab. Paris.* t. 1. A tree of Germany, *tab. 372.*

flowers are unknown to botanists. The fruit is a compressed, roundish, rugged, bordered *drupa*, not very fleshy, with a compressed nut of two cells, with one seed in each, but it often happens that only one cell perfects its seed. The *trunk* is 40 or 50 feet high, bearing numerous branches at the top, the ultimate ones very slender. *Leaves* two inches long, alternate, on short stalks, elliptic-lanceolate, pointed, entire. *Fruit* in terminal bunches. The bark of the tree is smooth and ash-coloured, milky when wounded. The heart of the wood is a kind of fattin wood, hard and heavy, red variegated with yellow, taking a fine polish. It is sometimes called *bois de Ferole*, from a name of a former governor of Cayenne, who first introduced it as an article of commerce.

Jussieu suspects this tree may be generically allied to the *Parinari* of Aublet, t. 204—206. *Petrocarya* of Schreber. They agree in the *drupa* of two cells, and are not dissimilar in habit.

FEROLLI, in *Geography*, cape or point, a cape on the W. coast of Newfoundland, N. of St. John's bay. N. lat. 51° 2' W. lon. 74 52.

FERONIA, in *Mythology*, derived from *fero*, to bring relief, or from the town Feronia, near mount Soracte, was, according to Servius, the patroness of the enfranchised slaves, to whom were presented many offerings; this goddess being in high veneration through all Italy. Servius supposes her to be the same with the virgin Juno, and this supposition is countenanced by an ancient inscription quoted by Fabretti, and expressed in these terms, "Junoni Feron." The Romans appropriated to this goddess the care of the woods and orchards. She had a temple at the foot of mount Soracte, where an annual sacrifice was offered to her; and it has been said that those who were fully inspired by this goddess walked bare-footed upon coals without being burnt, or suffering any harm. Horace in one of his satires (l. i. sat 5.) mentions the homage that was paid to this divinity, in washing the face and hands, according to custom, in the sacred fountain which flowed near her temple.

FERONIA, in *Botany*, after a goddess to whom the ancients dedicated forests. Correa Tr. of L. Soc. v. 5. 224. Class and Order, *Decandria Monogynia*. Nat. Ord. *Aurantia* Juss.

Gen. Ch. *Cal.* Perianth inferior, of one leaf, small, flat, in five deep segments, deciduous. *Cor.* Petals five, oblong, acute, spreading, much longer than the calyx. *Stam.* Filaments ten, inserted into the receptacle, awl-shaped, erect, shorter than the petals, broad and compressed, as well as very hairy, at the base; anthers erect, ovate. *Pist.* Germen superior, nearly ovate; style short, conical; stigma bluntish, notched. *Peric.* Berry of five cells, globular, with a tough roughish coat. *Seeds* very numerous, in simple rows, attached to the central receptacle.

Ess. Ch. Calyx in five deep segments. Petals five. Berry superior, of five cells. Seeds numerous. Stigma notched.

The only known species is

F. elephantum. Roxb. Coromand. v. 2. 21. t. 141. Elephant apple. A native of moist woods and mountainous parts of India, flowering, according to Dr. Roxburgh, during both the hot and cold seasons, and ripening fruit in hot and rainy weather. It forms a large tree, with a deeply cracked bark, from which, when wounded, issues a beautiful transparent gum, excellent for water-colours. The wood is white, hard and durable, but splits in the sun. Pulp part of the fruit universally eaten by the inhabitants of the coast of Coromandel. The branches are thorny. *Leaves* pinnate, of about seven obovate, entire, smooth, opposite leaflets. *Flowers* in terminal and axillary clusters, white tinged with

purple. *Fruit* the size of an orange, greenish. Some flowers have an abortive pistil.

FEROSEPOUR, in *Geography*, a town of Hindoostan, in Moultan, on the Setledge; 48 miles S. of Lahore. N. lat. 31° 5'. E. long. 73° 59'.

FERRACINO, BARTHOLOMEW, in *Biography*, was born at Bassano in Vicentin, in 1692, of parents so humble, that in early life he was engaged in sawing wood as the means of a livelihood. Having a natural genius for mechanics, he soon invented a saw that was worked by the wind, and which he rendered so perfect, as to perform his work with expedition and accuracy, without much manual exertion. Success in one invention soon led him to make experiments in other branches of business, in which he likewise succeeded; he made clocks in iron; and invented some useful hydraulic machines; of these, one was formed on the principle of Archimedes's screw, which raises water to a considerable height. His chief work was the noble bridge over the river Brenta, at Bassano, which is greatly admired for boldness of conception, and solidity of construction. Ferracino died soon after he had completed this undertaking. His life was published in 1764, by M. F. Memo, in quarto, who has entered pretty largely into his labours and inventions. *Nouv. Dict. Hist.*

FERRAND, LEWIS, was born at Toulon in 1645, where he received the elements of a learned education, but he finished his studies at Lyons. He was originally intended for the law, but he gave early proofs of attachment to biblical literature and theology, by publishing, when he was but nineteen years of age, "A paraphrase on the seven penitentiary Psalms." In the following year he went to Mentz, with a view of employing all his powers in a new translation of the bible from the Hebrew. His zeal being now checked by the want of encouragement, he returned to France, applied himself to the law, took his degrees at Orleans, and was admitted an advocate of the parliament of Paris. In 1670 he published a work, consisting of a plan of annals of the kings of France and the Ottoman emperors: in 1679 he published "Reflections on the Christian Religion, containing Explanations of the Prophecies of Jacob and Daniel relating to the advent of the Messiah," in two vols. abounding in much curious chronological and historical matter. For this work, on account of its high merit, he obtained a pension of 800 livres. M. Ferrand died in 1699, having published many other works besides those which have been referred to, almost entirely on theology. The last labour in which he was engaged was entitled "A collection of Dissertations, &c. on the Bible, in the Latin language," only one volume of which was published during his life. He left behind him a great mass of MSS. on various topics; of these, one was committed to the press, entitled "Of the knowledge of God." He was esteemed by his contemporaries a very able, and very learned man; and he was unquestionably most indefatigable in whatever he undertook. *Moreri.*

FERRANDUS, surnamed *Fulgentius*, who flourished in the sixth century, was an African by birth, and a disciple of St. Fulgentius. When that prelate was banished by the Arians to Sardinia, Ferrandus accompanied him; but on his return he was chosen deacon of the church of Carthage, when he entered with much zeal into the question which was the subject of warm discussion at that day, "whether it could be said that one of the persons of the Trinity suffered on the cross." Ferrandus died about the year 535, leaving behind him many works that were highly thought of by his contemporaries. The most considerable was "A Collection of Ecclesiastical Canons," for restoring discipline in the churches of Africa. This is one of the most ancient collections

collections of canons among the Latins. It consists of between two and three hundred abridged from the councils of Africa, Ancyra, Laodicea, Nice, Antioch, &c. A life of Fulgentius has also been ascribed to Ferrandus, but by some authors it has been ascribed to another of the prelate's pupils. Moreri.

FERRAR, ROBERT, was an eminent divine, born at Halifax, in the county of York, at which place he received the rudiments of his education; for its completion he was sent to Cambridge, and afterwards was admitted ad eundem into the university of Oxford. Having early embraced the doctrines of the Reformers, and in their defence displayed a considerable portion both of learning and zeal; he was patronized by archbishop Cranmer, who appointed him one of his chaplains, and subsequently procured for him the bishopric of St. David's. During the regency of Edward VI. he fell into disgrace at court, on suspicion of his entertaining heretical opinions, and was put in confinement on charges falsely preferred against him, as was subsequently proved; for in the reign of Mary he so far distinguished himself in the Protestant cause, as to excite the vengeance of the insatiate persecutor of truth, bishop Gardiner; by whom Ferrar was summoned to recant his errors, and, persisting in his refusal to comply, was condemned as an heretic, and burnt at the stake in the town of Caermarthen, South Wales; where an inscribed monument still records the sanguinary transaction, and designates the spot on which the pious prelate suffered martyrdom in the year 1555. Fox's Arts and Monuments.

FERRARA, in *Geography*, a city of Italy, and capital of the exarchate of the Lower Po, situated on a branch of the Po, on the frontiers of the Venetian states. Fortified by Smaragdus, exarch of Ravenna in 585, it was erected into a bishopric by pope Vitalian in the year 657, and in 735 it was made an archbishopric. It was afterwards enlarged, and became celebrated under the princes of the house of Este; but having lost its dukes it declined in magnificence and wealth. It is about four miles in circumference, and defended by a citadel, strong walls, and bastions. The streets are handsome, and it has many magnificent palaces and churches. They reckon, besides the cathedral, which is ancient, 100 churches, 38 convents, and about 14,000 inhabitants. The air in its environs is unwholesome on account of the marshes that encompass it: Ariosto lies buried in the Benedictine convent, and in the hospital of St. Ann Tasso was confined as an idiot. Its university was founded in 1390 by Albert, marquis of Ferrara; 40 miles S.E. of Mantua. N. lat. 44° 51'. E. long. 11° 35'.

FERRARESE, late a province of Italy, in the state of the church, is bounded on the N. by the Poelino, on the E. by the gulf of Venice, on the S. by the Romagna and Bolognese, and on the W. by the Mantuan and Modenese. The whole country is fertile, but low and marshy, being often overflowed by the waters of the Po. After passing from the house of Este, to which it was granted by the emperor Frederic II. to the state of the church, it now constitutes the department of the Lower Po, being ceded by the pope in 1797. It has few towns, being badly cultivated, and thinly inhabited. The chief places are Ferrara and Comachio.

FERRARI, JOHN MATTHEW, in *Biography*, known by the surname of *De Gradulus*, or *De Grafo*, from the villa in which he was born, in the Milanese, was one of the most expert physicians of his time. He practised medicine at Milan, whence he was invited to Pavia, to occupy the medical chair in that university, an appointment which he fulfilled with great applause. He was also physician to Maria Bianchi Vis-

conti, dukes of Milan. He died in 1480. He has left three large works, which have been frequently reprinted. The first is "A Commentary on Rhases;" the second is entitled "Expositiones super vigesimam secundam Fen 3tia. Canonis Avicennæ;" and the third also "A Collection of the Opinions of Avicenna, and Rabbi Moyses."

FERRARI, OTTAVIANO, was born at Milan in 1518, and having pursued a regular course of studies, he was made professor of moral philosophy and politics in the Canobian college, a post which he occupied eighteen years. He was afterwards professor at Padua, or Pavia, but returned to Milan, where he died in 1586. He was intimate with the most eminent scholars of his time; and published an introduction to the Aristotelian philosophy, entitled "De disciplina Encyclica;" and another work, "De sermonibus Exotericis," which treats on the exoteric books of Aristotle. But his most valuable work is "De Origine Romanorum," devoted to the detection of the forgeries of Annus of Viterbo. He translated Athenæus into Latin, and wrote notes upon Aristotle. Moreri.

FERRARI, LEWIS, inventor of the first method of resolving biquadratic equations, was born at Bologna about the year 1520. He studied mathematics under the celebrated Cardan, who, having had a problem given him for solution, gave it his pupil as an exercise of his ingenuity. This led to the discovery of a new method of analysis, which is precisely that of biquadratics. Cardan published this method, and assigned the invention to its real author, and, but for this liberal conduct of the master, the pupil, for want of publishing any thing himself, would have been unknown to posterity. At the age of eighteen he was appointed a tutor in arithmetic, and was equal to the task of disputing with the most distinguished mathematicians of his own age. He was afterwards appointed professor of mathematics at Bologna, where he died in 1565. Ferrari was an excellent classical scholar, a good geographer, and well versed in the principles of architecture. He was, however, addicted to astrology. Hutton's Math. Dict. Moreri.

FERRARI, FRANCIS BERNARDIN, was born at Milan in 1577. He was educated in his native city, attracted the notice, and acquired the patronage of archbishop Borromeo, who, having projected a grand library at Milan, appointed Ferrari to travel through different parts of Europe to purchase the best books and MSS. that could be obtained. With this view he visited Spain and Italy, and procured a vast number of valuable works, which laid the foundation of the Ambrosian library. To this institution he was appointed the librarian, and created doctor. In 1638 he was nominated director of the college of Nobles, then recently erected at Padua, but the state of his health obliged him to resign that situation in less than two years. He returned to Milan, where he died in 1699, having attained to the ninety-second year of his age. He left behind him numerous works in ecclesiastical and profane antiquities in an unfinished state. His chief publications are, "De Antiquo Ecclesiasticarum Epistolarum genere," lib. iii. Milan, 1613 4to. "De Ritu Sacrarum Eccl. Cathol. Concionum," lib. iii. Milan, 1620. 4to. which was afterwards reprinted by Grævius; and "De Ritu Veterum Acclamationibus et Planctu," lib. vii.; this also is reprinted in the sixth volume of Grævius's Rom. Antiq. Ferrari was author likewise of "A Treatise on the Funerals of Christians."

FERRARI, OTTAVIO, was born at Milan in 1607, and so quickly did he establish his literary reputation, that at twenty years of age he was chosen professor of eloquence in the Ambrosian college. In 1684 he occupied the same post in the university of Padua, where he was also appointed professor.

professor of the Greek language, and by his means that feminary was restored to its ancient splendour. On account of his extraordinary services he received a stipend of two thousand florins; for a panegyric in praise of queen Christina he was rewarded with a golden collar, value one thousand ducats, and another, published in honour of Lewis XIV., obtained him a pension of 500 crowns for five years. He was appointed historiographer to the city of Milan, and composed eight books of its history, but either the want of necessary documents, or the fear of offending the house of Austria, or his benefactor the king of France, caused him to leave his papers unfinished. He was well known as an antiquary, and published several learned works on that subject, these are "De re vestitaria," to which he added "Analecra," and dissertations "De Lucernis Sepulchralibus Veterum," "De Pantomimis et Minis," "De Balneis et Gladiatoribus." He died in 1684. Moreri.

FERRARI, JOHN BAPTIST, a native of Sienna, deeply learned in the Oriental languages, published, in 1622, a Syriac dictionary, with a view of furnishing biblical scholars with such Syriac words as occur in the scriptures. It is well and highly spoken of by Simon and Labbe. He was author of "Flora, seu de florum cultura;" also of "Hesperides, five de Malorum Aureorum cultura et usu." He died in 1655. Moreri. See FERRARIA.

FERRARI, PHILIP, was an Italian monk, who flourished in the 17th century, and taught mathematics in the university of Pavia. He recommended himself to the esteem of several popes, as Clement VIII., Paul V., and Urban VIII., and was twice general, and twice vice general of his order. He was author of "Typographia in Martyrologium Romanorum," "Epitome Geograp. lib. iv.," but his principal production was his "Lexicon Geographicum," which has been frequently reprinted. Moreri.

FERRARI, BENEDETTO, of Reggio in the Modenese state, spent the chief part of his life at Venice, where, though the inhabitants of that city cultivated and encouraged the drama with more diligence and zeal than any other city in Europe, during the latter part of the 17th century, and the beginning of the last, yet they were not very early in its establishment; as the first regular opera or drama set to music which was performed at Venice after the invention of recitative was "Andromeda," written by Benedetto Ferrari, and set to music by Francesco Minelli of Tivoli, in 1637. Ferrari was himself a celebrated performer on the lute, an able poet, and a good musician; who, collecting together a company of the best singers in Italy, brought this opera on the stage in the theatre of S. Cassiano, at his own expence, in a very sumptuous manner. An extraordinary instance of spirit and enterprise in a private individual of moderate fortune, to vie with princes in an exhibition of which they only could support the splendour. (Le Glorie della Poef. et della Mus.) Ferrari was not only qualified in an eminent degree for directing such enterprises, but for supplying the principal materials; from his excellent performance on the lute, he was very early styled Ferrari della Tiorba. He was a poet, a composer, and a singer in his own dramas. For five succeeding years, he annually produced an opera, which being collected into volumes in 1651, the printer informs the reader, that Benedetto had still twelve more musical operas to give to the public. In 1638, "La Maga Fulminata," by the same poet and musician, was exhibited at the expence and risk of Ferrari and of five or six of the performers, in a very sumptuous and magnificent manner, though the expence did not amount to more than 2000 crowns. A sum which, at present, (says the author of "The Glory of Poetry and Music," 1730) is hardly

sufficient to satisfy the demands of an ordinary singer. But at this time the performers either shared in the profits, or were content with a moderate salary; public singers being then but seldom wanted, and that only in the capital cities of Italy; whereas, at present, dramatic representations abound in villages. Ferrari was author of both words and music of two operas, "Armida," in 1639, and "Il Pastor Reggio" in 1640; it was, however, much easier to set these dramas than to compose, as these operas preceded the invention of airs, the dialogue being only carried on in recitative, till about the year 1649, when, in the opera of "Giasone," written by Cicognini, and set by Cavalli, it is said that the grave recitative began first to be interrupted by that anacreontic kind of stanza which has since been called aria. Storia Criti. de Teatri del Dottor Napoli Signorelli.

FERRARIA, in Botany, so named by Burmann, in the Ephemerides of the Imperial Academy *Natura Curiosorum* for 1761, in honour of John Baptist Ferrari, a Jesuit, who published at Rome, in 1633, a quarto volume on the culture of flowers, the pompous plates of which are said to have been drawn by Guido Reni and Pietro da Cortona. He published also at Rome, in 1646, a still more splendid work, in folio, on the culture of orange-trees. Linn. Gen. 165. Schreb. 451. Willd. Sp. Pl. v. 3. 580. Juss. 57. Gawl. in Ann. of Bot. v. 1. 241. Mart. Mill. Dict. v. 2. Clafs and order, *Monadelphia Triandria*. Nat. Ord. *Enfatae*, Linn. and Gawler. *Irides*, Juss.

Gen. Ch. *Col.* Spatha of several inflated leaves. Perianth none. *Cor.* of six petals, regular, cohering by their claws, reflexed, pointed, crisped, with involute points; the three alternate ones rather the smallest. *Stam.* Filaments three, united into a tube in their lower part, equal, spreading above; anthers didymous, two-celled. *Pist.* Germen inferior, obovate, obtuse, somewhat triangular; style thread-shaped, the length of the filament; stigmas three, dilated, petal like, cloven, deeply fringed, converging. *Peric.* Capsule oblong, triangular, of three cells and three valves; partitions contrary to the valves. *Seeds* numerous, roundish, in two rows.

Ess. Ch. Spatha inflated. Petals six, regular, crisped and fringed. Stigmas three, petal-like, fringed. Capsule of three cells. Seeds roundish. This genus is very properly reduced by Mr. Gawler to the original species, and another which he has described, excluding *F. Pavonia* of Linnæus, and *ixioides* of Willdenow.

1. *F. undulata*. Linn. Sp. Pl. 1353. Mill. Ic. t. 280. Jacq. Hort. Vind. t. 6). Curt. Mag. t. 144. (Fl. indicæ, e violaceo fuscus, radice tuberosa; Ferrar. de Fl. Cultura 168. t. 171.) "Border of the corolla thrice as long as the claws. Lobes of the anthers close." Native of the Cape of Good Hope, cultivated by Miller at Chelsea in 1759. *Ait. Hort. Kew.* v. 3. 305. It flowers with us early in the spring, being kept in a greenhouse, like other Cape bulbs. The leaves are equitant, somewhat glaucous, inflated at the base, and the floral leaves and spathas resemble them, only being shorter. The stem is branched above, bearing numerous, very transient flowers, of a singular curled appearance, variegated with purple and white, and bordered with brown.

2. *F. antberosa*. Gawl. in Curt. Mag. t. 751. (*F. viridiflora*; Andr. Repos. t. 285. *F. Ferrariola*; Willd. Sp. Pl. v. 3. 581. *Moræa Ferrariola*; Jacq. Coll. v. 4. 141.) "Claws of the corolla equal to the border. Lobes of the anthers divaricated." Native of the Cape of Good Hope, introduced by Mr. G. Hibbert in 1802. It much resembles the former, but differs essentially in the greater length of the claws of the petals, the shape and greater size of the
anthers,

anthers, and the *stigmas* being more toothed at their base, *Gawler*.

FERRARS, GEORGE, in *Biography*, was born at St. Albans about the year 1510. He studied at Oxford, and from thence he removed to Lincoln's-inn, and became a distinguished pleader in Westminster-hall. He was patronized by lord Cromwell, and obtained the favour of Henry VIII. whom he attended in a military and civil capacity. In 1535 a considerable grant was made to him out of the royal demesnes in Hertfordshire, but, notwithstanding his ample income, want of economy brought his affairs into such a situation, that, in 1542, while representative for Plymouth, he was arrested for debt, and thrown into the compter. He was, however, set at liberty by virtue of privilege of parliament, and the officers concerned in his arrest were imprisoned for contempt of the powers and privileges of a representative of the people. In the reign of Edward he accompanied the protector, Somerset, to Scotland, as commissioner of the army. He was afterwards master of the sports, at a festivity held at Greenwich for twelve days, in order to amuse the king. This appointment is supposed to have been occasioned by some metrical stories of his composition, inserted in the "Mirror of Magistrates," the first edition of which appeared in 1559. Ferrars is said to have been the author of "The History of the Reign of Queen Mary," in the Chronicles published under the name of Richard Grafton. He published a translation of Magna Charta, from the French, into the Latin and English, and other laws enacted in the time of Henry III. and Edward I. Mr. Ferrars died in 1579. *Biog. Brit.*

FERRATO SASSO, an historical painter known under that name, but whose real name was Giovanni Battista Salvi. He derived the former appellation from being born at an ancient castle so called, on the borders of the territory of Urbino, in 1504. He went to Rome to study the works of Raffaello, then, as since, the admiration of the world. Francisco Penni assisted Salvi in his studies, who had obtained great skill in copying: but his original works do not exhibit much comprehension of mind. He died in 1590, at 86 years of age.

FERRATO, CAPE, in *Geography*, a cape on the east coast of Sardinia. N. lat. 39 31'. E. long. 9° 34'.

FERRATT, CAPE, or *Cape Mesuff*, a cape on the coast of Algiers. N. lat. 36° 9'.

FERRE, CAPE, a cape on the S.E. coast of Martinico. N. lat. 14° 30'. W. long. 60° 40'.

FERRE-ANAH, a town of Africa, in the kingdom of Tunis, was formerly, according to Dr. Shaw, the largest city of Bizacium, though its ancient grandeur is exhibited only in a few granite and other pillars, which the Arabs have suffered to remain. It was well watered by a stream which ran under the walls, and by wells within the city, encompassed by a corridor, and vaulted over with cupolas. The circumjacent country, however, is dry, barren, and inhospitable, for want of water. Several circumstances lead us to conclude that it was the ancient Thala, mentioned by Tacitus, or Telepte; and that Thala and Telepte were the same; 13 miles S.W. of Tunis.

FERREIN on the Vocal Organ, in *Music*. See *VOICE*.

FERRERA, in *Geography*, a town of Spain, in Granada: 48 miles S.E. of Guadix.—Also, a town of Portugal, in the province of Alentejo; 13 miles W. of Beja.

FERRERA des Aves, a town of Portugal, in the province of Beira; 15 miles N.E. of Viseu.

FERREOLA, in *Botany*, from *ferrum*, iron, alluding to the hardness of the wood. *Roxb. Corom. v. 1. 35.*

Mart. Mill. Dict. v. 2. Class and order, *Diazia Hexandric*. Nat. Ord. *Guaiacane*, *Juss.*

Gen. Ch. Male *Cal.* Perianth inferior, bell-shaped, three-cleft, permanent. *Cor.* of one petal, tubular, cut half way down into three erect segments, externally hairy. *Stam.* Filaments six, inserted into the receptacle, awl-shaped, equal, erect, the length of the corolla; anthers erect, oblong. Rudiment of a germen roundish, abortive. Female *Cal.* and *Cor.* like the male. *Stam.* none. *Pist.* Germen superior, ovate; style short, columnar; stigma three-cleft. *Peric.* Berry round, of two cells. *Seeds* solitary, convex on one side, flat on the other.

Eff. Ch. Male, Calyx three-cleft. Corolla tubular, three-cleft. Female, Cal. and Cor. as in the male. Berry superior, of two cells. *Seeds* solitary.

Obs. Sometimes, according to Koenig, there are but five stamens.

1. *F. buxifolia*. *Roxb. Corom. v. 1. 35. t. 45.* (*Ehretia ferrea*; *Willd. Phytogr. fasc. 1. t. 2. f. 2.*) Native of Coromandel, growing to the size of a tree on the mountains, but in the Low Countries it is but a shrub. The wood is dark, hard, and durable, very useful where its small size does not preclude its use. *Branches* numerous, rigid, and divaricated. *Leaves* not an inch long, on short stalks, alternate, obovate, entire, obtuse, emarginate, smooth. *Flowers* small, yellow, axillary, solitary, nearly sessile. *Berry* the size of a large pea, red, eatable, and very good. *Roxburgh.*

FERRER'S BAY, in *Geography*, a bay on the N. coast of Egmont island, or New Guernsey, with a town or village; five miles E. of Carteret point.

FERREAS, DON, JOHN DE, in *Biography*, a noble Spaniard, born in the province of Astorga in 1652, was brought up with the monks, and became distinguished for pulpit eloquence. He twice refused the honour of a bishopric, choosing rather the life of a literary man in the metropolis, than the emoluments attached to the most elevated situation in the church. He was elected a member of the Spanish academy in 1713, and soon after was made royal librarian. He took a considerable part in the compilation of a dictionary, and contributed the articles under the letter G, and a discourse on the origin of the Castilian tongue. He died at Madrid in 1735. He was author of many pieces in theology and general literature, but he is best known for a "General History of Spain," in 16 vols. 4to. It has been translated into French by M. de Hernally. *Moreri.*

FERRET ISLAND, in *Geography*, a small island near the E. coast of Labrador. N. lat. 53 40'. W. long. 55° 40'.

FERRET, Viverra, in *Zoology*, an animal of the *mustela* or *weasel* kind, called by some also *mustela sylvestris*, *furo*, and *surunculus*. See *MUSTELA Furo*.

FERRET, Indian, viverra Indica, a name by which some have called the animal known in America by the name of *quirpele* and *quill*. See *VIVERRA Mungo*.

FERRETS, in *Glass-making*, the irons with which the workman tries the melted metal to see if it be fit to work.

It is also used for those irons which make the ring at the neck of bottles.

FERRETES D'ESPAGNE, in *Natural History*, a name given by authors to certain stones of a regular figure, found on the sides of a rock in Spain; which have been since discovered very plentifully on the bottom and sides of the Fontaine de Salut, near Bagnères in France, and in other places in the country thereabout.

Every one of these stones, so long as it remains in the rock,

rock, is always found between two bundles or clusters of transparent fibres, of which generally one is placed on the one, and the other on the opposite side; these clusters of fibres are largest in the largest stones; however, they are always found even about the smallest in some quantity. *Philos. Trans.* N^o 472. p. 30.

FERRETI, EMILIO, in *Biography*, born at Castel-Franco, in Tuscany, in 1489, studied at Pisa and Sienna, and became secretary to cardinal Salviati at Rome. He was admitted an advocate at the age of nineteen; after which he was made professor of law, and secretary to Leo X. This office he filled with much reputation for several years, and then retired to his own country. On his return he accompanied Montferat, the commander of the French army, to Rome and Naples. On his return he was taken prisoner by the Spaniards, and obliged to pay a high ransom for his liberty. He next went to France, and taught the law at Valence with great reputation. He was then employed in various diplomatic stations, and as counsellor of the parliament at Paris. At length, after various negotiations, he finally became professor of the law at Avignon, where his stipend was raised to a thousand crowns. He died in 1552, and when his successor Craveta began his lectures by strictures upon Ferreti, the scholars shewed their attachment to their old master by hissing and driving him from the place. Ferreti was a man of general learning, and well acquainted with classical literature. He gave an edition of the principal orations of Cicero. *Bayle. Moreri.*

FERRETO, an historian and poet of Vicenza, was born about 1296, and took a considerable part in the restoration of polite literature in Italy. He wrote, in Latin, a history of Italian affairs, from 1250 to the year 1318. This is one of the best compositions of the age, and was first printed in Muratori's Collection of Italian writers. *Moreri.*

FERRETTE, in *Geography*, a town of France, in the department of the Upper Rhine, and chief place of a canton in the district of Altkirch. The place contains 608, and the canton 11,470 inhabitants, on a territory of 225 kilometres, in 31 communes.

FERRETTO, in the *Glass Trade*, a substance which serves to colour glass. This is made by a simple calcination of copper, but it serves for several colours. There are two ways of making this; the first is as follows: take thin plates of copper, and lay them on a layer of powdered brimstone, in the bottom of a crucible; over these lay more brimstone, and over that another layer of the plates, and so on alternately till the pot is full. Cover the pot, lute it well, place it in a wind-furnace, and make a strong fire about it for two hours. When it is taken out and cooled, the copper will be found so calcined that it may be crumbled to pieces between the fingers like a friable earth; it will be of a reddish, and in some parts a blackish colour. This must be powdered and sifted fine for use. *Neri's Art of Glass*, p. 30.

The other way is less easy, but it makes a more valuable ferretto. It is this: make a number of stratifications of plates of copper and powdered vitriol alternately in a crucible, which place on the floor of the glass-furnace near the eye, and let it stand there three days; then take it out, and make a new stratification with more fresh vitriol, and calcine it again as before; repeat this operation six times, and a most valuable ferretto is produced.

FERRI, PAUL, in *Biography*, who flourished in the 17th century, was born at Metz in the year 1591. He pursued his theological studies with so much zeal that he was introduced to the ministerial office when he was but

19 years old, and even then he had appeared as an author by a volume of poems written in the moments of relaxation. He possessed very extraordinary pulpit talents, and was the most popular preacher among the reformed in his province. He died of the stone in 1669, in his 79th year. The works published during his life were chiefly theological, but he left behind him collections for a history of Metz, in three or four volumes folio, which are referred to by Calmet as abounding in curious researches. In the height of his popularity he was charged with having received an annual pension of five hundred crowns from cardinal Richlieu, as a bribe for his services in attempting to promote an union between the Catholic and Protestant religions. This charge has been fully investigated, and proved to be without the smallest foundation. *Bayle. Moreri.*

FERRI, IL CAVALIER BALTAZAR, of Perugia, in the 17th century, is inflamed by Rousseau, in his "Mus. Dict." as the most extraordinary vocal performer that ever existed. "This singular and prodigious singer," says he, "who had such talents as all the sovereigns in Europe courted and seized by turns, was loaded with gifts and honours during his whole life, and his powers and glory all the muses vied with each other in celebrating after his death. Every panegyric that was written upon this musician, breathes rapture and enthusiasm; and his contemporaries all unite in affirming, that a talent so perfect and so rare, was above all competition, and had even silenced Envy herself. It is impossible, say they, to express the brilliancy of his voice, or the graces of his style. He had all the characteristics of different styles in the highest perfection; he was lively, dignified, grave, and tender, at his pleasure, and all hearts were melted by his pathos. Among the infinite passages of the extremest difficulty which he performed with his voice I shall only repeat one. He ascended and descended in one breath two full octaves in a running shake, in chromatic degrees of half notes with such accuracy, though without accompaniment, that, if suddenly the base was struck to any one of these intervals, whether flat or sharp, the exact intonation was instantly felt in an astonishing degree by the audience." *Bontempi Istoria Mus.*

We used to wonder whence Rousseau took this splendid account, as we found nothing so marvellous elsewhere; in Quadrio's ample list of opera singers, from the year 1634 to 1744, amounting to 273, no such name as that of Ferri occurs. We find him not in Padre Martini, Algarotti, Planelli, Napoli Signorelli, Arteaga, or Eximero, and it seems as if Bontempi, in imitation of Apelles the painter, who composed the face of his Venus of the best features of all the beauties of Greece, had rather told us what was to be wished in a perfect singer than what really ever did exist in any one mortal; and we cannot help thinking that Bontempi has coloured his piece the higher from Ferri having been his countryman. One great singer may have possessed two or three of his excellencies at most. But exaggeration is the constant companion of panegyric and satire. If a singer of the name of Baltazar Ferri ever saw the light, and had transcendent powers, they are certainly magnified à la Herschel: but his name not occurring in any other musical work, or dramatic personæ of the innumerable operas that we have collated and examined, obliges us to doubt the authenticity of the account given us from Bontempi by the ingenious and enthusiastic citizen of Geneva.

Monf. Laborde has abridged the tale from Rousseau, and placed the name of Ferri in Quadrio's list, between Cavalli and

and Paita, among fingers who flourished between 1690, and 1700; but *non est inventus* either there or elsewhere.

FERRI, CIRO, an historical painter, born at Rome in 1634. He was a favourite disciple of Pietro da Cortona, whom he assisted in finishing several of his works at Florence, and at Rome; and whose style he so nearly adopted that their pictures may sometimes be mistaken for each other. Generally, Ferri has less grace of design, less ease in his actions and draperies, and less compass of mind; but he has more solidity and carefulness of finish than his master. His St. Ambrosio in the church of that saint at Rome offers the fairest comparison between them and Romanelli, a fellow scholar with Cirò Ferri. His principal works in fresco are in the Palace Pitti, at Florence, and at St. Maria Maggiore of Bergamo.

FERRIER, JEREMIAH, a Protestant minister, and professor of divinity at Nîmes in Languedoc, in the beginning of the 17th century, maintained in public debate that pope Clement VIII. was properly and truly Antichrist. For this liberty of speech he was arrested and thrown into prison at Toulouse; from the effects of which he escaped, in consequence of an arrêt from Henry IV. forbidding persons to molest him on account of that business. Notwithstanding Ferrier's zeal in the instance referred to, he was one of the firm who, in the political assemblies of the protestants, opposed their proceedings in support of their civil and religious privileges and immunities. He began now to be suspected of having been induced by a bribe to desert his cause, and was forbidden to appear in their assemblies again. His conduct in other respects was equally reprehensible, and he was prohibited from exercising his ministry within the province of Languedoc. He now turned his attention to the law, but the populace, who are ever indignant at the treachery of public characters, attacked him publicly in the streets, with stones, and other missile weapons, so that his life was in imminent danger. Not contented with the injury inflicted on his person, they proceeded to ransack his house, burning and destroying his goods and books, and treating with much brutality his wife and children, whom the prudence of the magistrates preserved from greater mischief. Hence he became an avowed convert to the Catholic faith, settled at Paris, and took some pains to advance his fortune. His zeal was now equally great in defence of his new opinions, at least of what were considered his new opinions, and he published a treatise, entitled "De l'Antichrist, et de ses Marques, contre les ennemis de l'Église Catholique," &c. He was likewise supposed to be the author of "Catholique d'état, ou discours des Alliances du roi tres Chrétien contre les calomnies des ennemis de son état." M. Ferrier was employed by the king in many affairs of great national importance, and was, in 1626, appointed privy counsellor. He stood also high in estimation with cardinal Richieu. He died in 1626, and on his death-bed dictated an epitaph, in which he declared his steady attachment to the Catholic faith: he went much farther, and even extorted from his children a promise that they would live and die in the communion of Rome. Bayle. Moreri.

FERRIERES, in *Geography*, a town of France, in the department of the Ourte, and chief place of a canton, in the district of Huy; the place contains 689 and the canton 4,981 inhabitants, on a territory of 145 kilometres, in 16 communes.—Also, a town of France, in the department of Loiret, and chief place of a canton, in the district of Montargis; the place contains 1610, and the canton 9,025 inhabitants, on a territory of 270 kilometres, in 7 communes.

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FERRILITE, in *Mineralogy*, a name given by Mr. Kirwan to rocks found at, and in the neighbourhood of, Rowley Regis, Staffordshire, and known by the term Rowley rag. It has been considered by many as basalt, by others as Floetz greenstone, and by some called winn, an indefinite term used in the north of England, and applied to various hard stones.

Its colour is greyish-black, inclining to greenish-black, and, when exposed to the weather, brownish. It occurs massive in great beds, or strata, in the vicinity of Rowley, Dudley, Walsall, and the south-west part of Staffordshire; and in some instances in columnar distinct concretions, particularly at Powk Hill, near Walsall, where it is quarried for mending the roads.

Internally it is glimmering, from minute crystals of hornblende and felspar, particularly the fractured surface of the latter, which is foliated.

The fracture is generally fine-grained, uneven, but often flat, conchoidal, and fine splintery. The fragments rather sharp edged.

When disintegration has taken place to a considerable extent, it occurs in large globular concretions, which appear to be composed of concentric laminæ.

It is generally opaque, but sometimes faintly translucent at the edges, gives a whitish grey streak, hardish, scratches glass, brittle, and difficultly frangible, but less so than basalt of Werner; specific gravity 2.7 to 2.9.

It melts easily, without addition, before the blow-pipe, into a black glass.

It consists of felspar and hornblende in a confusedly crystallized state: it has been analysed by Dr. Withering, with the following result:

Silica	47.5
Alumina	32.5
Oxyd of Iron	20.0
	<hr/>
	100.0

It is probable, as so great a portion of it consists of felspar, that it contains pot-ash, but which, at the same time when this analysis was made, was not suspected to occur in the mineral kingdom.

It is also probable that the iron it contains is in a low degree of oxydation, as it exerts so much influence on the magnetic needle. This effect has been long known, as Dr. Plott, in his "History of Staffordshire," mentions, that it drew the compass needle 6° out of its proper direction.

The lower stratum of the Derbyshire toad-stone, which very accurately resembles ferrilite in its external character, is also very magnetic.

Mr. Keir has, in Shaw's "History of Staffordshire," given an interesting account of this ferrilite, and lately Mr. G. Watt (in *Philos. Trans.* 1804) has given a still more interesting detail of experiments made on this substance, by melting, and cooling it with different degrees of rapidity.

When cooled suddenly from the fluid state, it assumed the appearance of an opaque black glass, but when the heat was so slowly withdrawn that it was several days in cooling, its appearance was as stony, and texture as crystalline, as the original rock.

For observations on the phenomena, and conclusions illustrative of the igneous formation of basaltic, and other rocks; see *Philos. Trans.* 18.4.

FERRITER'S ISLAND, in *Geography*. See **BLANKETS**.

FERRO, or **HIERO**, the most westerly of the Canary islands, about 15 miles in breadth, and 45 in circumference. The ascent from the sea is difficult, as it is on all sides high and craggy: but on the summit it is tolerably level and fruitful; abounding with many kinds of trees and shrubs. It produces better grafs, herbs and flowers than any of the other islands; so that bees thrive and multiply here exceedingly, and yield excellent honey. The greater part of the wine of Ferro, which is bad, is distilled into brandy; and there are only three fountains of water on the island. On account of the scarcity of water, sheep, goats, and swine do not drink in summer; but they are accustomed to dig up the roots of fern, and chew them in order to quench their thirst. The larger cattle are watered at those fountains, and at a place where water distils from the leaves of a tree. The English and French geographers formerly reckoned their longitude from Ferro; but Englishmen now count their longitude from Greenwich, and the Frenchmen reckon theirs from Paris. N. lat. 27° 45'. W. long. 17° 46'.

FERROGAN, or **FARRAGON**, a mountain of Scotland, in Perthshire; 18 miles S. of Blair Athol. Its height is estimated at 2548 feet above the level of the sea.

FERROL, a handsome sea-port town of Spain, and harbour for the royal navy, in the province of Galicia, the entrance of which is formed by Cape Prior. It is situated N.N.E. of Corunna, and ten Spanish leagues from Cabo Ortegal, and has been, since the middle of the eighteenth century, one of the most famous maritime places in Europe, and one of the best in Spain. Before the year 1752, Ferrol was merely a kind of hamlet, inhabited by the sailors of coasting vessels, and fishermen: but a town has since been raised with an increasing population. The harbour is very safe, being on every side protected from the winds; it is surrounded by redoubts, mounting five cannon on each front, and four on each side: the whole is connected by an intrenchment and a parapet, which mask the interior works. It has one parish, containing about 8000 settled inhabitants, and occasionally many more, who are attached to the navy and the harbour, and it has two hospitals, one for the inhabitants, and the other for soldiers and sailors. It has also a school for midshipmen, magnificently built; the handsomest arsenal in the kingdom; a machine for hammering copper to sheath vessels; and an extensive rope-walk. The naval barracks are large and commodious, and capable of containing 6000 men. Here is also a good dock-yard. This place is at present the first arsenal of the royal navy of Spain: it was erected by order of Ferdinand VI., the father of Charles III. Art and nature have conspired to render the position of the harbour impregnable. The basin for the fleet is immense; each ship having a separate warehouse, where the tackle, rigging, and spare stores are marked, and placed in the greatest order. The "presidiario" is composed of 600 galley slaves, who are employed in the most laborious works of the harbour. Two castles, that of St. Philip, and that of the Palma, defend the approach of the coast between Corunna and Ferrol, and the road passes between them. Ferrol being more a military than a civil place, has only an alcalde mayor, and some alcaldes of districts, to attend to the police of the town; but it has a military commandant, a governor, an intendant, a complete and numerous staff, who serve for the fortifications, the harbour, and the garrison, which is always very strong. As Ferrol is altogether intended for the royal navy, general commerce and all foreign merchant-ships are excluded, except such coasting vessels, &c. as supply articles of necessity. The environs of the town have many fountains of excellent water, and the town has abundance of river and sea fish. It has

only one manufactory, which furnishes sail-cloth. N. lat. 43° 28'. W. long. 8° 11'.

FERROL, a small island in the Pacific ocean, near the coast of Peru. S. lat. 9° 15'.

FERRUGINOUS, denotes a thing to partake of the nature of iron, or to contain particles of that metal.

It is particularly applied to certain mineral springs, whose water, in their passage along the strata of the earth, meets with the ore of this metal, or with pyrites containing it, part of which they wash off, and carry with them, and thus become impregnated with the principles thereof. Such are what we call *chalybeate waters*.

The waters of Tunbridge, those of Forges, and of the iron spring at Bourges, and many others, are ferruginous.

FERRUGO, the rust of iron, or a kind of calx found on the surface thereof.

The rust of iron is a restraining; applied by way of pessary, it represses the fluor uterinus; and diant, prevents conception; it cures the erysipelas, and exanthematous eruptions. It is of good use in a paronychia, roughness of the eye-lids, and a condyloma. It also strengthens the gums, relieves under the gout, being rubbed on the part affected, and makes the hair grow after an alopecia. Wine or water, in which red hot iron has been quenched, being drunk, is good for the colic passion, dysentery, disorders of the spleen, cholera morbus, and relaxations of the stomach. See IRON.

FERRULE, in a *Ship*, a small iron hoop, fixed on the extremities of the yards, booms, &c.

FERRUM. See IRON.

FERRUM Equinum, in *Botany*, Horse-shoe Vetch. See HIPPOCREPIS.

FERRY, a liberty by prescription, or the king's grant to have a boat for passage upon a river, for the carriage of horses and men for a reasonable toll: it is usually to cross a large river. *Termes de Ley*.

A ferry is no more than a common highway; and no action will lie for one's being disturbed in his passage, unless he allege some particular damage, &c. (3 Mod. Rep. 294.) The not keeping up of a ferry has been held to be indictable. If a ferry be granted at this day, he that accepts such grant is bound to keep a boat for the public good. Holt, Ch. J. Shaw. 257.

FERRYLAND HARBOUR, in *Geography*, a bay on the east coast of Newfoundland. N. lat. 47° 8'. W. long. 52° 51'.

FERSIN, a town of Persia, in the province of Irak; 22 miles S. of Sava.

FERSINA, a river of Tyrol, which rises in a lake near St. Boldo, and runs into the Adige, 2 miles N. of Trent.

FERTE-ALLAIS, LA, a town of France, in the department of the Seine and Oise, and chief place of a canton in the district of Etampes. The place contains 780, and the canton 8,583 inhabitants, on a territory of 167½ kilometres, in 18 communes.

FERTÉ-Bernard, La, a town of France, in the department of the Sarthe, and chief place of a canton in the district of Mamers, surrounded with walls, and containing three fauxbourgs, 21 miles N. E. of Le Mans. N. lat. 48° 11'. E. long. 0° 44'. The place contains 2314, and the canton 11,720 inhabitants, on a territory of 181½ kilometres, in 14 communes. This is the birth-place of Robert Garnier, a poet.

FERTÉ-Chaudron, La, a town of France, in the department of the Nièvre; 10 miles N.W. of Moulins.

FERTÉ-Fresnel, La, a town of France, in the department

ment of the Orne, and chief place of a canton in the district of Argentan, 21 miles E.N.E. of Argentan. The place contains 376, and the canton 8,697 inhabitants, on a territory of 200 kilometres, in 20 communes.

FERTÉ-Gaucher, *La*, a town of France, in the department of the Seine and Marne, and chief place of a canton in the district of Coulommiers; 9 miles E.S.E. of Coulommiers. N. lat. 48° 47'. E. long. 3° 22'. The place contains 1,800, and the canton 10,241 inhabitants, on a territory of 277½ kilometres, in 19 communes.

FERTÉ-Macé, *La*, a town of France, in the department of the Orne, and chief place of a canton in the district of Domfront; 12 miles E. of Domfront. The place contains 3849, and the canton 13,470 inhabitants, on a territory of 135 kilometres, in 11 communes.

FERTÉ-St. Aubin, *La*, a town of France, in the department of the Loiret, and chief place of a canton in the district of Orleans. The place contains 1,558, and the canton 5,330 inhabitants, on a territory of 450 kilometres, in 8 communes.

FERTÉ-sous-Jouarte, *La*, a town of France, in the department of the Seine and Marne, and chief place of a canton in the district of Meaux; 10 miles E. of Meaux. The place contains 3,703, and the canton 15,206 inhabitants, on a territory of 210 kilometres, in 19 communes.

FERTÉ-sur-Amance, *La*, a town of France, in the department of the Upper Marne, and chief place of a canton in the district of Langres. The place contains 493, and the canton 5,972 inhabitants, on a territory of 120 kilometres, in 13 communes.

FERTÉ-Vidame, *La*, a town of France, in the department of the Eure and Loire, and chief place of a canton in the district of Dreux; 13 miles W. of Chateaufort. The place contains 1,271, and the canton 10,744 inhabitants, on a territory of 272½ kilometres, in 29 communes.

FERTIE'RE, a town of France, in the department of the Po, on the Dora; 8 miles N. of Sufa.

FERTILE, in *Agriculture*, a term signifying fruitful or abundant.

FERTILE *Soil*, is that sort of soil which, from the nature of its constituent principles, is capable of producing full crops. See *SOIL*.

FERTILE *Flowers*, in *Botany*, and *Vegetable Physiology*, are the *flores femineæ*, female flowers, of Linnæus. Being furnished with only one kind of sexual organs, the pistils, they cannot indeed of themselves bring the rudiments of the fruit to perfection, but with the assistance of the male ones, termed in contradistinction barren flowers, as having no rudiments of seed, they at length become prolific. (See *FECUNDATION of Plants*.) Examples are seen in the Oak, Hazel, and Walnut, where the fertile flowers, distinguished by very conspicuous stigmas, are of a quite different form and size from the barren ones. In several plants the fertile flowers are accompanied by rudiments of stamens, mostly inefficient, though liable to become perfect, according to circumstances, as in *Rhodiola*.

FERTILE *Florets*, in compound, and umbellate, flowers, are not only such as answer to the above description, as in the radius of the Daisy, Aster, &c., but the term is applied to all florets, (whether furnished with stamens or not, as well as with a pistil,) that bring their seed to perfection; which many, though formed with the rudiments of a germ and style, do not. In some compound flowers fertility resides more towards the circumference than the centre, as in the Marigold, *Calendula*, whole disk is altogether male. In the Sunflower and Knapweed it is otherwise,

yet rather by abortion than original conformation. See *FLOWER* and *FLORET*.

FERTILITY, FRUITFULNESS, that quality which denominates a thing fertile or prolific.

FERULA, a little wooden pallet or slice, reputed the schoolmaster's sceptre wherewith he chastises the boys by striking them on the palm of the hand.

The word is Latin, and has also been used to denote the prelate's crozier and staff. It is supposed to be formed of the Latin, *ferire, to strike*; or, perhaps, *ferula* in this sense may be derived from the name of a plant, called, in Latin, *ferula*; in English, *fennel-giant*; the stem whereof was anciently used to correct children with.

Under the eastern empire the *ferula* was the emperor's sceptre, as is seen on divers medals; it consists of a long stem or shank, and a flat square head. The use of the *ferula* is very ancient among the Greeks, who used to call their princes *αφηνολογοι*, q. d. *ferula-bearers*.

In the ancient eastern church, *ferula* or *narthex* signified a place separated from the church; wherein the penitents or the catechumens of the second order, called *αυσculτantes*, *αυγουσττικοι*, were kept, as not being allowed to enter the church; whence the name of the place, the persons therein being under penance or discipline: *sub ferula erant ecclesie*.

FERULA, in *Botany*, a name in Pliny, derived by some from *fero*, to carry, because its light hollow stalks were carried in the hand, as walking-sticks; by others from *ferio*, to strike, because they were used to chastise school-boys. *Fennel-giant*. Linn. Gen. 136. Schreb. 186. Willd. Sp. Pl. v. 1. 1411. Juss. 222. Tournef. t. 170. Gært. t. 85. Mart. Mill. Dict. v. 2. Class and order, *Pentandria Digynia*. Nat. Ord. *Umbelliferae*.

Gen. Ch. *General umbel* of numerous rays, globose; *partial* similar to it. *General involucrem* deciduous; *partial* of numerous, small, linear leaves. *Perianth* scarcely discernible. *Cor.* *Universal* uniform; flowers all fertile; *partial* of five oblong, straightish, nearly equal petals. *Stam.* Filaments five, the length of the corolla; anthers simple. *Pist.* Germen inferior, turbinate; styles two, reflexed; stigmas obtuse. *Peric.* Fruit oval, somewhat compressed, marked with three elevated lines on each side, separable into two parts. *Seeds* two, very large, elliptical, flat on each side, marked with three distinct ribs.

Eff. Ch. Fruit oval, compressed, with three ribs on each side. Calyx obsolete. *General involucrem* deciduous. Flowers uniform, all fertile.

Obs. The stalk of the principal umbel sometimes throws out lateral opposite flower-stalks.

The loftiest of umbelliferous plants, whose stems, though annual, and consequently properly herbaceous, have, when dry, a woody hardness; hence a quibbling ancient is reported to have called *Ferula* wood and no wood. The species in Willdenow are 12, but the synonyms are not free from confusion. The leaves of all are extremely compound, with narrow, nearly linear, leaflets or segments, often shining. The *flowers* are generally copious, yellow, disposed in a corymbose manner on a round, upright, tall, hollow stem. The plants when wounded exude an acrid or fetid resin.—They generally grow in the south and east of Europe.—The chief species are,

F. communis. Linn. Sp. Pl. 355. Dod. Pempt. 321. f. 11. Na. 875 of Dioscorides. "Leaflets linear, very long and simple." This was formerly supposed to yield the gum called *Sagapenum*, but modern naturalists have thought otherwise. It is scarcely cultivated but in curious botanic

gardens, on account of its cumbersome size and weed-like aspect. It is common in fields about Rome, flowering about Midsummer.

F. Ferulago. Linn. Sp. Pl. 356. Sm. Prod. Fl. Græc. v. 1. 191. (*F. nodiflora*; Jacq. Austr. append. t. 5. Willd. Sp. Pl. v. 1. 1413). "Leaflets linear-oblong, flat, three-cleft. Flowering branches mostly ternate. Bractæas reflexed, obtuse."—Native of Austria, and various more southern countries. This is a much more humble plant, with numerous small yellow flowers. Its flavour is acrid and nauseous.

F. Asa-fetida. Linn. Mat. Med. 40. (*Asa fœtida*; Kœmpf. Am. Exot. 535, t. 536). "Leaflets alternately sinuated, obtuse."—Native of Persia, from whence the drug is brought to us. (See *ASSA-FŒTIDA*.) We know nothing of this plant but from Kœmpfer's account and figure, from whence the above character is taken.

F. persica. Willd. 1413. (*Asa fœtida*; Hope Tr. of R. Soc. for 1785. 36. t. 3, 4). "Leaflets many-cleft, acute, decurrent. Primary umbel sessile."—The seeds of this plant were sent from the mountains of Ghilan in Persia to the Petersburg Academy, and two roots were communicated to Dr. Hope at Edinburgh, from whence Chelsea and other gardens have obtained living specimens. The leaves do not accord with Kœmpfer's figure above quoted, and therefore this is supposed a distinct species from the last, yielding, nevertheless, genuine *Asa-fœtida*, with the flavour of which every part is strongly impregnated, and which exudes in the form of a milky fluid wherever the herb is wounded. The leaves are rather glaucous. Flowers deep-yellow. It is perennial and hardy with us.

The sailors in the Levant make use of the *ferula* to transport fire from one island to another. This custom is of the earliest antiquity, and may serve to explain a passage in Hesiod (*Op. et Die*. l. i. v. 52.) who, speaking of the fire stolen from heaven by Prometheus, says, that he carried it in a *ferula*, ἐν κοίλῳ κρηθῆκε, since the foundation of this fable is undoubtedly owing to what Diodorus Siculus (l. 3.) tells us of Prometheus, that he was the inventor of the steel, τὸ πνεῦρον, with which fire is struck from the flint. In all probability, that prince made use of the pith of the *ferula*, instead of tinder, and taught men to preserve fire in the stalk of that plant. Its stalks are strong enough to serve for a support, but too slight to wound those who are beat with them. Hence we are told by Diodorus Siculus (*ubi supra*) that Bacchus, one of the greatest legislators of antiquity, enjoined primitive mortals, when they drank wine, to use these *ferula* canes, because they frequently broke one another's heads with those they used to wear of another kind.

FERULA, in *Gardening*, comprises plants of the herbaceous, perennial, flowery kind. The species chiefly cultivated being the common fennel giant (*F. communis*); the glaucous fennel giant (*F. glauca*); the Tangier fennel giant (*F. Tingitana*); and the broad-leaved fennel giant (*F. ferulago*).

They are all plants which rise to a great height in such soils as suit them.

Method of Culture.—All these plants are capable of being readily propagated by sowing the seeds either in the autumnal or spring season, in drills on beds of light earth, at one foot apart, and three inches distant. As the plants advance in growth they must be kept properly clean from weeds, and be well thinned out in order to afford full room for their spreading out.

They should continue in these beds for about two years, when they may be carefully taken up in the beginning of

the autumn, and be planted out where they are to remain. They mostly succeed in the best manner in the rather moist mellow loamy soils.

They are rather hardy, and well suited for being planted for ornament, in the more extensive borders and clumps of pleasure grounds, where they often continue for several years without requiring any other attention than that of being kept clean from weeds.

FERULA, in the *Materia Medica*. See *ASSA-FŒTIDA*.
FERULÆ, a word used by the ancients to express the horns growing on the deer or stag at the age of two years.

FERULÆ, among *Surgeons*, called also splinters, are little chips of different matter; as of wood, bark, leather, paper, &c. applied to bones that have been disjoined when they are set again.

The bark of the herb fennel-giant, called by some, in Latin, *ferula*, was anciently much used on this occasion; whence the name *ferula* became common to all.

FERUS, JOHN, in *Biography*, who flourished in the 16th century, was a native of Metz, where he took the habit of the Franciscans, and became warden of the order. He preached many years with great reputation, and died in the year 1554. His great work as an author was entitled "Commentaries" on almost all the books of the Old and New Testament. These are characterized by Dupin as large and eloquent discourses, in which the holy scriptures are faithfully explained. He was a candid as well as learned expositor, so that his writings have been in high estimation with Protestants, as well as by the liberal of his own denomination. By the bigots he was fiercely attacked and charged with Lutheranism. *Ferus* did not live to write his own defence, but he met with an able apologist even in Spain, viz. Michael Medina, a learned monk, who vindicated the explications which he had given by an appeal to the scriptures, and the doctrines of the apostles. The author had nearly suffered for his boldness in defence of a friend, and the works of *Ferus* were inserted in the "Index Expurgatorius." Like many good and excellent men of all persuasions he denied the lawfulness of war, holding it to be repugnant to the distinguishing principle of Christianity, which is universal benevolence. Moreri.

FERZAA, in *Natural History*, a name given by the Persians to that gem which we call the turquoise or Turkey-stone, a blue, opaque, and soft gem. See *TURCOIS*.

FESCAMP, in *Geography*. See *FECAMP*.

FESCENNINE, in *Antiquity*. *Fescennine verses* were a kind of satirical verses, full of wanton and obscene expressions, sung or rehearsed by the company, with many indecent gestures and dances, at the solemnization of a marriage among the Romans, and also at the festival of "Harvest-home." Hor. ep. i. lih. v. 145.

The word is borrowed, according to Macrobius, from *fascinum*, a charm; the people taking such songs to be proper to drive away witches, or prevent their effect; but its more probable origin is from *Fescennium*, a city of Campania, where such verses were first used.

FESHN, in *Geography*, a town of Egypt; 18 miles N. of Abu-Girgê.

FESOLI, or *FIESOLI*, *Congregation of*. See *JERONYMITES*.

FESSE, in *Heraldry*, one of the nine honourable ordinaries of the escutcheon, which it divides horizontally in the middle, and separates the chief from the point. It is supposed to represent a broad girdle or belt of honour, such as those with which knights at arms were anciently girded.

It possesses the centre of the escutcheon, and contains in breadth

breadth one third part thereof. Thus, he beareth azure, a fesse, or, by the name of Elliot.

When the fesse takes up less than its proper breadth, it is called a bar.

FESSE-point is the exact centre of the escutcheon.

It is thus called, as being the point through which the fesse line is drawn from the two sides; and accordingly it divides the escutcheon into two equal parts when the escutcheon is parted per fesse.

FESSE-ways, or in *Fesse*, denotes things borne after the manner of a fesse; *i. e.* in a line or range, across the middle of the shield, which the French call en fesse.

FESSE, *party per*, implies parted across the middle of the shield, from side to side, through the fesse point.

This the French expresses by one word, *coupé*.

FESSELDORF, in *Geography*, a town of Germany, in the bishopric of Bamberg; four miles S. W. of Weismayn.

FESSIER, in *Anatomy*, the name given by the French to the glutei muscles, which are distinguished as the grand, moyen, and petit. It is derived from fesse, the buttock.

FESTA, CONSTANTIUS, in *Biography*. Besides the works of such musicians as may be classed under the several schools of Italy, there are extant many admirable productions of a much higher period than Palestrina, preserved in the collections of the curious, by Italian composers, the particular place of whose birth or residence has not been recorded. Among these, there is one who for his genius and abilities well deserves a niche in every history of music. This is Constantius Festa, of whose compositions there are several in the British museum. There is likewise a motet of this ancient master in the same collection, printed in the fourth book of "Motetti della Corona," which was printed so early as 1519, ten years before Palestrina was born.

In the third book of Arkadelt's madrigals, printed at Venice, 1541, there are also seven compositions by Costanzo Festa, in which more rhythm, grace, and facility appear, than in any production of his cotemporaries, that we have seen. Indeed, he seems to have been the most able contrapuntist of Italy during this early period; and if Palestrina and Constantius Porta be excepted, of any period, anterior to that of Carissimi. His motets, for three voices, printed in 1543, are in the church style of the times, a model of elegance, simplicity, and pure harmony; the subjects of imitation are as modern, and the parts sing as well, as if it was a production of the present century. We could not resist the pleasure of scoring his whole first book of three-part madrigals, from the second edition printed at Venice, 1559; for we were astonished as well as delighted to find compositions so much more clear, regular, phrased, and unembarrassed than we expected.

FESTA in *Cappis*, in *Middle Age Writers*, grand holidays, in which the whole choir of the cathedrals wore caps.

FESTENBERG, in *Geography*, a town of Silesia, in the province of Oels; 10 miles N. of Oels. N. lat. 51° 21'. E. long. 17° 30'.

FESTI DIES, among the ancients, were feast-days or holidays.

Numa distinguished the days of the year into *festi*, *profesti*, and *interfesti*. The first were those dedicated to the gods; the second were those allowed to men for the management of their own affairs; the third were shared between the gods and men.

The festi dies, again, were divided, according to Macrobius, Saturn. cap. 16. into *sacrifices*; *epula*, or banquets;

ludi, or games, and *feria*; and the *profesti* into *fasti*, *comitiales*, *comprehensivi*, *flavit*, *praetorales*.

FESTING, MICHAEL CHRISTIAN, in *Biography*, an eminent musician, whose instrument was the violin, and who, during many years, was the leader and principal conductor of almost every musical establishment in London.

This performer, with a feeble hand, little genius for composition, and not a deep contrapuntist, by good sense, probity, prudent conduct, and a gentleman-like behaviour, acquired a weight and influence in his profession, at which hardly any musician of his class ever arrived. He led during many years at the opera, at Ranclagh, at the concert at Hickford's room, at the Swan and Castle concerts in the city, and often at Handel's oratorios. Nor was there a benefit concert for any English professor at that time without a solo on the violin by Mr. M. C. Festing; and yet there is not a ripieno player on the violin at the opera now, whose hand and abilities are not superior to those of Festing upon that instrument. Learn hence, ye young professors, that something else is necessary, besides musical talents, to carry you reputationally and comfortably through the world!

FESTING-Men. See FASTERMANS.

FESTING-Penny, in *Rural Economy*, a term provincially applied to the earnest given to servants when hired at fairs, or other places.

FESTINO, in *Logic*, one of the moods of the second figure of syllogisms.

In a syllogism in festino, the first proposition is an universal negative; the second, a particular affirmative; and the third a particular negative.

FESTIVAL. See FEAST and FESTUM.

FESTNERSGREATH, in *Geography*, a town of Germany, in the bishopric of Bamberg; 16 miles S. S. W. of Bamberg.

FESTOON, in a *General Sense*. See GARLAND.

FESTOON, in *Architecture* and *Sculpture*, is a decoration in form of a garland or cluster of flowers.

The word is French, *fesson*, which signifies a garland, formed of the Latin, *festum*, *jeail*.

It consists of a string or collar of flowers, fruits, and leaves, tied together, somewhat biggest in the middle, and suspended by the two extremes; from which, beside the main part which falls down in an arch, two lesser parts hang perpendicularly.

This ornament is made in imitation of the festoons or long clusters of flowers, hung by the ancients on the doors of their temples, &c. on festival occasions.

Festoons are now chiefly used in friezes, tablets, and other vacant places, required to be filled up and adorned. They are sometimes used over or under a niche.

FESTUCA, in *Botany*, a Latin word expressive of the shoot of an herb or tree, adopted by Dillenius, in his Nov. Pl. Gen. 90. t. 3, for a genus of grasses. The *Festuca* of Dillenius however, comprehended under the *Bromus* of Linnaeus, is distinct from the genus here intended.—*Festuca*—Linn. Gen. 36. Schreb. 50. Willd. Sp. Pl. v. 1. 418. Juss. 32. Lamarek. Illustr. Gen. t. 46. Sm. Fl. Brit. 113. Leers. t. 8. Class and order, *Triandra D. S. P. Nat. Ord. Gramina*.

Gen. Ch. *Cal.* Glume of two valves, erect, containing many florets, in a slender, roundish, two-ranked spikelet; its valves awl-shaped, pointed, the lower one smallest. *Cor.* of two valves; the lower one larger, of the form of the calyx but larger, somewhat cylindrical, pointed, awned. "Nectary either of two ovato-lanceolate, acute leaflets, gibbous at their base; or of one rather concave, horizontal, notched leaf." *Schreber. Stam.* Filaments three, capillary,
the tee

shorter than the corolla; anthers oblong. *Fls.* Germen turbinate; styles two, short, reflexed; stigma downy. *Peric.* none, except the corolla closely enfolding, and united to, the seed, not burbling. *Seed* one, oblong, slender, very sharp at each end, marked with a longitudinal furrow.

Ess. Ch. Calyx of two valves. Spikelet oblong, somewhat cylindrical, two-ranked, with sharp-pointed glumes.

A rather large genus, of slender, narrow-leaved, rigid grasses, of a glaucous or greyish-green hue, whose species are often very difficult to define. Some diversity of opinion has existed among botanists respecting the generic distinction between *Festuca* and *Bromus*. (See *BROMUS*.) The terminal awn of the former is generally constant, to which Dr. Smith has added the smoothness, or at least only fine pubescence, of the edge of the inner valve of the corolla; considering the most important mark of *Bromus* to consist in the strong bristly fringe of the same part. With this last character will always be found the proper habit, colour and proportion of the latter genus, whether the awn be accurately terminal or no.

Willdenow has 26 species of *Festuca*, but many more are now known. Of these 26, 15 have the panicle pointing to one side; the rest have an equally spreading panicle.

The *Flora Britannica* describes 12 species, to which two have since been added in *Engl. Bot. vis.* *F. caesia*, t. 1917, a glaucous kind found on barren open heaths in Surrey and Suffolk; and *F. triflora*, t. 1918, found by Mr. Crowe at Saham, Norfolk, and since by the Rev. Mr. Holme, F. L. S. at Hinton, Cambridgeshire, and by Mr. G. Don in Scotland. This is *Bromus triflorus* of Linnæus, very near *F. gigantea*, t. 1820, and like that, approaching too much to the habit of a *Bromus*, but both of them have the two most essential characters of *Festuca*.

F. ovina, *Engl. Bot.* t. 585, common in dry open ground, has been much celebrated by Stillingsfleet as good for sheep; but some late observations have discredited this opinion, it being doubtful whether those animals eat it, though it grows where they feed. From this *F. vivipara*, t. 1355, was first separated, as a species, in Fl. Brit. it having before been thought a variety, caused by its moist alpine place of growth. But its glumes are very differently shaped from those of *ovina*. There is more doubt whether *amethystina* be really distinct from *ovina*, and also whether *rubra*, t. 2056, and all its acknowledged varieties, be specifically different from *duriuscula*, t. 470, and *dumetorum* of Linnæus and Willdenow. On all these subjects experiments and repeated observations are wanting. Soil and situation cause great differences in the extent of the creeping roots, and the downiness, as well as size, of various parts. Some of our British species are trilling worthless annuals, as *bromoides*, *Engl. Bot.* t. 1411, *myurus*, t. 1412, and *uniglumis*, t. 1437, the latter remarkable for having scarcely more than one valve to the calyx, the other being, as it were, abortive. Others are valuable perennial meadow grasses, as *pratensis*, t. 1592, and *elatior*, t. 1593.

Of the foreign species, *F. pumila* of Villars and Willdenow, much better named *varia* by Jacquin, has an elegantly party-coloured panicle, and is frequent in Switzerland, and other alpine countries in the southern parts of Europe. *F. spadicæ* is famous in botanic story as being the long-dubious *Anthoxanthum paniculatum* of Linnæus, or *Nardus spuria narbonensis* of Bauhin, and the *Poa Gerardi* of Allioni. See *Transf. of Linn. Soc.* v. 1. 111. t. 10, and v. 2. 101. This is a tall handsome perennial grass, with a dense bronze-coloured panicle, and purple anthers. *F. fusca*, a native of the Levant, has long creeping roots, with very

woolly fibres, formed, like *rubra*, to bind loose sandy soils. Its brownish panicle approaches in beauty to *Poa Eragrostis*. *F. indica*, copied by Willdenow from Retzius, is the very same plant as *fusca*.

F. spinosa, Linn. Suppl. 111, a native of the Cape of Good Hope and the Canary islands, is a wonderfully rigid, spinous, widely-creeping species, no doubt formed to grow in the most arid sand. This is referred by Willdenow to *Poa*, see his N. 41, perhaps not amiss, but then *F. fusca* will go near to be a *Poa* also, notwithstanding its awns.

F. stitans of Linnæus and Willdenow is removed by Scopoli and others to *Poa*. *F. decumbens* is also made a *Poa* in Fl. Brit. but it is more naturally perhaps, as Haller thought it, a *Melica*. Thus even the above list in Willdenow, imperfect as it is, becomes still shorter.

We know of no genus of grasses, that requires to be more studied, either in a botanical or economical point of view, than *Festuca*.

FESTUM, in a *General Sense*. See FEAST.

FESTUM, in our *Law Books*, is frequently used for a general court or assembly, because such were anciently always kept on the great festivals of the year.

Thus, in our chronicles, we read, that in such a year the king kept his *festum* at Winchester, &c. that is, he kept a court there at that time: "Rex apud Winton. maximum *festum* & convivium celebravit, tempore Natalis Domini, convocatis ibidem principibus & baronibus totius regni."

FESTUS, POMPEIUS, in *Biography*, a well-known grammarian, but of what particular age has never been ascertained. He wrote an abridgment of Verrius Flaccus "De Verborum Significatione." Scaliger pronounced this as one of the most useful works connected with the Latin language. It has passed through many editions; the one by Dacier in usum Delphini, 1681, is reckoned the best. Moreri.

To FETCH *Way*, in *Sea Language*, is to be shaken or agitated from one side to another. The terms are usually applied to a mast, bowsprit, &c. when it is not sufficiently wedged, being loose in the partners; or to any body which is moved by the rocking of the ship, for want of being well secured.

FETCHING *the Pump*, is the act of pouring water into the upper part of it, to expel the air which is contained between the lower box or piston and the lower end of the pump that rests on the ship's floor; and accordingly to make the water poured into the chamber communicate with that in the bottom of the pump-well, so as to be thrown out above by striking with the break or handle.

FETE, *Fr.* a feast, an entertainment of singing and dancing, introduced in an act of an opera, which always interrupts or suspends the action. (See BALLETT.) These obtrusive entertainments, says Rousseau, are only amusing in proportion as the opera itself is tiresome. In an interesting drama, well conducted, it would be impossible to bear them. We have sometimes thought the same of the masque in Shakespeare's *Tempest*, though not in the feast of Romeo and Juliet, which is analogous and connected with the plot.

FETHARD, or FEATHARD, in *Geography*, a market and post town of the county of Tipperary, Ireland, which before the union was represented in parliament. It is at present rather in a state of decay. Fethard is 76 miles from Dublin, and nearly seven north from Clonmell.

FETI, or FETTI DOMENICO, in *Biography*, an historical painter, born at Rome in 1589. He was a disciple of Ludovico Cigoli. From Rome he went to Mantua, with the cardinal Gonzaga, on whose accession to the dukedom

of Mantua he was declared painter to that court. In the works of this painter, who hardly merited so high an exaltation, there is a peculiarity of feeling and expression, but marked with colouring of a brown or blackened hue. He appears to have made his studies among the Lazaroni, as his characters are in general of a low cast, and even his best have their draperies thrown in a common and vulgar manner. Notwithstanding this, his small pictures, being executed with great freedom and firmness of touch, are much admired, which is not a little assisted by their general harmony in the tone of colouring. His works are scarce, as he died when only thirty-five years old at Venice.

FETICHE, in *Modern History*, a name given in Guinea to their divinities; one of whom is supposed to preside over every separate canton or district, one over every family, and one over each individual, which he worships on that day of the week when he happened to be born. On this day they are dressed in white, and, as an emblem of their purity, besmear their bodies and cloaths with a kind of white loam or clay. Those of the better fashion, and especially the chiefs of the people, have, besides this birth-day, another weekly festival dedicated to their fetiches, on which they kill a cock or a sheep; which sacrifice is consumed by the priests. The word fetiche, in a strict sense, signifies whatever represents their divinities; this may be a mountain, a tree, a large rock, a peculiar fowl or fish, with the head of an ape, or any such thing, as their fancy suggests. They not only believe these material substances, or fetiches, endowed with intelligence, and the power of doing them good or evil, but also that the priest or fetichere, being of their council, is privy to all that those divinities know, and thence acquainted with the most secret thoughts and actions of men. The household, or family fetiche, narrowly inspects the conduct of every individual in the house, and rewards or punishes according to the respective deserts of each. Their rewards consist in the multiplication of their wives and slaves; and their punishments in the want of all these: but the most terrible of all punishments is death. At Cape Coast there is a public guardian fetiche, the highest in power and dignity. This exalted fetiche is a rock, that projects into the sea from the bottom of the cliff on which the castle is built. To this rock yearly sacrifices are offered by the priests with ridiculous gestures and strange invocations, assuring the spectators that he receives verbal answers from Tabra, what times and seasons will be propitious; and for this intelligence every fisherman presents him with an acknowledgment suited to his ability.

FETICHES also denotes among the negroes pieces of sophisticated gold, in which is a mixture of one-half or one-third part of silver and copper. These fetiches are cut by them into small bits, to the value of three farthings each, which serve for the current coin of the country. The fetiches of artificial and base gold are strangely shaped in moulds of a black ponderous earth. The negroes have also fetiches of unalloyed mountain gold, which they keep for ornaments, and seldom pass into trade.

FETIE, in *Geography*, a town of the Arabian Irak, on the Euphrates; 50 miles N.W. of Bassora.

FETISLAW, or **KLADOWO**, a town of Servia, on the Danube; eight miles E. of Orsova.

FETLAR, **FITLAR**, or *Theodore's Isle*, one of the Shetland islands, lying two miles E. of Yell, and nine miles in circuit, consists for the most part of a rich black loam and some sand, which yields barley, oats, and pasture. It is separated from Yell by Colgrave sound, and has several creeks, but no secure harbour. Fetlar and North Yell contain

227 houses, and 1389 inhabitants. N. lat. 60° 58'. W. long. 1° 6'.

FET-LOCK, in the *Manege*, a tuft of hair growing behind the pastern-joint of horses.

Hence, the joint where it grows is called the fetlock-joint.

FETOVA, in *Geography*, a town of European Turkey, in Bulgaria; 25 miles S. of Ruzsak.

FETSA, in *Modern History*, is a name which the Turks give to the written judgments or decisions of the mufti. The word in the Turkish language signifies *sentence*, and in Arabic, *reply*, or *judgments of a wise man*.

FETTEE, in *Geography*, one of the branches of the Indus.

FETTERCAIRN, a town of Scotland, in the county of Kincardine; near it is an ancient ruin called Fenellas castle, in which Kenneth III. was murdered; 11 miles N.W. of Montrose.

FETU, **FETOU**, or *Afuto*, a kingdom of Africa, bounded on the west by the river Benji, and kingdom of Commodo; on the north by the country of Ati; on the east by Sabu; and by the ocean on the south.

The crown is elective; and the capital, called also *Fetu*, stands in the inland country. Bosman assigns to this kingdom 160 miles in length, and nearly as much in breadth: he describes it as commencing at mount St. Jago, or the river Seel, and terminating at mount Manfoo, or Montfort. It was formerly very powerful; but has been much reduced by civil divisions, so that it is now subject to the absolute controul of the king of Commodo. Before these contests it was filled with populous villages, and exhibited signs of wealth and plenty. Its principal riches consisted of grain, cattle, oil, and palm wine; and it was rendered beautiful and pleasant by the groves that shaded all the roads, and sheltered passengers from the rain and sun. It is extremely well situated for European settlements, on account of the neighbouring trading kingdoms and the cheapness of living. The Dutch had a fort at *Elmina*, which see.

FETUS. See **FOETUS**.

FETWAS, in *Geography*, a town of Hindoostan, in Bahar; 20 miles S.W. of Patna.

FEU, **CAPE**, a cape on the E. coast of Majorca. N. lat. 39° 4'. E. long. 3° 28'.

FEU de Joie, in the *Military Art*, meaning a salute occasioned by some joyful occurrence, is generally confined to three distinct volleys fired by troops drawn up at open order, in which the soldiers elevate the muzzles of their firelocks to an angle of about thirty degrees, or more, thereby to prevent the discharge from doing injury to these in their front.

But in large armies this ceremony is conducted on a suitable scale: the park of artillery firing royal salutes between the several volleys, for which, in lieu of a word of command, signals are given by beat of drum, or eventually by the discharges of three cannon: the first indicating that the whole should "make ready," the second that they should "present," and the third that they should "fire." The re-loading is performed by attending to the fusil-man of each corps respectively.

In some instances, the feu de joie is performed by substituting a "running fire" from one to the other flank, in lieu of firing by volley. This makes the ceremony last much longer, and proves more striking, especially when the fire-drecks attached to the several battalions discharge as it comes to their turn. When the force is very considerable, each of the three rounds of "running fire" may occupy from a quarter of an hour up to a full hour. The music generally performs some loyal strain during the intervals of such protracted fires, and the ceremony is always concluded by

by a general salute, in which the arms are presented, and the colours drooped.

In fortresses, the whole of the cannon mounted on the works fire one round, at the same intervals between the discharges as are usual in ordinary salutes; the colours are invariably displayed on such occasions.

In the navy, a feu de joie consists in the discharge of all the guns in succession, in the above manner; but if their number should not amount to twenty-one, that number of discharges is completed by as many repetitions of the firing of each gun as may be necessary. On very joyful occasions it is common to "dress the ship," by hanging out, upon various parts of the rigging, all the colours, of whatever nation or pattern, so as to make a very motley, but a rich and interesting appearance. During the discharges of cannon, the crew man the rigging, and conclude the ceremony by giving three cheers.

FEU-ARDENT, FRANCIS, in *Biography*, a French monk of the Franciscan order, noted for the fury of his zeal against Protestants, and the boldness of his seditions harangues in support of the measures of the league during the reigns of Henry III. and IV., was born at Contances, in Lower Normandy, in the year 1541. His name completely corresponded with his nature and intemperate zeal; he was a bitter enemy of the Protestants, and unwearied in exciting against them the most cruel persecutions. Notwithstanding the madness of his temper he was unable to stem the torrent of liberality then setting in, and he lived to see his party ruined, and the Protestants enjoying their religious and civil rights and immunities, which were secured to them by the famous edict of Nantes. He died at Bayeux in 1610, and it is said so completely changed, that he was as anxious for Christian union and brotherly love as he had formerly been desirous of lighting up the flames of persecution. He was author of Commentaries on several books of the Old and New Testament. He edited some of the works of the fathers, particularly the five books of Irenæus against heresies. Bayle. Moreri.

FEUCHTWANG, in *Geography*, a town of Germany, in the principality of Anspach, situated on the Sulz, formerly imperial; 12 miles S.W. of Anspach. N. lat. 49° 13'. E. long. 10° 22'.

FEUD, FEODUM, the same with fief or fee. See FEE.

Estates in land were originally at will, and then they were called *munera*; afterwards they were for life, and then they were called *beneficia*; and for that reason the livings of clergymen are so called at this day; and afterwards they were made hereditary, when they were called *feoda*, and in our law *fee-simple*.

When Hugh Capet usurped the kingdom of France, about the year 947, to support himself in such usurpation, he granted to the nobility and gentry, that whereas till then they generally enjoyed their honours for life, or at will only, they should from thenceforth hold them to them and their heirs. However, under the reign of Ludovicus Pius, who succeeded his father A. D. 814, grants of hereditary fiefs were frequent in France. Muratori observes, that the word *feudum*, which came to be substituted in the place of *beneficium*, does not occur in any authentic charter previous to the eleventh century; and Dr. Robertson adds, (Hist. Ch. V. vol. i. p. 269.) that a charter of king Robert of France, A. D. 1008, is the earliest deed in which he has met with the word *feudum*. This was imitated by William, called the Conqueror, upon his accession to the crown of England; for till his reign, feuds or fees were not hereditary, but only for life, or for some determinate time. See FEE.

Feuds were called by various names, according to their respective natures; as *feudum antiquum*, which descended to a son, &c. from his ancestors; *apertum*, resulting back again to the lord of the fee, where the blood of the last person last seized in fee-simple is utterly extinct and gone; *honorarium* and *individuum*, a title of nobility, not of a divisible nature, and descendible to the eldest son in exclusion of all the rest; *improprium*, an improper or derivative feud; *maternum*, descending to the son from the mother; *novum*, one newly acquired by the son, to which, in ancient times, only the descendants from his body could succeed, by the known maxim of the early feudal constitutions; *novum* held *ut antiquum*, descendible in the same manner as a *feudum novum*: *paternum*, descendible from father to son; and *proprium*, a proper feud, distinguished from one improper, which are the two grand and general divisions. Blackst. Com. vol. ii.

FEUD is also used in our ancient customs for a capital quarrel or enmity, not to be satisfied but with the death of the enemy; and thence usually called *deadly feud*.

Feud, called also *feida*, and *faida*, in the original German signifies *guerram*; i. e. *bellum*, *war*. Lambert writes it *feets*, and saith it signifies *capitales inimicitias*, or *implacabile hatred*.

In Scotland and the north of England, feud is particularly used for a combination of kindred to revenge the death of any of their blood, against the killer and all his race, or any other great enemy.

FEUDAL, or FEODAL, of or belonging to a feud or fee. We say a feudal matter, feudal jurisprudence, feudal seizure, feudal system, &c. A feudal lord, in default of fealty and homage from his vassal, may seize the fruits of the fee. A Neapolitan lawyer, called Caravita, has a Latin treatise of the feudal law, intitled "Prælectiones Feodales."

About the year 1170, a compilation of the feudal laws, as practised in Lombardy, was published at Milan, in two books, by two senators and consuls of that city, Gerardus Niger, and Obertus de Odo. In imitation of the "Pandects," they contain the opinions of lawyers, on questions concerning the feudal customs, with some imperial constitutions, relating to feuds. They were long afterwards divided into five books by Cujacius, their best commentator, before whose time they had obtained so great an authority in many countries of Europe, that they were received in courts of justice as parts of the civil law. The learned Craig ascribes this authority to imperial constitutions contained in them, or by which they were confirmed; but Du Moulin, Giannone, and others say, that, like the books of Justinian, they acquired by degrees the force of laws, from usage, from the approbation of the people, and from the tacit consent of princes, who permitted them to be publicly taught in universities, enriched with commentaries, and cited in tribunals for the decision of causes. It does not appear that any such regard was paid to them in England; though in many points our laws were similar, as being derived from the same principles, and directed to the same ends. Yet it is not improbable that even in the latter times of king Henry II., and, still more in the next century, some parts of the English laws, concerning feudal estates, may have been regulated according to their decision, by the statutes then made, and, in the determination of doubtful cases, by the opinions of the judges.

When once the use of fees was thoroughly established in France, they would needs extend it much farther; and almost all the great officers of the crown thus became feudal; even the courts of justice were drawn in; in order

to which, they were annexed to certain lands or revenues.

The design of these infeodations was to render the offices hereditary, after the manner of fees, which were now become so; and thus the offices of the grand chamberlain, grand butler, &c. came to be held by hereditary right.

As the northern nations brought in the use of coats of arms, by preserving down in their families the armorial bearings of their ancestors, shields, &c. as hereditary marks of honour, so they also, according to some, brought in the feudal law, by means of which, arms grew up to farther perfection, as is evident by many armorial figures of ancient families, representing the acknowledgments and services they were obliged to perform to their own lords and superiors.

Thus, roses, cinquefoils, spur-rowels, bow and arrows, hunting-horns, ships, and the like figures, were expressive of the services they were bound to do their lord; and hence these figures have become common in arms throughout all Europe. For instance, the old barons of Arran and Lorn were obliged to furnish their lord with a ship in time of war; and thence it is that their arms carry ships or lymphods to this time.

FEUDAL *Systm.* See FEE.

FEUDATORY, or FEODATARY, a vassal or person who holds of a superior in fee; *i. e.* on condition of yielding him fealty and homage, or other service. See FEALTY, FEE, HOMAGE, and VASSAL.

The electors, princes, and free cities, of Germany, were all feudatories of the emperor.

FEUDBOTE, a recompence for engaging in a feud or action, and for the damages consequent thereon; it having been the custom of ancient times for all the kindred to engage in their kinsmen's quarrels; according to that of Tacitus De Morib. Germanor. "Suscepere tam inimicitias seu patris, seu propinqui, quam amicitias, necesse est."

FEUDIST, a lawyer, or doctor, learned or much conversant in feuds or fees. Du-Moulin is reckoned a great feudist.

FEUDO, in *Geography.* See St. GOTTHARD.

FEVE. See AURELIA.

FEVENIST, in *Geography,* a river of Carinthia, which runs into the Drave, 6 miles N.W. of Villach.

FEVER, in *Medicine,* a term employed to designate various conditions of the body, in which more especially the heat is augmented, the pulse increased in velocity, and the other functions more or less deranged.

The word, *fever,* has always been used with great latitude, as well by medical writers, as by mankind in general; and scarcely two physicians have agreed in the definition of it which they have given. The increase of the animal heat, however, which is commonly both sensible to the touch of others, and distressing to the sick, has been the subject of universal observation; whence the denomination of the disease, in almost all languages, bears a reference to this symptom. By the Greeks the word *pyretos*, πυρετος, from *πυρ*, *fire*, was the appellation applied to fever; and the name used by the Romans, *fibris*, was deduced from *ferreo*, or *ferreo*, (signifying to be hot,) by a transposition of letters common in most languages. From the latter our word is derived, probably through the medium of the French. That the idea of *heat* is predominant in the use of the term fever is obvious from the popular expressions which represent a person much heated, in any way, as "in a fever,"

and which designate the cold and hot stages, or the rigors and heats of intermittents, by the words "ague and fever." Physicians, however, include, in the term fever, the whole of the phenomena which belong to the disease, the cold as well as the hot and sweating stages; that is, the beginning as well as the middle and end of the disease.

Fever, in the most extensive signification of the term, is the most general of all the morbid states to which the human constitution is liable; for, it is common to both sexes, to every period of life, and to all climates and countries. Sydenham affirms, that the various forms of fever constitute two-thirds of the diseases of mankind; and he has calculated, that as large a proportion as eight of nine of all who die are cut off by febrile diseases; a proportion which is probably not over-rated, if we include in the calculation not only all the forms of intermittent, remittent, and continued fevers, and the fevers accompanied by eruptions on the skin, such as small-pox, measles, scarlet fever, &c. but also the various local diseases and injuries of the body, which are accompanied by fever, such as inflammations of all the organs, whether induced by internal causes or external violence.

In reviewing the numerous forms of fever, however, it is evident that, for the practical purposes of the physician, this general application of the term is too vague and indefinite; since the circumstances under which fever occurs are materially different in various respects. The most obvious distinction, which has induced an universal division of fevers into two great classes, consists in a difference of origin; some arising from general causes operating on the body at large; while others depend on inflammation, or other local affection of a particular organ. The former have been denominated *primary*, or *idiopathic* fevers; the latter *secondary*, or *symptomatic* fevers. In the more accurate medical vocabulary of the present day the term fever is applied solely to the idiopathic fevers: in the other class of febrile diseases the state of fever is but a symptom, a secondary consequence of inflammation, or some other morbid change of a particular part of the body, which constitutes the primary disease; when this is removed, the fever ceases; but in proper fever, the symptoms are probably independent of any pre-occurring organic disorder, and are not regulated in their course or termination by the progress or removal of any other disease. Idiopathic fever alone is, therefore, the subject of our attention at present; the various species of symptomatic fever will be found under their respective terms of application, according to the organ which is the seat of the primary disease. Thus, for the *pleuritic* and *peripneumonic* fevers, depending on inflammation of the lungs, see PLEURISY and PERIPNEUMONY; for that arising from inflammation of the bowels, see ENTERITIS; and so forth.

Under the head of idiopathic fevers, those febrile diseases, which originate from a specific contagion, such as small-pox, measles, scarlet fever, &c. might with propriety be comprehended; inasmuch as the eruption on the skin, which characterizes them, is not the cause of the fever, but appears subsequent to the occurrence of the fever itself. Nevertheless, as these eruptive fevers differ most materially in their course, their phenomena, and their period, and originate from a distinct species of contagion, it is useful to separate them from the simple idiopathic fevers.

This plan has been adopted universally by theologists. Dr. Cullen has constituted three orders of his first class of diseases, entitled *pyretic*, or febrile diseases, from the division which we have just described; the first order, comprehending the simple idiopathic fevers, is entitled "febrile" or fevers; the second, including the symptomatic fevers, is

entitled the order of "phlegmasiæ," or inflammations; and the third, comprising the eruptive fevers, is denominated the order of "exanthemata," or efflorescences. It may be added, that this scientific physician has likewise constituted two other orders of febrile diseases; the fourth consisting of "hæmorrhagies," from the lungs, uterus, &c.; and the fifth, entitled "profluvia," or fluxes, containing two diseases, catarrh and dysentery, which depend on a peculiar inflammation of the mucous membranes of the bronchial tubes, and of the alimentary canal. See Cullen. Nofol. Method.

Fever, properly so called, or idiopathic fever, is the subject of the present article. It occurs under the form of ephemera, intermittent fevers, or agues; remittent, and continued fevers: the last of which appear under a variety of types, in the instances of the plague, gaol-fever, or typhus, low, nervous fever, &c. See the conclusion of this article.

Notwithstanding the great prevalence of fever in all ages and climates, and the universal attention which it has excited among medical observers, from the time of Hippocrates downwards, the disease still remains the subject of much discussion; and its essential nature, or the proximate cause of its symptoms, is still a problem in medical science. This obscurity will appear the less surprising, however, when we consider the almost endless varieties under which fever occurs: for not only are its modifications so various, that of those fevers, which are nominally the same, scarcely any two instances accurately resemble each other; but of all the symptoms which constitute those varieties, not one can be found which is invariably present in every case,—not one, therefore, which can be considered as characteristic of the disease. In the technical phraseology, we are not acquainted with any *pathognomonic* symptom of fever. Hence, although the concurrence of symptoms, which mark the presence of fever, is well known, and easily recognized by a moderate degree of observation and experience, and consequently capable of being accurately described, yet it is not easy to frame a definition of fever, which should comprehend every variety that may occur.

Boerhaave, the able and learned professor of physic at Leyden, at an early period of the eighteenth century, investigated the subject of fever more rationally than his predecessors: he found that *three* symptoms were generally observable in all fevers; and therefore he deemed these the characteristic symptoms of fever, in which he has been followed by the nosologists who have succeeded him. "In every fever, arising from internal causes," he says, (Aphorism 563.) "there is always a *shivering*, a *quick pulse*, and *heat*, varying in degree at different times of the fever." But of these three symptoms, he considers the second, or quick pulse, as the essential or pathognomonic symptom, and not the heat, as was the opinion of the ancients. He observes again, in the 57-th aphorism, "These symptoms, indeed, are present in every fever, but the *quick pulse* alone is present throughout its whole course, from the beginning to the end, and by that only the physician judges of the existence of fever." It cannot be questioned, that these three symptoms are found in the great majority of instances of fever, and that the quickened pulse is the most universally observed, and continues during the longest period of the disease. But, on the one hand, these symptoms are common to the symptomatic fevers, as well as to the idiopathic; and, on the other, they have each been observed to be absent in different instances, even the quickness of pulse. By these three symptoms Dr. Cullen has characterized the whole class of febrile diseases, the idiopathic, the eruptive, and the symptomatic fevers; in addition to which he has introduced the lesion of some of the functions, especially of the muscular strength,

which generally accompanies them. His definition of the class *Pyrexia* is as follows. "Post horrorem, pulsus frequens, calor major, plures functiones læsæ, viribus præsertim artuum imminutis." These symptoms, occurring generally in the order here mentioned, are deduced from a correct generalization of the common occurrences in febrile diseases; but if it can be shewn that each of them has been occasionally absent, it will be a sufficient proof that none of them can be deemed essential to the existence of fever. On the contrary, it will be equally easy to prove that all these symptoms have been occasionally present, without the occurrence of fever.

The chilliness, shivering, *horror*, *rigor*, or *horripilatio*, which is commonly one of the first symptoms of idiopathic fever and often of symptomatic fevers, as has been observed by the best writers on the subject, is occasionally absent; the fever begins at once in the hot stage, or with some other symptom, as nausea, or head-ache, to which the hot stage succeeds; and no *cold* stage, whether marked by the feelings of the patient, or of a by-stander, or by the application of a thermometer, occurs. For this fact we have the authority of Celsus: and among modern physicians Gorter, Burserius, Fordyce, and others, have distinctly attested its truth. On the other hand, cold, estimated by the means just mentioned, often takes place, where no fever can be admitted to be present, as in hysterical complaints. See Celsus, De Medicina, lib. iii. cap. 3. where he says, "aliæ protinus a calore incipiunt, &c." Gorter, Compend. Med. Tract. 52. § 3. Burserius, Instit. Med. Pract. vol. i. p. 83. Fordyce, Dissert. on Simple Fever, p. 11.

With respect to the *quick pulse*, which is deemed by Boerhaave, and his commentator, Van Swieten, as the essence of fever, and the only criterion by which the physician judges of its existence, the evidence of its absence, which the records of medicine afford, is very abundant. It might seem extraordinary indeed if quickness of pulse were the essential symptom of fever, that the ancient fathers of physic should have become so well acquainted with the disease, without paying much attention to the state of the pulse. Yet it is certain that Hippocrates has seldom mentioned the pulse, and lays little stress upon it; and we are informed by Galen, that he (Hippocrates) was the first writer who mentioned the pulse. The pulse, however, was noticed afterwards by Herophilus and Erasistratus, and particularly mentioned by Aretæus. In the time of Celsus it was an object of considerable attention with physicians; but he expressly remarks, that in trusting to the pulse, as a test of fever, we depend on a most fallacious criterion (*fallacissima res*); for not only external heat, the bath and exercise, but also fear, anger, and the other passions and emotions of the mind, even the anxiety of the patient on the approach of the physician will excite and depress, and otherwise modify the pulsations. "Quas venas autem," he concludes, "conspectus medici movet, quam facile mille res turbant!" De Med. lib. iii. cap. 6.

But not only is the pulse quickened by heat, exercise, and mental emotions, as stated by Celsus, and by other causes, when no fever can be said to exist; but farther, continued fever has been observed to go on even to a fatal termination, without any increased frequency of the pulse. The frequency of the pulsations in health varies according to the age, sex, climate, season, and to the particular constitution of individuals. It is only about a century since the pulsations were counted, and within that period authors have not agreed as to the number which constitutes a febrile pulse. It is admitted that in the adult age of men, the number of pulsations of the heart and arteries is commonly about 73 in a minute. (See PULSE.) But in particular constitutions

the pulse of health is found regularly at a much higher or lower rate: sometimes beating 80 times or upwards, sometimes 50, 60, or less in a minute. Dr. Fordyce counted the pulse of an old man in the Charter house, whose natural number did not exceed 26 contractions in a minute. It is obvious then that the disputes about the number of pulsations which constitute the febrile state are frivolous: for the man whose natural pulse was 40 would be in a high fever in other respects when his pulse reached 60; while the person, whose pulse in health was at 80, might labour under slight febrile indisposition when his pulse beat nearly 100 times in a minute. But let us advert to other facts. Sydenham long ago stated, that in the first days of a fever which he calls *febris hiemalis*, the pulse continued like that of a person in health, "*sanorum pulsui non admodum absumilis.*" (Tractat. De Hyrope, postscripto.) Werlhoff has noticed the same fact in small-pox, and Greding in a contagious epidemic fever. (Ludwig. Advers. Med. vol. i. p. 1. cap. 1. p. 22.) The pulse has been observed to be slower than natural, in several instances of malignant fever; by many clinical observers, both ancient and modern. Several of these are particularly referred to by Burserius (Loc. citat. p. 84. et seq.) It may be sufficient to mention Russell (Nat. Hist. of Aleppo, p. 230.), Sauvages (Nosol. Method, tom. ii. p. 307.), and De Haen (Rat. Medendi, p. 12. cap. 2. p. 50 et 117.) Nay, it sometimes happens, as in a case recorded by the last mentioned writer, that the pulse, which was slow during the continuance of the fever, becomes more frequent during the state of convalescence and health. The pulse, indeed, has been often observed to undergo considerable changes in the course of fever, when the rest of the symptoms continued unaltered. Dr. Fordyce remarks, that he "has seen, in many instances, a fever take place, and go on as a continued fever, so that in the middle of the second week the pulse has been frequent, from 100 to 110, or even more; the tongue covered with a brown fur, and dry; the skin dry; there has been great depression of strength, costiveness, violent pain of the forehead, delirium, strong evening exacerbations with stupidity of the eyes: in such cases the author has known the pulsations become as few as 60, 50, or even 45 in a minute, all the other appearances of the disease remaining the same, or the fever even increasing in all respects. This small number of pulsations, after continuing for two or three days, has given place to a number of pulsations as great as before, so that if a man had attended to the other circumstances of the disease, and not felt the pulse, he would have had no reason to suspect that the pulse had been fewer during that time. This the author has frequently shewn to the pupils attending St. Thomas's hospital, as it was shewn to him by Dr. Cullen, sir John Pringle, &c. &c." (Loc. cit. page 18.) It may be added, that Dr. Home remarks that patients have died of typhus under his observation in whom the pulse was not quickened. (See his Clinical Experiments.) On the whole, then, it cannot be doubted, that Boerhaave maintained an erroneous doctrine, in stating the quick pulse to be pathognomonic of fever. See also the works of Pringle and Lind.

The increased *beat* is still less entitled to be deemed an essential symptom of fever, notwithstanding the labours of the Galenists to prove it the proximate of the whole disease. It is curious to observe the sophisms by which they attempted to reconcile the doctrine of their master, with stubborn facts, that are incompatible with it. Thus Sennerius affirms, that "it is not the heat generated in the heart, and thence communicated to the rest of the body," (which is Galen's hypothesis) "that produces or constitutes fever, but the morbid disposition which the heat oc-

casions, and which is inconsistent with the proper performance of the functions. Hence the heat occasioned by passion, violent exercise, or the bath, is not to be deemed fever, unless it reaches that degree of inflammation which disturbs the functions." (De Febribus, lib. i. cap. 1.) But the excitement of heat, by the same causes which raises the pulse, according to the observation of Celsus, its occurrence in hysterical and other diseases, not febrile, and its frequent absence during the whole course of fever, for which we may state the authority of Fordyce, and other observers, prove that heat is not the essential symptom of fever. "*Altera res, cui credimus, calor, æque fallax.*" (Celsus, loc. citat.)

The other symptoms, alluded to by Dr. Cullen, in his definition of febrile diseases, namely, "the disturbance of several of the functions, especially the depression of the muscular strength," although they commonly occur both in idiopathic and symptomatic fevers, are common to a great variety of diseases, and were not stated as pathognomonic symptoms.

As there is no symptom, then, which, being invariably present, characterizes the disease, called fever, we can only obtain a knowledge of the existence and nature of the disease, from an attention to the concurrence and succession of the symptoms. This attention is extremely important in a practical view, not only from the great variety of fevers which require an appropriate variety of treatment, but also from the necessity of modifying the treatment in different stages of the same case of fever. We shall, therefore, detail the symptoms of fever in the order in which they usually occur, including the whole of those which have been seen in various cases, and leaving the modifications of the disease to be more particularly noticed under their respective appellations. The paroxysm of an intermittent fever is generally pointed out as the most perfect example of the febrile state, both in respect to the distinctness and the regularity of the symptoms, which characterize it. This has already been described under the article AGUE. When the paroxysm is less severe, and does not recur, it is denominated an *Ephemeræ*, (which see.) There is perhaps more of fancy, however, than of sound observation, in the affinity which has been described between the intermittent and continued fevers; and especially in the assumption of the intermittent paroxysm, as the prototype of all febrile diseases; and in considering continued fevers, as consisting but of a series of these paroxysms, the succeeding one commencing before the termination of its predecessor, so that no period of intermission intervenes. Such, however, has been the practice of our best authors; Dr. Cullen, the systematic, has been followed by Dr. Fordyce, the practical physician, in this account of the disease.

Symptoms of Fever.—The commencement of fever is generally marked by some degree of languor, lassitude, and general uneasiness; the patient feels himself ill, without being able to refer his uneasy feelings to any particular part of the body. There is also a listlessness, or a desire frequently to change the posture, but at the same time the sense of weariness disposes the patient to resist this inclination; the motions when made are sluggish, and frequent yawning and stretching accompany the attempt. The mind is affected in a similar way; it cannot rest upon any object; the attention is not under the command of the will, but wanders from one subject to another; and as the ability of exerting the muscular powers, or of performing any of the body becomes actually diminished; there is likewise an actual inability of exercising the faculties of the mind; the patient cannot think or reason, even upon his ordinary affairs, with

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his usual ease. Along with these symptoms, but more frequently after them, he feels a sensation of cold, commonly first in his back, but afterwards over the whole body; the same kind of sensation that he feels when surrounded by a colder medium than he is accustomed to: he wishes, therefore, to go near a fire, or into the rays of the sun, or to put on warmer clothing. At the same time the face and extremities are observed to be pale, the features shrink, the bulk of every external part is diminished, and the skin over the whole body appears constricted, as if cold had been applied to it. This sensation of cold varies much more in different instances of incipient fever, than the languor and lassitude before-mentioned; in some cases it is very slight, in others not at all felt or noticed; whilst in many instances, particularly in the intermittent fevers, it becomes so great as to produce a tremor or shaking in all the limbs, with a chattering of the teeth, and frequent rigors of the trunk of the body. In this state, the actual heat of the surface, whether measured by the sensations of a by-stander, or a thermometer, is considerably diminished; in the extremities in particular it is many degrees below the standard of health. (See Burserius, loc. cit.—Currie, Medical Reports on the effects of Water, cold and warm, in Fevers, &c. p. 168, 2d edit.) Not only on the surface, as is generally imagined, but even over the whole system, the heat is probably diminished; the air expired from the lungs, feels cool to the back of the hand, held near the mouth. Dr. Currie states, that he has found the heat under the tongue, and at the axilla, as low as 94, 93, and 92 degrees of Fahrenheit's thermometer. (The healthy temperature of the human body, it may be observed, is about 98° of the same thermometer.) Dr. Fordyce affirms, that 94° was the lowest degree of heat that he had witnessed under the same circumstances. (First Dissertation on Fever, page 40.) The sensations of the patient, however, do not always correspond with the actual degree of cold, as measured by the thermometer, or by the sensations of others; for it has been remarked, especially towards the termination of the cold stage of the fever, that the patient feels himself cold, even on those parts of the body which are shewn, by the application of a thermometer, to be of the natural heat, or even hotter than they usually are in health. With this state of coldness, the sensibility of the body is considerably diminished; all the sensations, but especially those of touch and taste, are less accurate and distinct than in the healthy state. Dr. Fordyce remarks, that, "in the attack of fever, such a degree of insensibility, with a feel of coldness, has in many cases taken place, that even hot substances have been applied in such manner as to coagulate, nay, perform the chemical analysis of the part, without any sensation of heat having arisen in the mind of the patient." (Loc. cit. p. 49.) The diminution of the faculty of sensation is very various in different instances of the attack of fever.

Upon the first approach of febrile languor the pulse is not always altered in respect to frequency, but it always becomes weaker than before; sometimes it is also slower than in health for a short time. But as the sense of cold increases, it becomes smaller, and gradually more and more frequent, and often irregular. While the contractions of the heart and arteries are thus feeble, all the secretions of the system are likewise diminished. The tongue and mouth become dry and clammy, in consequence of the diminished supply of saliva and of the mucus of those parts; the skin also becomes dry, as well as pale and cold, there being little or no matter of perspiration poured out. The changes in the urine are still more remarkable; the impaired action of the secretory vessels of the kidneys is evinced by

the diminished quantity of the urine, at this period of fever, as well as by the paleness of its colour, in consequence of its holding less of the mucilaginous and saline parts in solution than in health, and by the absence of any cloudiness or deposition when it cools. There is generally also a smaller quantity of feculent matter evacuated from the intestines at the commencement of fever, or in other words a degree of constipation, which implies a deficiency of the fluids secreted from the inner surface of the alimentary canal, as well as of the bile and pancreatic liquor, by which the feces are rendered more liquid and moveable, and the bowels are stimulated to action. Analogous to these changes in the state of the secretions are the sudden and considerable detumescence of swellings, which may happen to subsist on the surface of the body, and the drying up, or cessation of the discharges from ulcers and wounds, during the cold stage of fever.

The respiration also suffers some change in the attack of fever, being often short and frequent, and sometimes attended with a cough, more particularly in intermittent fevers. There is at the same time a great anxiety, or a sense of weight, fullness, and great uneasiness in the breast. This distressing feeling, which has been thought by some physicians a pathognomonic symptom of fever, and hence denominated *febrile anxiety*, is totally different from, and independent of, the general uneasiness all over the body, which was before mentioned, and often occurs in a very disproportionate degree. It resembles that anxiety which takes place from grief, fear, and other depressing passions of the mind, and which is also accompanied by paleness, and diminution of size of the veins, which are seen on the surface. The patient likewise respire irregularly, as one under the influence of the passions just noticed, and frequently sighs deeply, as if to free himself from the load that oppresses the region of the heart.

At the beginning of the attack of fever, sometimes as the very first symptom, but often later, a dull pain is felt in the small of the back, which seems to occupy the lumbar vertebræ, but is not accurately referred to any particular point. It is very similar to the pain which arises from weakness or fatigue; but, unlike that, according to Dr. Fordyce, it is equally felt in the horizontal, as in the erect posture of the body. The head at the same time is affected with pain, which is commonly seated in the forehead over the eyes, and feels to the patient as external; sometimes it likewise occupies the back part of the head; and occasionally it is felt all round the head. It varies much in degree, but commonly increases as the attack proceeds; it is usually attended with a sense of weight, and is often augmented by light falling upon the eyes. A similar pain generally arises all over the body, which the patient often describes as seated in all his bones, without being able to particularize in what part of the body it is felt. Sometimes it is more particularly confined to the larger joints; and it is occasionally attended with great soreness, as from over-fatigue. Such soreness, however, is more commonly confined to the subsequent periods of the disease.

From the commencement of the attack of fever the natural functions are always deranged. The changes in the appearance of the tongue are among the first indications of this derangement. At first the tongue appears to be thinly covered on its upper surface with an extremely viscid fluid, especially in the middle and towards the root, the edges and point being nearly free from it. The under surface of the tongue, below the point, is scarcely ever covered with this matter. Sometimes, at the very beginning of the disorder, the covering of the tongue is a solid crust of a whitish colour,

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colour, adhering so firmly as to be incapable of being scraped off; sometimes it verges towards a brown colour. At the approach of the cold stage of fever the stomach is commonly affected; the appetite for food ceases, and aversion even to the sight or smell of food often takes place. Dr. Fordyce remarks, that he "has known several instances where persons, sitting down to the table with a strong appetite, an attack of fever having suddenly taken place, in less than two minutes they have been unable to eat any thing, and have been seized with perfect aversion even to the smell of food." (Loc. cit. p. 93.) Sickness at the stomach often comes on at the first attack, and this is increased occasionally to such a degree as to produce vomiting. More commonly, however, this does not take place at the very commencement; but the disinclination to food increases gradually to nausea, then to vomiting, which in some cases is very severe, not only the contents of the stomach being evacuated, but likewise those of the duodenum, and of the glands, the secretory ducts of which open into it. Bile, therefore, and the pancreatic juice, are thrown up, together with the contents of the stomach, and the other fluids secreted into the stomach and duodenum. Of these fluids, however, the bile is the most conspicuous from its colour, taste, and smell, and it has, therefore, often been observed by practitioners, while the gastric and pancreatic, and other juices secreted into the duodenum, as they are not very conspicuous from their sensible qualities, have not been taken into the account. Combined with the aversion to food, and sickness, there is generally a considerable degree of thirst.

Few other symptoms, which are observable at the commencement of fever, remain to be mentioned. The state of the countenance is very peculiar and characteristic, from the moment of the attack. It not only becomes pallid, or of a dirty hue, in common with the rest of the surface of the body, but it assumes an expression of dullness or heaviness, partly in consequence of the languid action or relaxed condition of the muscles of the face, and partly from the same condition of the muscles of the eye-ball, by which its form and motion are altered, and its usual brightness and quickness are impaired. The disposition to sleep is diminished or lost; or, if it occurs, the repose is short and interrupted, and very imperfect, so that there is much dreaming, during which the ideas that present themselves are mostly of an unpleasant kind.

When the sensation of cold, and the attendant symptoms have continued for some time, (the period being very various in the different kinds of fever,) the cold becomes less violent, and is alternated with flushes of heat. In the more severe continued fevers, it frequently happens that the cold is not permanent for any length of time, but that this alternation of chills and heat takes place from the beginning. By degrees the cold goes off entirely, and a heat greater than natural is extended, at first inequally in different parts, but at length generally over the whole body; but even when it is so far advanced, that the heat, measured at the axilla or under the tongue, is greater than the standard of health, a slight accession of external cold will produce a general chilliness. There is no regularity in the restoration of the heat to the surface, in some parts the heat is above what is natural, while in others it remains below this standard; and hence arises that mixed sensation of cold and heat, which every one acquainted with fever has experienced, in the transition from the cold to the hot stage of the paroxysm. This inequality of the distribution of the heat is less in the simpler forms of fever, and greater in those which are more complicated and irregular. In general the

sense of cold predominates, even after a morbid heat has taken place at the axilla, under the tongue, and in distant parts of the thorax and abdomen. At length, however, the heat of the surface becomes general and uniform, rising to 102°, 103°, 104°, and sometimes 105° of Fahrenheit's thermometer. Different authors indeed speak of febrile heat four or even five degrees higher than this; but such heat has never occurred under the observation of Dr. Fordyce or Dr. Currie, the best authority on this subject; the writer of this article has frequently employed the thermometer, in cases of continued fever, and never observed a higher temperature of the body than 104°, in intermittent or continued fever, the patients being in cool apartments, with very light bed coverings. The sensation of heat becomes at length strong and steady, and the accession of external air does not produce a return of chilliness as before; this sensation is most powerful in the extremities, particularly on the palms of the hands and soles of the feet.

The increase of the circulation takes place at the same time as the returning heat, and often in the same unequal manner, being evidently greater in some particular parts, than in others. Thus it frequently happens, that one part shall become red and enlarged, one arm, for instance, while the other is pale and contracted; the veins of the one being full, and the blood flowing in them more rapidly, while those in the other remain contracted. This shall continue for some time, when the parts become affected in the opposite way; the arm which was florid and distended, becoming pale and contracted, and *vice versa*. This shifting, however, remains but a short time in simple fever, perhaps not above half an hour; in the paroxysms of intermittents it continues longer, and still longer in the first attack of continued fever. Universal redness at length takes place; the features of the face and other parts of the body recover their usual size, and become even more turgid; and the superficial veins evince the greater circulation now going on through them by their fullness and increased size. The skin is relaxed and smooth, no longer exhibiting the goose-skin appearance, by its contraction round the little glands and roots of the hair, but it continues for some time dry. The pulse now becomes fuller and stronger, and its frequency continues or is still farther increased; in simple fevers, it beats occasionally at the rate of 140 or 150 strokes in a minute, with a considerable degree of fullness and hardness (Fordyce); but in the hot stage of intermittents, and in the heat of continued fevers it is most commonly from 90 to 110, at this early period of the disease; subject, however, to great variation according to the constitution of the patient, and the type of the fever. The respiration, though more free than during the chilliness, continues still frequent, and accompanied by a sense of load and anxiety, which the patient endeavours to remove by occasional laborious efforts, and deep sighing. The secretions still remain diminished; the skin is parched, no perspiration breaks forth; the tongue and mouth are also dry and parched, and the fur on the former becomes thicker, the urine, though it becomes higher coloured than in the cold stage, remains transparent, and deposits no sediment; and the bowels are constive. The thirst is considerably increased as the heat advances, the nausea and vomiting gradually diminish, but the aversion to food is augmented.

The corporeal strength and the mental powers become more oppressed; the sensibility, however, is restored in general with the returning circulation and warmth of the surface; sometimes it becomes even more acute than in the healthy state, so that the skin is more easily irritated, the eyes are offended with the light, and the least noise is heard

with pain, and greatly disturbs the feelings of the patient. The attention becomes less under the controul of the will, and the faculty of recollection and the reasoning power are exerted with difficulty, and imperfectly, so that some confusion of thought takes place, which often arises to delirium, when the hot stage is completely formed: occasionally, indeed, a degree of delirium occurs in the beginning of the cold stage, but more frequently in the subsequent periods of the fever. The numerous and distressing dreams, which constantly recur in the disturbed and unrefreshing sleep, which takes place in the first stages of fever, may be considered as the slightest degree of delirium. (See the articles DELIRIUM, and DREAMS, in *Pathology*.) In the next degree the patient, when he awakes, is some time before he can attend to the impressions made on the organs of sense: he does not know his bed, his bed-chamber, or his attendants for a few minutes, but seems to awake as it were a second time, and becomes perfectly sensible. If the delirium is in a little greater degree, the ordinary impressions of external objects produce no effect; the ideas, which float in the mind rapidly, seem to be excited without train or connection; the association being carried on by the internal impressions alone. If the attention of the patient, however, be strongly excited by external impression, he is capable of distinguishing the surrounding objects, and of returning correct answers to questions put to him; but that strong impression being withdrawn, he relapses into his delirious dream. As the delirium increases, with the advance of the fever, the faculty of distinguishing the objects that surround him gradually diminishes; he begins to express his ideas in words, *i. e.* to talk incoherently; the ideas which present themselves rapidly, and without apparent connection, are generally disagreeable and distressing. He is sometimes in a church-yard among tombs, sometimes falling from a precipice, sometimes pursued by wild beasts, in the midst of conflagrations, &c. The delirium increasing, he becomes completely insensible to external objects. This is a common progress of the alienation of mind in fever, beginning on the second or third day, or later, and increasing to the fourteenth or fifteenth, if the patient survive so long; at first being only obvious in the night, or during the imperfect slumbers, or in the waking moments, when external impressions are fewer, or almost entirely excluded; but afterwards continuing night and day without intermission.

With the beginning of the hot stage, the head-ache is commonly increased, and appears to be dissimilar from that which took place in the cold stage. The latter pain, Dr. Fordyce remarks, always feels to the patient as external; "it is clearly a pain affecting the integuments of the head, perhaps the skin alone, at most the pericranium; but the pain which arises in the second stage is felt by the patient internally, and gives him the idea that there is something distending the head or the brain, so as to attempt to burst the cranium." (See First Diss. on Fever, pp. 85 and 228.) In the mean time the carotid and temporal arteries beat full and strong, the eyes are rather red, and the face is flushed. Connected with these symptoms, which obviously imply an increased quantity and impetus of the blood carried to the brain, the organs of sensation, while fully capable of conveying impressions to the mind, nevertheless produce sometimes erroneous impressions. Thus the patient can see, but he mistakes objects; he fancies one individual is another, or that a man is a post: and his organs of hearing, which are also more readily affected, do not convey the same perceptions, which the same sounds would excite in health. The same thing happens with regard to his other senses.

As the symptoms above enumerated increase from the

second day of fever. The tongue grows more foul, and the crust which forms upon it thicker, until the middle of the second week. Towards the end of the second week this crust often disappears more or less, and the surface of the tongue looks raw when moist, and when dry has a polished glaze, especially about the middle, some of the crust remaining upon the sides towards the edges (Fordyce.)

Before these symptoms, however, have advanced to the degree just described, and after the general heat has continued for an indefinite time, (in the ephemeral and intermittent fevers a few hours, in continued fevers several days,) it often happens, that a partial moisture begins to appear on the skin, generally on the forehead, which extends gradually downwards to the neck and breast, and at length a free sweat takes place from the whole surface of the body. At the same time the symptoms of the first stage of the fever begin to abate, sometimes one giving way first, and sometimes another, so that it cannot be said which has the priority: sometimes the weight and anxiety about the præcordia are first observed to diminish, sometimes the change of the pulse from hardness to softness is the first obvious amendment, and sometimes the relaxation of one or other set of secretory vessels, &c. Such a change of the symptoms, terminating speedily in a restoration of the health, has been called, by a term borrowed from the Greek, a *Crisis*, (which see,) and the excreted fluids, which are poured forth at the time of this change, have hence been denominated *critical discharges*. The most striking appearance, both to the patient and by-stander, is the perspiration, which is frequently carried to the extent of profuse sweating, in intermittents, and the simpler forms of fever, but sometimes amounts only to gentle moisture. While the sweating continues, all the symptoms of the previous stages abate: the preternatural heat is gradually diminished; the pulse becomes softer and less frequent; the breathing is likewise frequent, and more free, and is unaccompanied by sighing, and the anxiety and heaviness in the chest are greatly alleviated; the head-ache gradually goes off, and the pains of the loins and extremities cease; the nausea and vomiting no longer distress the patient, who now acquires a relish for light nourishment: the thirst is removed; the mouth and tongue become moist, as the salivary and mucous glands pour out their fluids, and the tongue becomes gradually clean, first upon the edges, afterwards in the middle and near the root, the crust, which had formed upon it, coming off in small flakes, until the whole surface is in its ordinary state. The secretions of the liver, pancreas, and intestinal glands being restored, the bowels begin to act, and the evacuation from them comes to its ordinary quantity. A loose stool is commonly passed, at the end of a paroxysm of intermittent fever; and sometimes a diarrhœa comes on in continued fever, and being the most obvious, is then considered as the critical discharge. The urine generally undergoes some peculiar changes in the crisis of fever: it is not only secreted in larger quantity, but, although bright and transparent when discharged, if allowed to remain for some time, it is observed to grow turbid, as if containing a quantity of a yellowish-red powder, and at length to deposit flakey crystals of a dirty red colour, commonly termed a *lateritious sediment*. Tumours, which were diminished during the cold, and more painful in the hot stage, return to their usual size during the sweat, and ulcers again begin to discharge matter. The intellectual functions are also restored during the crisis; the attention of the patient is no longer absorbed by his uneasy feelings, the confusion of his head is relieved, and he is not harassed by the perpetual recurrence of distressing images to the mind, especially in his slumbers; a disposition to calm sleep

sleep returns; and the countenance resumes its natural expression.

It was remarked by Hippocrates, and the majority of the ancient physicians, that these *crises* occurred more frequently on particular days of the fever, which they, therefore, observed with great care, as affording both particular indications in practice, and the means of prognosticating the phenomena of the subsequent periods of the disease. Hence they called these days *CRITICAL days*, (which we have already described under that head). These periodical changes, happening on particular days, are, however, seldom distinctly noticed in this country; they seem to occur more decidedly in warm climates, where all fevers have a greater tendency to assume the remittent form. Dr. Cullen, who believed that even in this country these critical days were observable, though less distinctly than in hot climates, explained their occurrence upon the principle, that continued fevers were in some degree disposed to take on the types of intermittents; and in this principle he has been followed by Dr. Fordyce. (See Cullen, First Lines, § exix, *et seq.* Fordyce, Third Dissert. on Fever, part i. p. 120.) But it must be remarked, that the doctrine of critical days, as taught by Hippocrates, was ridiculed by Aesclepiades and Celsus, who practised in the same climate with Hippocrates; and in the same city with Galen: (see Celsus, *Loc. cit.* lib. iii. cap. 4.) and Herophilus altogether denied its truth. See *CRITICAL Days*.

In this country, and in cold climates in general, continued fevers are seldom terminated by crisis. Some practitioners have maintained, that a crisis never takes place, whilst others have insisted that crises happen in all continued fevers. Dr. Fordyce justly remarks, that these extremes of opinion are both inconsistent with correct observation. It is admitted, however, that crises occur much less frequently in this climate than in hotter countries; and we think that the physician just mentioned considerably over-rated the proportion, when he says, that "not above one-third part of the fevers which happen in London are terminated by a crisis." (*Loc. cit.* p. 125.) We believe the proportion to be very far below this statement. In the great number of instances of fever, no crisis takes place, but the disease terminates in a more slow recovery, or in death.

The symptoms, before enumerated, increase gradually to the end of the first, or middle of the second week; sometimes by the seventh day the symptoms have attained their greatest severity; sometimes, too, the second week is gone through without very severe symptoms, and in other cases symptoms of the greatest distress and danger then occur; and there are all gradations between these extremes.

The appearances in the second week, when the fever is not extremely severe, are often as follows. The pulse is frequent, beating from 100 to 110, in the evening, and in the morning somewhat less; the skin continues dry and hot, in various degrees; the tongue is covered with a brownish fur; the appetite is often totally lost; thirst continues, but is often complained of less during the second than during the first week; and the depression of strength is considerable. The sleep is disturbed and short, and the delirium is manifested in the intervals by the incoherence of the observations of the patient, until he is completely roused by some strong impression on the senses. In the morning the delirium is less than in the early part of the night, and the sleep sometimes tolerably quiet; even during the day there is considerable confusion, and occasionally much slowness of intellect. Hence perhaps the thirst, as well as the head-ache, and pains of the back and limbs, is less complained of, rather than from actual relief or dimi-

nution of these symptoms. The eyes have a dull and confused appearance, and commonly some degree of redness, from a number of small vessels distended with blood. Sometimes a degree of stupor comes on in the morning, and continues till the more active delirium of the night. If this state should remain, Dr. Fordyce observes, till about the fourteenth day, the evening attacks become by degrees less, but the stupor continues, with deafness, and inattention to external objects, and these appearances remain the very last symptoms of the disease.

Very frequently about the end of the second week, and often sooner, the symptoms begin gradually to diminish in severity. The first appearance of this abatement is not uncommonly a cleanness and healthy look about the edges of the tongue; sometimes, although not very generally, a sweating takes place all over the body, and the skin afterwards continues moist; more commonly the moisture and softness of the skin appear in a less marked manner. The delirium abates altogether in the day, and returns less severely at night; or if the patient be deaf with some stupor, these symptoms are little changed in the twenty-four hours, but remain until the whole of the disease has disappeared. The depression of strength goes off, but leaves real weakness behind. The urine deposits sometimes a copious lateritious sediment for a day or two, and afterwards returns to its natural appearance. Sometimes there is a copious lateritious sediment in the urine made in the night, and a mucous one in that made in the day time. The costiveness goes off, and the *æcæ* return to their ordinary appearance; and all the secretions become gradually increased, not equally, but sometimes one more speedily, sometimes another. The eyes, unless when the delirium has ended in stupor, begin to have a more healthy appearance, are more composed and clearer, and express a greater attention to the objects around them. The sleep returns, but not equally; the patient sometimes passing a quiet, at other times a restless night. The appetite returns, although seldom regularly; sometimes it is voracious, but the patient is notwithstanding satisfied with a very small quantity of food; in the other cases it returns very slowly. Although the depression of strength sometimes goes off almost at once, yet it leaves the patient often with a greater feeling of weakness. Thus, however, the whole disease disappears, and the patient recovers his strength very quickly.

But although this favourable termination of fever occurs in a large majority of instances in this country, it is nevertheless a disease frequently fatal, and, under particular circumstances, the cause of great mortality.

When fever terminates fatally, the symptoms present themselves chiefly under two different aspects, but variously modified, approaching to each other, or even partially combined. The individual varieties it is impossible to depict; a knowledge of them can only be attained by personal observation of numerous cases at the bed-side of the sick. One of the forms, just alluded to, consists principally of a great aggravation of the symptoms of the hot stage. The heat of the skin continues great and pungent, and its surface dry and parched; the countenance is flushed, and the eye suffused with redness, and intolerant of light; the head-ache is severe, little or no sleep is obtained, the delirium is augmented, and is accompanied with extreme restlessness, often with vociferation, and even great muscular strength, so that the patient is with difficulty confined in bed; and the pulse is frequent, with considerable hardness. About the end of the second week these symptoms suddenly change; the delirium ends in an indistinctness or confusion approaching to stupor, the articulation becomes indistinct,

the breathing laborious, the strength sinks rapidly, cold sweats, and convulsive motions ensue, and the patient is cut off in a few hours. Sometimes symptoms of inflammation of the lungs supervene, and continuing together with the delirium, hot skin, frequent pulse, and brown tongue, the patient dies with symptoms of suffocation; and sometimes inflammation of the intestines, or other important organs, being superadded to the original fever, accelerates and modifies the fatal termination. This has been called inflammatory fever. The other form of the disease, above-mentioned, is extended more commonly to the third week, sometimes later, and the progress of the symptoms is more gradual. The depression of the muscular powers continues to increase with the disease; the eyes become sunk, dull, and listless; the countenance dejected, and of a dusky hue; the delirium is attended with a low muttering, and the patient lies without the disposition or the power of making any exertion, or he picks the bed-clothes; the tongue becomes crusted with a dark brown or black matter, a similar fordes collects upon his teeth and lips; the pulse is frequent, beating from 120 to 130 times in a minute, and is at the same time small and feeble; the respiration is also weak, generally frequent, and interrupted with sighing or a dry cough; the voice becomes indistinct or inarticulate; and there are slight convulsive twitches, or subfultus tendinum. At length the prostration of strength becomes extreme; the patient lies on his back, being unable to support himself in any other position, and even slides down towards the bottom of the bed; he is altogether insensible to external impressions; the sphincters, as well as the muscles of voluntary motion are relaxed, and he passes his stools and urine involuntarily in bed; the pulse becomes very feeble, tremulous, and scarcely to be felt at the wrist; partial, clammy sweats break out; the eyes appear glazed and fixed, and the other features shrink; the patient is unable to swallow; his breathing becomes irregular and laborious, attended with some noise in the throat, as the fatal event approaches; the extremities grow cold; and, often after some hours, the functions of life finally cease. When fever assumes this form it constitutes *typhus*, or the nervous, malignant, &c. fevers of authors.

There are some other appearances, which, though not the ordinary attendants on fever, occasionally occur, especially when the disease is of a severe kind, and which have been considered as evidence of malignancy, or of putrescence. Generally in the second week of the disease, but sometimes as early as the fourth or fifth day, (see sir John Pringle's *Obs. on Diseases of the Army*, part iii. chap. 7, and Huxham on Fevers, chap. vii. p. 97.) an eruption of spots, not elevating the cuticle, of a red colour, sometimes pale, often darker, or even of a livid or purple hue, appears on the skin: these spots, or *petechiæ*, are thickest on the breast and back, less numerous on the legs and arms, and are seldom, if ever, seen on the face. They were first described, among the *moderas*, by Ingrassia of Naples, afterwards more particularly by Fracastorius, under the names of *lenticula*, *puncticula*, or *peticula*; whence also the same appellations were given to the fevers themselves. (See Fracastorius de *Morb. Contag.* lib. ii. cap. 6.) Petechiæ appear in fever, most frequently in close and crowded situations; formerly they were very frequent attendants on the fevers which occurred in the persons under confinement in close cells, or crowded apartments in our prisons. Dr. Willan has stated, however, upon the authority of the present surgeon of Newgate, that since a general attention to ventilation and cleanliness has been adopted, petechiæ do not now appear in more than one case of fever in thirty in that

prison. He has also added, from the observation of the physician of the Fever Institution, in London, (the writer of this article,) that the proportion of cases, in which petechiæ occur in that institution, is about one in forty-two. (See Willan on Cutaneous Diseases, order iii. *gen.* Purpura, p. 468.) Sometimes the purple spots are of a large size; in which case there are often also livid blotches, or stripes like the strokes of a whip, *vibices*, and hæmorrhages break forth from the internal parts, as the bowels, lungs, stomach, and wherever the surface is covered with a very thin cuticle, as from the nostrils, the gums and mouth, &c.

A rash of a different species, which Dr. Willan has termed *rosola*, "a rose-coloured efflorescence, variously figured, without wheals or papulæ, and not contagious," (Loc. cit. order iii. *genus* 4,) sometimes makes its appearance in fever, of the typhous type: sometimes it precedes the formation of purple spots and vibices, and in other cases it is seen early in the fever, but remains only for a short time without any material consequences. Some other cutaneous appearances occasionally occur, as mentioned by Huxham, (Loc. cit. p. 97,) such as military pustules, a scabby eruption about the lips and nose, and aphthæ.

Appearance on Dissection.—An examination of the bodies of those who have died of fever, though it has often thrown light upon particular symptoms, especially on those which have occurred late in the disease, has nevertheless failed to elucidate the subject of fever in general. The appearances which have been presented to the view of the dissector have been so various, the organs affected so different in different instances, even when such difference could not have been anticipated from a knowledge of the symptoms, that the principal general inference which can be deduced from the observations of the anatomists may be expressed in the words of Riverius; (see his *Praxis Medica*, lib. xxvii. cap. 2. Appendix,) that acute and dangerous fevers "*rarissime fieri sine interna et peculiari visceris cujusdam affectione, et pleurumque inflammatione; quare nunquam omittenda cura hypochondriorem, capitis, thoracis, uteri, renum, et vesicæ; ut omni ratione investigemus, quæ harum partium insigniter laboret, et ei, quoad fieri potest, subveniatur.*" Some one or other of the viscera are most commonly disordered, especially by inflammation, in the course of those fevers, each of which demands our attention respectively, in conducting the cure, according to the severity with which it suffers. Dr. Donald Monro has remarked, that, in fatal fevers, "the febrile matter is apt to fall on particular parts, and there to create abscesses; particularly in the brain, the lungs, and the glandular organs." (*Treatise on Military Hospitals*, vol. i. p. 237.) On the whole, it would appear, that the brain is the organ which has been found to have suffered most by the attack of acute idiopathic fever. But we have to observe, with regret, that dissections of bodies, cut off by fever, have been often too incompletely examined, to enable us to draw any satisfactory comparative conclusions from them. Thus even sir John Pringle acknowledges that of the few dissections made under his inspection, some were directed to the brain or to the bowels only, all the cavities being examined but in a small number of cases. In those instances of fever, in which the functions of the brain were much disordered, that organ has exhibited several morbid appearances: the most frequent of these are a congestion of blood; the vessels of the pia mater, or investing membrane, being all distended, as if injected; the brain itself, when divided, presenting a number of red points, which pour out blood; the arachnoid coat is not unfrequently at the same time separated from the pia mater by the interposition of a gelatinous or serous fluid; these

these membranes are both occasionally thickened, their transparency being partially lost, and they sometimes adhere closely together in particular parts, as well as to the dura mater. Occasionally an effusion of serum is found in the ventricles of the brain. Sometimes, though comparatively in rare instances, the inflammation of the brain has been so decided, as to have terminated in suppuration, or abscesses of the substance. These have been chiefly observed in the lobes of the cerebrum, the cerebellum in general being less liable to disease: but two instances of purulent matter being formed in the cerebellum are noticed by sir John Pringle. (Loc. cit. part iii. cap. 7.) Even suppuration of the cerebrum is not a common result of fever in this country. Dr. Fordyce says, that he "has caused the heads of many patients, who have died with very great delirium in fever, to be opened, and never found any marks of suppuration. Most commonly the brain appeared exactly as it is commonly found. Sometimes the blood-vessels were distended with blood, but never was any suppuration found; generally no uncommon appearance at all." (Third Dissert. on Fever, part i. p. 98.) In the yellow fever, Dr. Jackson states, that "the brain upon dissection appears to be more or less affected in the majority of subjects who die in the acute state of the disease; the membranes are then inflamed, or the blood-vessels turgid to an extraordinary degree, give an appearance of commencing gangrene rather than of inflammation, properly so called; water is sometimes found in the ventricles, with evident effusion in the interstices; but this is an effect not general, not even frequent." In the accounts of an epidemic fever, which occurred at Geneva, in the year 1805, published by two physicians, it is stated by both that congection of blood was often found in the brain, but in other cases the brain was in its natural state. And a Dr. Eisfield, who published an account of an acute typhus, as it prevailed at Leipzig, in 1799, observes, "in very many careful dissections of the brain (though I only once detected an abscess, and this was in the right hemisphere, about half an inch in diameter) the vessels, particularly those in the vascular membranes, almost always appeared turgid with blood. The four ventricles abounded with water, and sometimes a good deal of extravasated blood was present. The cortical substance was inflamed, soft, and flaccid." (See Beddoes' Researches, Anatomical and Practical, concerning Fever, as connected with Inflammation, p. 48.) The last-mentioned circumstance does not necessarily imply inflammation. It was observed by Chambon (Obs. Clin. Pract. Obs. 29.) that the substance of the brain in every part is often found harder than natural after malignant fevers. This, Dr. Clutterbuck remarks, we know to be a common effect of inflammation in other parts. (Inquiry into the Seat and Nature of Fever, part i. p. 173.) The writer of this article lately witnessed an unusual firmness of the brain of a patient, dead of petechial fever, at a time when the abdominal viscera had already become very putrid. The congection in the brain was very considerable.

Not only, however, are these congections and inflammatory phenomena of the brain frequently absent, but sometimes together with them, and not seldom in their absence, similar appearances are observed in other viscera, more especially in those of the abdomen. Dr. D. Monro included other organs with the brain in his mention of the morbid changes produced by fever: and sir John Pringle remarks, that when contagious fever proves fatal, it generally terminates either in the actual mortification of some part, or in an abscess of the brain; and he adds, that "the intestines more particularly are disposed to mortify." He likewise quotes the *Traité de la Peste*, to prove that some of the *viscera* were always

mortified and inflamed, the brain and lungs most frequently, in those who died of the plague at Marseilles. Dr. Eisfield, continuing his description of the appearances discovered by the dissection of those who died of the Leipzig fever, says, "the lungs were often found destroyed, inflamed, ulcerated, gangrenous, covered with much exuded lymph. The liver inflamed (especially the concave surface) tender, flaccid, full of blood, or pale and bloodless. I did meet with inflammation and gangrene of the uterus, the urinary bladder, the prostate and other glands (particularly the mesenteric) of the colon and rectum." "The pains in the head were sometimes so violent, and the delirium so furious, as to indicate inflammation of the encephalon, which however was discovered in the abdomen." In three dissections of persons cut off by an epidemic fever in Normandy, Dr. Monnet found the vessels of the brain and its membranes gorged with dark blood; the lungs were also diseased; all the ramifications of the mesenteric arteries full of black coagulated blood; the intestines in part inflamed, in part putrid and gangrenous, in two of the cases; a prodigious congection in the small curvature of the stomach and in all the intestines, especially the small. Of the fever which raged at Leghorn, in the summer of 1804, Thiebault reports, "that there were few of the viscera which it did not leave sometimes found, sometimes gangrenous, or at least with black spots on the surface. This alteration was especially seen on the concave part of the liver, the inner surface of the stomach and intestines, often in the right side of the lungs and diaphragm; the abdominal viscera, and still more the abdominal muscles, were excessively stabby and tender. The cavities of the thorax and abdomen, the pericardium and the ventricles of the brain, contained a yellow liquid, often fetid, and of a dark bloody tinge. The superficial vessels of the viscera, especially those of the brain and intestines, appeared dilated, and their extremities filled with a black matter. 'Nothing was found constant but the gangrenous nature of the alterations, and their being more concentrated on the stomach and intestines than in the other viscera.' (Recueil, period xxxiii. 12—13.) Palloni (Osservaz. Med. Livorno, 1804,) gives a very similar account. In his dissections, the force of disease still more plainly appears to have been exerted upon the abdominal and contiguous viscera. During the similar epidemic of 1800, in Spain, professors Sabater and Ramos found in the abdominal viscera sanious and purulent effusion with gangrene. It is expressly said that, in the two other great cavities, the head and the thorax, essential changes were seldom found. In some subjects, however, black gangrenous points appeared upon the lungs, and in others upon the brain. "The alterations in the abdominal viscera were the only ones that can be considered as the direct and immediate product of the disease." (Berthe, *Precis de la Maladie d'Andalousie*, 1802, p. 182—5.) Dr. St. Lirih, house surgeon to the Philadelphia dispensary, informs us, in his dissertation on malignant fever, (1804,) that the brain was generally found in a diseased state, the meninges being considerably inflamed, the dura mater being sometimes agglutinated to the pia mater, the blood-vessels turgid with blood as if injected, the brain firmer than usual, water frequently in the ventricles, and sometimes blood effused between the meninges. The stomach was always diseased; great inflammation observable throughout; erosions of the villous coat frequent; inflammation extending to the intestine; bladder diseased; liver, spleen, pancreas, kidneys generally found; lungs, pericardium, and heart inflamed." We quote these observations from Dr. Beddoes' researches, not having the original works. We add, that, in two cases which we lately investigated by

disection, the villous coat of the small intestines was ulcerated in parts, and altogether destroyed in others; the brain at the same time bore marks of great congestion in the one case, and its ventricles were much distended with serum in the other.

We have dilated upon the subject of the morbid structure occasioned by fever, (which must ever be deemed highly important,) because it is too much neglected, partly from a mistaken fear of contagion from the dead body, which deterred even Morgagni from such investigation; and partly from pre-conceived hypothesis, which has led to the examination of only one cavity of the body, when disease might be discovered in all.

Ratio symptomatum, or explanation of the Symptoms.—The first symptoms of every fever obviously indicate a diminution of the nervous power. Of the nature of this power we only know that it originates in the brain, and is communicated to every part of the animal frame by the medium of the nerves; and that the action of those parts, their motion and sensibility, depend upon this communication. The first symptoms of fever, then, indicate that less of this nervous power is produced and imparted to the organs of the system; or, to use a common expression on this occasion, that there is a torpor or atonic condition of the brain and nerves. This is shewn by the *languor* and *lassitude*, connected with the relaxation of the muscles. A similar condition is produced by the depressing passions, acting through the medium of the mind on the nervous power; whence the whole body becomes relaxed, as is shewn by the lengthened muscles of the face, the loss of strength, &c., and if the muscles of the heart are also relaxed, *fainting* is produced. The *depression of strength* depends upon the same cause; the muscles being unable to move the body with the usual force, and the powers of the mind being impaired. The muscular energy and powers of the mind are much connected in the animal economy; so that if the body have been fatigued, the mind cannot exert its powers of attention, memory, and judgment with alacrity, and *vice versa*. A student in mathematics would be unable to trace the steps of an intricate problem, after having contended in an athletic game; or, on the other hand, after having fatigued the mind by going through a new and laborious demonstration, he would be unable to exert the powers of his body in a fox chase. We cannot think much, and use strong exercise at the same moment. Both these powers, therefore, seem to depend alike on the nervous energy, and the simultaneous diminution of both implies the diminished state of that energy. Yet this is different from ordinary debility, and has therefore been distinguished by the terms depression of strength; the powers of the body not being lost, but only prevented from acting by the disease; for if the disease ceases in eight or ten hours, (as in the paroxysm of an intermittent,) the depression of strength ceases likewise, and both the body and mind can exert themselves with a vigour nearly equal to that which they possessed before the disease began, or in perfect health. The nervous power is diminished, like the action of a spring, which is overcome by the temporary pressure of a weight, that does not destroy its elasticity.

Another result of the muscular relaxation is the feeble action of the heart, on which many of the symptoms depend. This is evinced by the feeble, *small pulse*, by its occasional irregularity, and even slowness, at the onset of the fever. This languor of the circulation, especially in the extreme vessels, is the cause of the *pallens* of the *skin*, and the shrinking and diminution of size in the features, and every other external part, as well as of morbid swellings. The condition of the surface is the same, to all appearance, as

is produced by the application of external cold, which constricts, or rather diminishes the action of, the small superficial vessels; whence the *cutis anserina*, or goose-skin contraction and roughness of the surface takes place. Whence also the *skin* is *dry*, at the same time, as perspiration cannot be produced from vessels in which the circulation is nearly suspended. It must be observed, however, that the action of the capillary vessels of the skin is not entirely regulated by the action of the heart and great arteries; for the former are sometimes distended quickly, as in the blush of shame, or collapsed, as from external chill, when the pulse remains unchanged. From the same cause, (the languor of the circulation, and the contracted condition of the extremities of the arteries,) the other secretions are diminished. The mouth and tongue become *dry* from the scanty supply of saliva; the pancreatic juice, the bile, the mucous and serous excretions in the alimentary canal being diminished, as well as the muscular action of the bowels enfeebled, the feces are not passed forwards, and *costiveness* takes place; the *urine* is not only small in quantity, but of *pale* colour, from the diminution of the saline and mucilaginous animal matter, which are secreted by the kidneys in health, and give it its peculiar colour. From the same imperfect circulation the discharges from issues and ulcers cease in the attack of fever.

Until we obtain a more accurate knowledge of the origin and nature of animal heat, and of the means by which it is maintained at the regular temperature of $97\frac{1}{2}$ or 98, notwithstanding the varieties of the atmospheric temperature in which we live, we shall not be able to explain satisfactorily the changes which the heat of the body undergoes during the different stages of fever. We know, however, that the variations of the heat are much connected with the functions of respiration and circulation. In what are called cold-blooded animals, the function of breathing is performed at long intervals, and is capable of great suspension without injury to life; and general coldness takes place in the human body, when the passage of the blood is diverted from the lungs, as when the foetal organization of the heart remains in after life. With the circulation the connection of animal heat is so well known, that, in popular language, redness, or a florid colour of the skin, (which arises from its vessels being distended with blood,) is almost synonymous with *heat*. In all instances of acute inflammation the sense of heat is in a great measure proportionate to the vascularity and redness of the part affected. At the onset of fever, then, both the actual *cold* and sense of cold are doubtless the effect of diminished circulation on the surface, which is somewhat augmented, perhaps, by the imperfect respiration which is then carried on. It is not so easy to explain satisfactorily the sensation of cold existing, when to the feel of another person the heat is natural. This may be attributed partly, perhaps, to the state of torpor in the brain, partly to the disordered condition of the sentient extremities of the nerves, and partly to the actual chill, which remains in particular parts, while others have become warm.

The sensibility of the organs in general, we have said, is impaired, and the sensations are occasionally not only diminished, but depraved. This also arises principally from the deficient circulation in the extremities of the arterial system. Sensibility is greatly dependent upon a sufficient circulation of arterial blood to the extremities of the nerves, as well as to the brain. Those parts of the body through which red blood does not flow are possessed of little or no feeling; such are the cuticle, the nails, hair, tendons, &c. while, on the contrary, parts that are extremely vascular, as the true skin, are endowed with acute sensibility.

Again,

Again, the increased flow of blood to any part is generally attended with increase of the sensibility of the part; whence the augmented sensibility, the soreness and tenderness of parts that are inflamed. Hence, then, we may explain the *diminished* and *depraved* sensibility of the skin, and organs of sense, in the cold stage of fever. Even the torpor of the brain itself is increased, and therefore partly to be accounted for by the weakened circulation in it, at that period of fever, and is probably, in many cases, a secondary effect.

To the enfeebled circulation also, much of the *anxiety*, and sense of load about the region of the heart, the *sighing*, yawning, and stretching of the limbs, is to be attributed, as well as the short and *disturbed respiration*. The force of the heart being unable to propel the blood to the extremities of the arteries on the surface, a greater quantity must be accumulated in the great vessels about the heart and in the lungs; whence the load and oppression, the labour and irregularity of respiration; whence also the sighing and yawning, which are a sort of instinctive action, by which we dilate the lungs, give a freer passage to the blood, and therefore relieve, for a time, the uneasy sensation. According to Dr. Fordyce, indeed, this fact has been proved by dissection. "In those dissections," he says, "which have been made of patients, who have died in the attack of simple fever, the large veins going to the heart, that is, the vena cava, both superior and inferior, the right auricle of the heart, and the pulmonary arteries, have been found distended with blood to a much greater degree than they are commonly, when death takes place from other causes." (First Dissert. p. 95.) Sometimes a *cough* attends the cold stage of fever, arising from the irritation of this accumulated blood in the thorax.

The *littleness* and general *uneasiness* which are at the same time present, are almost the necessary consequence of these morbid conditions of the sensorium, of the circulation, of the breathing, and of the muscles of all parts. Uneasy feelings lead us instinctively to seek relief in frequent changes of posture. Besides these uneasy feelings, however, there are *head-ache*, and *pains in the back and the limbs*, which have been differently explained by different physicians. Some have ascribed the head-ache to the state of the brain in the cold stage of fever, but erroneously, in the opinion of Dr. Fordyce, since, whether it occupy the forehead over the eyes, or the back part of the head, it is equally external to the sensations of the patient. In like manner, the spinal marrow, as it is improperly called, being a continuation of the substance of the brain through the tube of the spine, has been considered as the seat of the pain of the small of the back which commonly occurs. (See Clutterbuck on Fever.) But why it should occur only in that part of the back, and not along the whole spine, it might be difficult to explain: while, on the other hand, if it were an affection of the great muscles of the loins, (and it very much resembles the pain of weakness and fatigue,) it should, like this pain, be greatly benefited by the horizontal posture; which, indeed, we believe to be the fact, notwithstanding the assertion of Dr. Fordyce. And the occurrence of similar dull pains in all the limbs renders it probable that it is chiefly muscular, and connected with a deficiency of nervous energy, as in muscles which have been exhausted by fatigue.

The affection of the stomach, indicated by the *loss of appetite*, *sickness*, *thirst*, and *sour tongue*, some or all of which are among the symptoms of the febrile attack, may not be so capable of a satisfactory explanation. It must be observed, however, that there are at least three sources of derangement to this organ in the cold stage of fever; namely, the state of the muscular fibres of the stomach and of its secre-

tions, which suffer in common with the other muscles and secretions of the body; the great sympathy which exists between the stomach and the brain; and, above all, perhaps, the intimate sympathy of the stomach and the skin. It seems demonstrable, from the effects of stimulant and tonic substances in augmenting the appetite for food, and the power of digestion, that a certain vigour of the muscular part of the stomach is necessary to, and co-existent with, the proper exercise of these functions; and, therefore, that a relaxation and debility of the same part must be the cause of a diminution of them. Observation also has taught us, that when the muscles are exhausted by exercise, the stomach partakes of the fatigue, and the appetite and digestive power are greatly impaired or lost. The influence of a morbid condition of the brain on the stomach, by sympathy, is well known to be great, inasmuch that some writers have considered this influence as amply sufficient to account for the disorder of the stomach in fever. Both in inflammation of the brain, and in the case of external injuries of the head, sickness and vomiting are among the most invariable symptoms. Dr. Clutterbuck remarks, that the stomach not only receives nerves from the great intercostal nerve, but also communicates directly with the brain, by means of the eighth pair of nerves, or *par vagum*. "Hence," he adds, "it is little to be wondered at, that the functions of the stomach in fever, like those of the other organs of sense, should suffer a deviation from the natural state. In this way the uneasy sensation often felt at the pit of the stomach in fever, the total want of appetite, the loathing and disgust commonly experienced even at the sight of food, are naturally and easily accounted for." (Loc. cit. p. 74.) Dr. Cullen, on the other hand, is disposed to consider the state of the skin as the principal occasion of the affection of the stomach, in consequence of the sympathy between the two organs. The sympathetic influence of the state of the skin in inducing disorder of the stomach is supported by a curious fact observed by Sydenham in the plague. In the attack of that disease, he remarked, that vomiting occurred, which prevented both food and medicine from remaining on the stomach; and that the means by which he was enabled to allay this symptom, was inducing perspiration by the aid of external covering; as soon as the skin became moist, the sickness diminished, and the proper medicines were then retained. (Sydenham, Oper. sect. ii. cap. 1.) We shall state hereafter that the occurrence of the hot stage generally removes the vomiting, that of the sweating stage always.

This doctrine is still farther supported by a consideration of the origin and removal of the *thirst*, which occurs at the onset of fever. The sensation of thirst doubtless arises from different causes, and under different circumstances, the mere dryness of the mouth and fauces, from evaporation of the moisture, in consequence of the heated breath, or from deficient secretion, may be attended with that sensation; sometimes it seems to be excited by a peculiar condition of the stomach, while the mouth and fauces remain moist, as appears from the thirst which arises from salted food in the stomach, or food of difficult digestion, or too great in quantity; or, as Dr. Fordyce suggests, it seems to be sometimes occasioned by a diminished proportion of water in the blood-vessels, as, in the case of diabetes, when the kidneys act with extraordinary rapidity, or after a great discharge of fluids by perspiration. This author, however, considers the matter as not capable of being determined, (see his First Dissert. p. 223.) although he is disposed to refer it to a particular affection of the stomach. (Ibid. p. 89.) This opinion, we think, is scarcely to be questioned for a

moment; since thirst often occurs in fever, when the tongue and fauces are moist, and generally before any diminution of the watery part of the blood has taken place. But several circumstances conduce to prove an intimate connection between this affection of the stomach, which occasions the sensation of thirst, and the state of the skin. It has been found by seamen, when accidentally deprived of drink, (as by lieutenant Bligh, and his men, in their miserable voyage in the South sea,) that by immersing the body in water, or applying wet clothes to the skin, the thirst has been relieved. Dr. Currie relates the case of a gentleman, who was prevented from taking any substance, solid or fluid, into the stomach, in consequence of an obstruction in the œsophagus. In the first days of his abstinence the sensation of thirst was very troublesome; but it abated, and, as he declared, was always removed by immersion in the tepid bath. (Med. Reports on Water, &c. p. 25: 2d edit.) The same author has stated, from numerous experiments, that the thirst, which continues in the hot stage of fever, is almost instantaneously removed by the affusion of cold water on the skin, which at the same time induces perspiration, and resolves the febrile paroxysm. (See *COLD*.) On the contrary, the swallowing of cold drink, in the hot stage of fever, which relieves the thirst, is often followed by a relaxation of the perspiratory vessels of the skin; and, when cold, drink does not produce a sensible increase of perspiration on the skin, the relief which it affords to the thirst is momentary only: which obviously proves the reciprocal sympathy of the organs. (Currie, loc. cit. 178.) And this is farther proved, as we have already stated, by the cessation of thirst when the sweating stage of fever is established.

All the symptoms, then, of the onset of fever, constituting the phenomena of the cold stage, are explicable, directly or indirectly, on the supposition of a depression or diminution of the nervous energy, however induced. In like manner, the symptoms of the hot stage and the subsequent phenomena, in continued fevers, are referable to an imperfect recoiling, as it were, of the nervous power, and more immediately to the increased action of the heart and arteries, and of the capillary vessels.

The *heat*, the redness of skin, and flushed countenance, the returning size of the external parts, the restoration or even increase of the sensibility of the organs, are all the result of the distension of the extreme vessels by the red blood, as the opposite symptoms of the cold stage were the consequence of an opposite condition of the circulation. Hence the frequent *soreness* of the body, which cannot bear its own pressure without pain; hence *intolerance of light* in the eye, and the quick sensibility to noise in the ear, both of which increase the *head-ache*, which is now more acute, and deep-seated: hence also diseased parts become more painful. The quick, and *strong pulse*, implies the greater force of the heart, and of the arterial action; nevertheless the dryness of the skin, and the continued suppression of the rest of the secretions, evince the continuance of a morbid condition (a constriction or spasm, it has been called) of the extremities of the exhalant and secretory arteries, by which their functions are impeded. This condition bears a considerable analogy to the state of inflammation, (see *INFLAMMATION*), and when this stage of fever, and these particular symptoms are very severe, the fever has been called *inflammatory fever*.

Connected with, and in a great measure the result of this morbid condition of the circulation in the brain, is the *delirium*, which, though it occasionally occurs in the cold stage, is usually absent until the hot stage has been formed. It is often accompanied by a throbbing or strong beating of

the carotid and temporal arteries, redness of the eyes, and flushed countenance, which give us reason to believe that it arises from over-excitement of the brain, by the quantity of blood thrown up into it by the increased action of the heart. In this state the ideas crowd themselves, as it were, upon the attention of the patient, and change rapidly from subject to subject; he is unable to court the access of sleep, in consequence of the torrent of images which are presented to the mind. The condition of the brain appears to be similar to that of the whole of the sentient parts: as the eye is more acutely sensible to the impression of light, and the skin to that of touch; so the brain or the sensorium is more easily excited to thought, by the impressions of internal irritation, which are exceedingly multiplied in this state of fever. Hence the incessant dreaming which distresses the patient, if he falls into an imperfect sleep; and as the internal feelings are all of a painful nature, whether we consider the anxiety, the head-ache, the pains of the back and limbs, or general uneasiness, &c. the dreaming ideas, which are associated with those feelings, are also of a painful and distressing nature. (See *DREAMS*, in *Pathology*.) If this increased action of the vessels of the brain continues, a degree of pressure is apparently produced by a more permanent distension of them, and a stupor and deafness come on. If the patient die in this state, a general congestion of the vessels of the brain is found upon dissection: but the mere active delirium, unattended by stupor and deafness, may even prove fatal, yet no traces of the morbid condition of the vessels of the brain shall be discoverable after death. (Fordyce, Third Diss. p. i. p. 99. 109.) In these cases, it sometimes happens that the delirium ceases some hours previous to death, although the other symptoms of fever continue. This obviously arises from the sinking powers of the circulation; whence the action of the arteries of the head is reduced to something approaching to the natural state, before it ceases altogether with death. Delirium is occasionally connected, it is supposed, with an enfeebled action of the vessels of the brain; in which case it assumes another form, is not accompanied with any violence, but with great feebleness, and a low muttering rather than a boisterous noise. It is the *delirium mite* of authors. (See *DELIRIUM*.) We believe, however, that even this low delirium is commonly the result of some degree of congestion of the vessels of the brain, arising from local inequality of the arterial action, although that action may not be violent.

The *sweating*, like the dry heat of the second stage, is produced in a manner not very well understood. It was supposed by the older physiologists, as by Albinus, Haller, &c. that the sweat, as well as the insensible perspiration, is a mere exudation of the watery part of the blood through the cuticle; hence it was said to arise, in fever, from a mechanical relaxation of the extreme arteries, which were supposed to be spasmodically contracted during the hot stage. But it has been observed, by later physiologists, that this opinion respecting the nature of the perspiration is contrary to all analogy, and founded only upon experiments made on the dead body. The opinion of Dr. Fordyce and Mr. Cruickshanks appears to be the true one: namely, that the matter of perspiration is secreted from the blood by the capillary arteries, and thrown out on the surface by organic pores in the cuticle, (however difficult to be discovered,) connected with the extremities of these arteries; and that in this process there is not a separation merely, but a new combination, as in similar instances of secretion. (See Dr. Currie, loc. cit. p. 200.) Although, therefore, the occurrence of perspiration has been considered as the cause of the cessation or diminution of the symptoms of fever, (and

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certainly no such change takes place without some appearance of moisture on the skin,) yet it is probably only one of the signs or effects of that cessation, in common with the restoration of the other secretions, which are also diminished or suspended in the attack of fever. This point, however, seems to be ascertained, that the process of perspiration is a cooling process, and the principal means by which the overheating of the body is prevented or removed. The heat of fever declines gradually, as the perspiration goes on; but the rapidity with which it declines is varied by the quantity of bed-clothes, and the closeness with which the body is enveloped. While perspiration goes on, it is difficult to raise the temperature of the body above the natural standard, and under such circumstances it is capable of bearing very extraordinary degrees of heat, as was proved by the experiments of Sir Charles Blagden, Dr. Fordyce, and others. Whether the refrigerating effect of sweating depends solely on the evaporation, or whether an absorption of heat takes place in the process of the secretion of perspirable matter, is not certain.

The *turbid urine*, throwing down a sediment of a lateritious or brick-dust appearance, arises from the restoration of the secretion of the kidneys, which now separate the lithic acid, as well as the animal extractive matter, in greater quantities than in health; but the urine contains, at these times, only a super-abundance of those substances which it contains in a state of health, there being no new or morbid matter produced in it. This change in the urine has been likewise explained upon the supposition of a spasm, in the secreting arteries in the kidneys, which suffered only the thinner parts to pass, or pale urine, in the first stages of fever; but being relaxed in the sweating stage, the thicker parts were allowed to pass, and thus occasioned the sediment. But the kidneys, like the other secreting organs, are not mere sieves, nor are those thicker parts existing in the blood, previous to the commencement of the sweating stage; they are then produced by the action of the kidneys. There is, however, an intimate connection of sympathy between the action of the perspiratory vessels of the skin, and the secretion of this over-proportion of lithic acid, and animal mucilage by the kidneys: for it is generally producible at pleasure by a dose of Dover's powder, or other sudorific medicine.

The symptoms, which occur in the later periods of fever, when it goes on to a severe or fatal degree, are explicable as the effects of an extreme prostration of strength. Hence the *tremors*, and slight convulsive motions, or *subfultus*, of the tendons and muscles; hence also the irregular vision, with the appearances of little bodies flying before the eyes, (*musca volitantes* of authors) or of black spots upon objects looked at, which imply a partial loss of sensibility in the retina, or nervous membrane of the eye; hence the general insensibility, the difficulty and labour of respiration, the involuntary discharge of stools and urine, the difficulty of swallowing, &c.

The regular *periods* at which the paroxysms of intermitting fevers, and the exacerbations of remitting, and even of continued fevers, return, require some notice, although a satisfactory explanation may not be attainable. The fact has been generally referred to the influence of *habit*, which is productive of many phenomena in the animal economy. (See *HABIT*.) It is observable, that all men, even in a state of good health, have a sort of feverish condition induced in the evening, which goes off in the morning: there is some depression of strength or debility both of body and mind, and the pulse is quicker than in the morning. In proportion as the health is more delicate, this state is more

evident. It is probable that this diurnal paroxysm is to be attributed to the effect of the irritations of the day, which are suspended during the night; and this diurnal habit might be sufficient to account for the usual evening exacerbation of continued fever. A similar diurnal habit is likewise observable in many of our actions and functions; as in the returns of sleep and waking, and of our appetites and excretions, which, if prevented from taking place, or being gratified at the accustomed period, are apt to cease or become less urgent. This is often remarked with respect to the desire of sleep, to hunger, and to evacuation of the bowels. These facts might afford an analogical explanation of the periodical returns of intermitting fevers, if they were all quotidian; but they afford us little assistance in accounting for the return of the paroxysm of those fevers at the end of forty-eight hours, in the case of tertian, or of seventy-two hours, in the case of quartan fevers. But it is remarked by Dr. Cullen, that even those distant paroxysms are in some degree connected with the diurnal revolution, as the times of their accession are generally fixed to one time of the day; so that quotidians come on in the morning, tertians at noon, and quartans in the afternoon. (First Lines, § lvi.) Some writers have attributed all these periods to the habit, but as the second and third paroxysms of a tertian occur as regularly, often more so, at the end of forty-eight hours, than the seventh and eighth, habit could not be the cause of the return in the former instances, whatever might be supposed with respect to the latter. On the whole, we can only conclude that a disposition to these periodical changes is a general fact in the animal economy. See *PERIODS of Disease*; also *CATENATION*.

General Prognosis in Fevers.—In continued fevers the event cannot be prognosticated with any approach to certainty. The disease is in its nature of a dangerous tendency; and although there shall be no unfavourable symptom for the first seven or eight days, yet the fever may afterwards assume a dangerous character, and terminate fatally: while, on the other hand, recoveries occasionally take place, when the severity of the symptoms seemed to preclude all hope. A large proportion of the cases of fever, however, if properly treated, terminate favourably. Under the various forms which fever puts on, we can arrive at a correct notion of the probable termination of each particular instance, by taking a comprehensive view of the living machine; by estimating the relative importance of the several organs and their functions, in the maintenance of life; and, therefore, by observing accurately the number of these, which are affected by the disease, and the degree in which they are deranged; and we must farther take into the consideration the species or type of the fever, its general tendency, as well as the particular tendency of the prevailing epidemic; and likewise the peculiar circumstances of the patient, in respect to age, constitution, previous habit of body, mode of life, &c.

The prognosis of a favourable termination is deduced principally from the lesser degree of violence in the symptoms in general, or the smaller number of those which are severe; and likewise from several changes in the course of the disease, which experience has ascertained to be salutary.

Favourable Symptoms.—If the sensorium continues unaffected until the middle of the second week, and a delirium moderate in degree should then come on, it is not unfavourable; it implies a moderate affection of the brain. Deafness is most commonly a favourable symptom in this country; it implies, indeed, a morbid condition of the brain, but one which experience has proved to be free from the danger which attends the opposite condition. A

sleepy or dozing state, from which the patient is easily waked, at the same time taking his food, and discharging his stools and urine properly, is commonly favourable. A spontaneous, thin, warm sweat, especially after the first week, or about the fourteenth day, is generally favourable; as is likewise a gentle bilious diarrhoea, about the same period, if connected with softness of the pulse; it generally relieves the head. A copious discharge of turbid urine about the same period, although not a common occurrence, is generally critical; the turbid appearance of the urine sometimes anticipated the favourable changes in the other symptoms of fever. If the tongue, after being dry and parched, becomes moist and clean about the edges, it is a favourable symptom, and it often appears like the last mentioned symptom, for some time before the other changes take place; it implies a restoration of the secretions, and therefore a resolution in the fever; it may be considered also as a sign of salutary change in the organs of digestion. The state of the pulse, we have already observed, is an uncertain index; but it may be observed in general, that when the pulse does not rise to above 100 or 110, it may be considered as favourable. When the countenance has a natural appearance, the eyes are not dim or heavy, the patient lies in a natural posture, (see DECUBITUS,) the breathing is easy, the voice natural, and the appetite returns, all these must be deemed favourable symptoms, as they indicate that there is no failure of the vital powers. When the pulse is observed to rise in strength, in the latter periods of the disease, with an abatement of the stupor, tremor, and other affection of the nervous system, it is favourable, implying that the morbid condition is not so severe as to resist the influence of medicines.

In intermittent fevers the previous occurrence of but a small number of paroxysms is favourable; for the shorter the duration of the disease, the more easily it is cured. The postponing of the paroxysm, or its occurrence later than the regular hour, is a favourable circumstance; as is also that gradual change of the whole train of symptoms, until the fit at length becomes incomplete, either in respect to the cold, hot, or sweating stage. The more complete the crisis and the interval between the paroxysms, the more effectual the medicines given.

Unfavourable Symptoms.—The degree of danger, which is to be anticipated in severe fevers, is principally indicated by the two following circumstances; *viz.* by excessive action or excitement; and by excessive debility, or failure of the *vis vite*, or nervous power. The first of these conditions, generally, is observed chiefly in those fevers which have been called ardent, or inflammatory; but, partially, that is, in individual organs, it is not uncommon in all forms of fever. The second, or excessive failure of the vital powers, is peculiar to fevers of the low nervous or typhous kind.

The symptoms of excessive action of the vascular system, which are necessarily unfavourable, (for the powers of life may be exhausted by such action,) are a strong, hard, and frequent pulse; an intense heat on the surface; a quick respiration; a dry and parched tongue, without much fur, or that of a light colour; a violent delirium, especially when commencing early; a ringing or other noise in the ears; intolerance of light, with a considerable redness of the eyes; intense thirst; constant watchfulness, and restlessness, with acute head-ache, or violent pain in the ear, and much throbbing of the temporal and carotid arteries. These last-mentioned symptoms imply a violent action of the vessels in the brain, approaching to inflammation, with a long continuance of which the existence of the safety of that organ, or of life itself, is incompatible. If any other

of the large or important viscera are attacked with inflammation, as the *lungs*, *liver*, *intestines*, &c., the danger is likewise considerable. The symptoms, which denote the occurrence of such inflammation, will be found described under the proper heads. See PNEUMONIA, HEPATITIS, ENTERITIS, &c.

The symptoms of a failure of the vital powers, however, which are more common in the fevers of this country, are less under the controul of medicines, and therefore more dangerous; and more especially when conjoined with a congestion, or low degree of inflammation, in any of the important viscera. We shall note these symptoms of failure of the *vis vite*, as they are connected with, and exhibited by, the disordered state of the functions of the leading organs. It has been stated, under a former article, that death is always occasioned by an interruption of the functions of the brain, of the heart, or of the lungs (see DEATH); and accordingly the symptoms which occur in the functions of the sensorium, and in the circulation, and respiration, in fevers, are those which mark the greatest degree of danger.

The defect of energy in the sensorial functions is indicated by the extreme muscular debility, or prostration of strength, in the latter periods of continued fevers. Thus, if the patient is unable to support himself on either side in bed, but lies constantly on his back, and even slides to the foot of the bed, a dangerous debility is indicated. Tremors of the hands, (as well as of the tongue, when protruded,) and of other parts, which with a slight increase pass to subfultus or starting of the tendons, and these again into convulsions, are bad symptoms, as they imply an imperfect and irregular distribution of the nervous influence from the brain. After the tremors and subfultus tendinum patients frequently recover; but rarely, if ever, when convulsions supervene. Sir John Pringle remarked, that a tremor of the hands in the beginning of fever was one of the most constant signs of that fever being of a typhous nature. (Loc. cit. part iii. chap. 7. § 2.) When the diaphragm is affected spasmodically, giving rise to hiccup, it is a fatal symptom; as is likewise the relaxation of the sphincter muscles of the bladder and the straight gut, (or rectum,) which allows the urine and the stools to pass involuntarily, and which marks an extreme degree of debility. And when the muscles of the gullet, and those of respiration, become so far enfeebled, that the act of deglutition becomes difficult or impracticable, and the breathing is short and very laborious, death is generally to be considered as near at hand. The foaming at the mouth, and the rattling noise in the throat, which is called by nurses the dead-rattles, are the still more immediate precursors of death; and are occasioned by air of respiration passing through the mucus and saliva, collected in the mouth and throat from total inability of swallowing it. Other unfavourable symptoms, indicating the deficiency of the nervous power, are found in the different degrees of stupor and delirium, which are more indicative of danger, in proportion as they appear earlier in the disease; but which often occur, nevertheless, to a very considerable extent, in cases which terminate well: so that we must take the other symptoms into consideration before we decide upon the danger of these. Dr. Fordyce has stated, that “although the patient should be insensible to all external objects; though he should sleep very little, or scarcely at all; yet, if the deglutition and respiration should remain unimpeded, the patient is not to be despaired of; it happens most commonly that he recovers. But if he respire with great difficulty or hardly at all, or if the deglutition be almost totally prevented, or if attempting it throws the patient into convulsive

convulsive contractions, he rarely recovers." (Third Differt. on Fever, part i. p. 111.) Nevertheless, he justly estimated the unusual continuance or increase of delirium as a dangerous symptom: for, "on the other hand," he adds, "if the other febrile appearances do not keep pace with the delirium; though the pulse should become more slow and less obstructed; though the tongue should become cleaner and moister; though the colour of the skin should become more natural, the secretory vessels more relaxed; if, however, the delirium should still continue, without stupor or deafness, and the other marks which have been pointed out as accompanying fulness of the vessels of the brain; in such case, notwithstanding the practitioner and bystander are flattered, the patient is frequently cut off." (Ibid.) The more active delirium is often accompanied with an inflammatory condition of the brain, even in fevers arising from contagion, in which the other organs evince a defect of power, and the rest of the symptoms are also indicative of great debility: this combination of a local inflammatory action with general defect of power, whether it be considered as implying an inequality of the distribution of nervous influence, or be explained by any other hypothesis, is invariably dangerous, in whatever organ the inflammatory action takes place, but particularly when it is in the brain. It is necessarily embarrassing to the physician, and difficult to treat successfully, from the opposite nature of the remedies required for the suppression of the local inflammation, and of the general prostration of strength; the nature of the one affection absolutely contra-indicating the treatment, which the nature of the other as decidedly requires. Connected with the defect of sensorial power, the absence of thirst, while the tongue and mouth continue exceedingly dry and parched, is deemed an unfavourable symptom; and a delirious patient fancying himself well, is equally unfavourable, as implying a great obtuseness of the sensations.

In respect to the circulation, all unusual perturbation in the action of the heart and arteries is in some degree unfavourable; but especially extreme frequency and feebleness of the pulse, and irregularity. When the pulse beats above 120 times in a minute, or more, in fever, it must be considered as an unfavourable symptom; when it reaches 130, or upwards, the prognosis is extremely unfavourable. Although in some diseases, as in hydrocephalus, the pulse has been counted at upwards of 200 beats in a minute; yet, in fever, before it comes to 150, it is generally too small and feeble to be counted at the wrist, and the case is then to be considered as desperate; the pulse, indeed, has sometimes been so obscure as not to be felt at the wrist, for a day or two before death, when it might be felt at the temples, or in the axilla. In this state, the extremities are generally cold, which is another fatal symptom, when combined with those before-mentioned. Sometimes, from an irregularity in the action of the heart, the pulse intermits. An intermitting pulse, according to Dr. Fordyce's opinion, "is always a very dangerous symptom, excepting where it also took place when the patient was in health, and before the disease arose; but in the attack it is particularly hazardous." (First Differt. p. 85.) It is certain, however, that an intermitting pulse occurs in some cases along with favourable symptoms; we have seen it in a few cases, and only under such circumstances, in all of which recovery took place. It is remarked by Dr. Gregory, the present professor of physic at Edinburgh, that when the intermission is connected with an obscurity or indistinctness of the pulsation, it is always very unfavourable. Frequent irregular flushes in the face, and other parts of the surface, are also among the un-

favourable symptoms, as implying great irregularity of the circulation.

Great derangements of the respiration, whether such as denote a degree of inflammation in the lungs, (constituting the *pneumonia typhodes* of authors) which, from the contra-indications already mentioned, is extremely difficult and embarrassing to the practitioner, or such as denote the failure of the muscular powers, before alluded to, are always extremely unfavourable symptoms.

Deficiency of the nervous or vital power is farther indicated by the effusions of blood which take place from the extremities of the arteries under the skin, forming the *petechiæ*, *vibices*, and blotches, before described. These are always symptoms of a severe disease, but far from being mortal. The larger they are, and the nearer they approach to purple in their colour, the more they are to be dreaded. (Pringle, loc. cit.) Dr. Huxham observes, that "when black, livid, dusky, or greenish spots appear, no one doubts the malignity; the more florid, however, the spots are, the less is to be feared; it is a good sign when the black or violet petechiæ become of a brighter colour. The large black or livid spots are almost always attended with profuse hæmorrhages. The small dusky brown spots, like freckles, are not much less dangerous, than the livid and black; though fluxes of blood do but seldom accompany them. The vibices, or large livid or dark greenish marks, seldom appear till very near the fatal period." (Loc. cit. chap. viii.) The passive hæmorrhages mark a greater degree of the same condition of the solids and fluids. Black and very fetid stools are bad, as indicating a strong putrescent tendency of the bile and fordes in the bowels, and as partly arising from blood effused into the canal. The urine sometimes deposits a black and fetid sediment, which consists of effused blood, and is equally unfavourable. These, together with the black fur which collects about the teeth and mouth, the fetid breath, the disposition to gangrene in parts inflamed by blisters, or by the pressure of the body in bed, the loose texture, and black colour of the blood, &c., are the symptoms, which have been considered as denoting a *putrid* condition of the fluids in these forms of fever. It cannot be questioned, that there is often a putrescent *tendency* in the circulating fluids and in the solids, so that they readily undergo the process of putrefaction, when discharged or after death; but it is well ascertained, and has been confirmed by direct experiments, that an actually putrid state of the smallest portion of the circulating fluids is incompatible with life. It is sufficient, however, to know that these symptoms denote great danger, or a great tendency to death, and to have learnt from experience, the remedies which contribute to remove the symptoms, and to counteract that tendency.

The changes which take place in the urine were formerly much attended to, and although not so much is to be learnt from its appearances, respecting the nature and progress of the fever, as was once supposed, nevertheless this excretion ought not to be neglected by the practitioner. It is an unfavourable symptom when the urine, after having been turbid, becomes again pale and limpid; as it implies a return of the torpor or contraction of the extreme vessels, *i. e.* a renewal of the febrile attack, and is therefore commonly followed by other bad symptoms, as by delirium, congestions in different organs, &c. Incontinence of urine, whether dependent on a laxity or paralytic state of the sphincter muscle of the bladder, or whether the urine is passed involuntarily from a stupor or indolence of the patient, is always unfavourable: if this is overlooked, excoriations are apt to take place from the patient lying wet, whence

inflammation.

inflammation and sometimes gangrene arise. A difficulty in discharging the urine, or passing it frequently in small quantities, indicate considerable irritation and congestion of the bladder, and are therefore bad symptoms: a suppression of urine may be considered as one of the worst symptoms of fever. When the urine exhales an offensive odour, or is black in its colour, especially when containing the black or bloody sediment before mentioned, it indicates a state of the body which is dangerous. Even the ordinary healthy appearance of the urine, combined with symptoms of severe fever, is considered as indicating an unfavourable state. (See Lommius, *Medicinal Observat.* lib. i. p. 5.)

Vomiting, especially of blood, or of matters of bad colour and smell, is a symptom of extreme danger. Obstinate costiveness in the latter stage of fever, which is generally accompanied with severe head-ache, is very unfavourable. It seems to imply great torpor in the bowels, in consequence of the affection of the nervous system. Diarrhœa, in the late periods of fever, is generally unfavourable, especially when the fœces are liquid, and at the same time very pale, or black, and fetid: the pale colour implying the absence of the bile and proper fluids of the intestines; the black and fetid condition indicating a corrupted state of the bile and other secretions, or a mixture of blood, and a putrescent tendency of the whole contents of the bowels. A more copious discharge of unmixed blood from the intestines is a dangerous symptom; if hiccup or convulsions follow it, death generally soon ensues. This condition of the bowels seems to arise in many cases from a neglect of opening them, or removing the fordes in the beginning. A great distention of the abdomen, or of the epigastric region, arising from flatus, which the stomach and intestines have not sufficient power to expel, is often among the late and fatal symptoms of fever.

The changes of the countenance afford very important indications in respect to the severity and probable event of the disease. With a small share of experience, indeed, any person will recognize fever, from inspection of the countenance alone: and the disease never advances to a dangerous state without being accompanied by proportionate alterations in the features. In extreme debility, the eyes are often much sunk or collapsed; sometimes they remain fixed and unmoved, which state is connected with the coma and stupor; and occasionally arises from a spasm of the muscles of the eye-ball, in which case they are also sometimes prominent; at other times there is a constant rolling of the eyes, which is often connected with delirium: or there is a distortion, or squint, which commonly implies some pressure or other affection of the optic nerves. All these are of course unfavourable symptoms; as is also that curious defect of vision, from impaired sensibility of the retina, which gives rise to the appearance of *muscæ volitantes*. When the white part of the eye is principally seen, the pupil being turned upwards, and the upper eye-lid a little let down, it is unfavourable, as implying a spasmodic contraction of the muscles of the eye-ball, and great relaxation in those of the eye-lid. The prognosis is also bad, when a sort of film is formed over the eye, or mucus collects within the eye-lids, on their edges, or at the angles of the eye, or when the cornea is red; or when one eye seems larger than the other, implying irregular action of the muscles. Any distortion of the features is a bad symptom, for the same reason, indicating the great affection of the functions of the sensorium.

Great restlessness, a constant motion of the arms, uncovering the bosom, or the arms and legs, which nevertheless are not hot, picking at the bed-clothes, as if to catch flies

or insects, grinding the teeth, (which is a spasmodic affection of the muscles of the lower jaw,) are all symptoms of considerable danger, as indicating great derangement of the nervous system. The changes of the voice, as connected with debility of the muscles of respiration, as well as of the lesser muscles of the larynx, are also unfavourable signs. The tone and articulation are thus variously altered; and the thick black crust and fur which collect on the tongue and lips, and in the fauces, farther contribute to impair the speech, by preventing the free motions of those parts. A cold sweat, cold extremities, and great collapse of the countenance, together with laborious respiration, and rattling in the throat, are signs of impending dissolution.

The causes of Fever.—At present we shall confine our attention to the remote causes of fever; the proximate cause will be the subject of discussion in the sequel. (See *CAUSE*, in *Medicine*.) It is not always easy to distinguish between the *predisposing* and the *exciting* causes of fever; those circumstances which have been ranked among the latter by some physicians have been considered by others as operating only in the former way; and it would seem that in certain cases, where the predisposing causes are applied suddenly or to a great extent, they actually become exciting causes of the disease. The middle periods of life appear to be more liable to fever, than either of the extremes of old age or infancy. Inflammatory fevers in particular are more readily produced in the vigour of the constitution, or in youth, from the period of puberty to the age of 35 or 40. Whatever produces either of the opposite states of plethora and strength, or inanition and debility, predisposes the habit to fever, and favours the operation of the exciting causes: plethora giving a predisposition to fevers of the inflammatory kind, while inanition predisposes to intermittents, remittents, and to the nervous or typhous fever from contagion. Hence, with respect to the last mentioned circumstance, the connection between *bad diet*, or *scarcity of food*, and fever, has been observed from the earliest periods of history, and pestilence and famine have been commonly mentioned together. It is probable that the extensive occurrence of contagious fever in London, during the winters of 1799 and 1800, was occasioned by the predisposition to be affected by contagion, which the scarcity of provisions in those years produced; and that the almost total disappearance of such fever, since that period, must be ascribed to the absence of such predisposition; since the exciting or occasional causes continue to exist as before. Galen justly remarks, “*Oportet enim hoc in toto sermone memoria repeteri, quod nulla causerum sine patientis aptitudine agere possent.*” (*De Differ. Febr.* Transl. of Leonicensus, lib. i. 1809.) It is not improbable, however, that the depraved aliment, which is used in times of scarcity, may of itself actually produce fever. The weakness produced either in the nervous system, by depressing passions, such as fear and grief, or in the sanguiferous system, by great evacuations, appears to constitute a great predisposition to be affected by fever. With respect to the *depressing passions*, there cannot be a doubt of the influence which they exert in predisposing the body to suffer from the exciting causes of fever. The observation that the panic occasioned by the prevalence of a contagious epidemic disease, tends to favour its progress, is as old as Thucydides; who has mentioned, that those who were low in spirits, and felt much fear and anxiety during the dreadful pestilence which he has described, were cut off most speedily. Diemerbroeck quotes an observation of Pigræus, who compares the effect of imperfect aliment on the body with that of the depressing passions on the mind,

in facilitating the access of the plague. "Sicut mala vicibus ratio præparat humores, sic animi passiones præparant spiritus ad recipiendam pestem; et tristitia, terror, ira, ac metus, sunt pabulum ac nutrimentum pestis." And Bauderonus observes, "Confidentes ut plurimum servantur; contra meticulosi facile corripiantur." (See Diemerbroeck, de Peste, lib. i. cap. 8. § 9. and again, lib. ii. cap. 7. Annot. where much evidence on this point is collected.) The debility occasioned by *fatigue*, from violent or long continued exertion, is another cause which predisposes the body to be affected by the exciting causes of fever. This is, without doubt, one of the reasons why soldiers, harassed by fatigues of a campaign, so readily fall into fever when confined in hospitals and barracks. The fact was so generally observed, at the time of the epidemic fever which Diemerbroeck has described, that many among the lowest people abstained from hard labour; even the peasants during the hay-harvest were unwilling to mow and collect the hay, being taught, by many lamentable examples, that those who undertook any severe work were immediately afterwards seized with the plague. (Loc. cit.) It is probable, indeed, that very violent exercise, as well as violent and sudden gusts of passion, may at once throw the system into a febrile state: we are certain that an ephemeræ, beginning with shivering, which is succeeded by heat, and, lastly, by sweating, is not an uncommon result of a severe day's journey, or labour, in those who are unaccustomed to such exertion. Excess in the gratification of the venereal appetite, as contributing to debilitate greatly, especially the nervous system, is justly ranked among the predisposing causes of fever. Evidence of the pernicious influence of this excess was abundantly manifest during the last plague at Marseilles, in which the recently married people suffered greatly. Immoderate study or other application of the mind, which not only implies a sedentary life, but particularly an encroachment on the hours of sleep, which greatly debilitate and exhaust the nervous system, also favours the action of the exciting causes of fever, if it does not actually in some cases bring it on.

Yet notwithstanding the unquestionable influence of a debilitated state of the constitution, in general, in giving a predisposition to fever, it has been observed, that persons labouring under particular diseases, which are connected with much debility, are not liable to be affected by the exciting causes of fever. Dr. Gregory remarks, in his lectures, that he has known persons much debilitated by dropsy, and pulmonary consumption, who have been greatly exposed to the operation of contagion, without being attacked by fever; and Dr. Lind observes, that those who labour under scurvy are less liable to be attacked with fever from contagion, than those in health. (Treatise on Scurvy.)

There is a particular predisposition attached to certain constitutions, (which are not to be distinguished by any external character,) to be affected by the exciting causes of fever, upon every slight exposure to them. This is daily exemplified in respect to contagion, and is often observed with respect to the effluvia of marshes. The predisposition to be affected by both these causes, but more especially by the latter, is diminished by the habit of exposure; so that new-comers are more certainly seized with intermittent and remittent fevers, for instance in the countries where they prevail, than the inhabitants: and the attendants on patients labouring under continued fever are perhaps less liable to be infected than visitors. The greatest predisposition to intermittents appears to be occasioned by a previous attack of the disease, inasmuch that a relapse is often produced, at

some distance of time by very slight causes, and even, it would appear, without exposure to the original exciting cause.

Particular seasons, especially those in which great heat prevails, or, in low countries, those which are very wet, seem to give rise to a great predisposition to fevers; the hot seasons producing a tendency to bilious and inflammatory fevers, the wet to intermittents and remittents, and the combination or alternation of the two is particularly pernicious. The history of medicine shews us, that it is in such seasons that contagious and pestilential fevers have most generally prevailed. (See EPIDEMIC.) Great heat, indeed, appears to be frequently an exciting cause of fever, especially in warm climates. (See INSOLATION.) An exposure to cold and moisture appears also to favour the operation of the exciting causes of fever, especially of the miasmata of marshes in the production of intermittent and remittent fevers. It is hence, probably, that the night-air appears to be so fatal near the coasts in tropical climates, as related by Dr. Lind, Dr. Badenoch, (Med. Obs. and Inquir. vol. iv. p. 156.) Bontius, Rouppe, and others. Dr. Lind has stated, that, "during the sickly season, a boat, belonging to the Medway man of war, which attended on shore every night to bring fresh provisions, was three times successively manned, not one of her crew having survived that service."

We must here notice a circumstance respecting the predisposition to fevers, in warm climates, which was first noticed by Dr. Lind, of Windsor, in his inaugural essay, published at Edinburgh in 1768, and afterwards more particularly examined by Dr. Jackson and Dr. Balfour; namely, the influence of the moon, or of the sun and moon conjointly, in giving a predisposition to fevers to the human body. Dr. Mead, indeed, had collected some evidence of the influence of these luminaries in this climate, (see his treatise *De Impetio Solis et Lunæ*;) but that influence has been said to be much more obvious in tropical countries, in producing relapses or first seizures of fever. Dr. Lind observed eight seamen attacked by a relapse at the same time, during the occurrence of a lunar eclipse, which of course implied a full moon. Dr. Jackson made some observations on the subject in 1776, in the West Indies, and found that of 30 cases of remitting fever, 28 had happened on one or other of the seven days preceding a new or full moon; in the following years his observations were continued, and seemed to confirm this result. (See London Med. Journal, vol. viii. p. 25.) In 1785, Dr. Balfour published "A treatise on the Influence of the Moon in Fevers," in which he states that the attack of the bilious remittent fever of Bengal almost invariably commenced on one of the three days which immediately precede and follow the change of the moon; and that the changes of this planet are no less remarkable for occasioning relapses. "For my own part," he says, "I have observed this tendency to relapse at the full and change invariably for these fourteen years; and in particular cases can prognosticate the return of the fever at these periods, with almost as much confidence, as I can foretel the revolution itself." Dr. Lind, however, fifteen years after the publication of his thesis, seems to have changed his opinion, and was disposed to attribute the frequent attacks and relapses of these fevers "to the noxious vapours arising from the swamps, produced by the high tides, which happen at the time of the full and change of the moon, and, overflowing a great part of the country, leave it in a marshy state at low water. This I am induced to believe to be the sole cause," he adds, "first, because this lunar influence entirely ceases, when the patient is removed but a few miles

from the swamps that are left uncovered by the tide at low water; secondly, because intermittent fevers are not observed to follow lunar periods at many places within the tropics, even at Canton, (where there is a large river and great tides,) by reason of the industrious Chinese keeping the river within its bounds." (Lond. Med. Journal, vol. viii. p. 146.) But Dr. Jackson contends, that at Savanna la Mar, in Jamaica, the connection of the moon with fevers is more remarkable than in any other part of the world, in which he has been; although the tide scarcely ever rises eighteen inches, and the beach is sandy. (Ibid. p. 302.) Dr. Balfour has supported his original doctrine in subsequent publications "on sol-lunar influence;" to which we refer the reader for farther evidence. See also Dr. Jackson's Treatise on the Fevers of Jamaica.

Exciting causes of Fever.—Dr. Cullen was of opinion that idiopathic fevers were induced by the operation of two exciting causes only; namely, *contagion*, or human effluvia, and the *miasmata* of marshy or swampy ground; the former giving rise to continued, and the latter to intermitting and remitting fevers. (See EFFLUVIA, in *Medicini*.) It seems probable, however, that this opinion was adopted rather in conformity with his hypothesis respecting the nature of fever, than from a comprehensive observation of facts; and his reasoning in support of it is liable to much objection, if not to an easy refutation. "As fevers are so generally epidemic," he says, "it is probable, that some matters floating in the atmosphere, and applied to the bodies of men, ought to be considered as the remote cause of fevers; and these matters present in the atmosphere, and thus acting upon men, may be considered either as *contagious*, that is, effluvia, arising directly or originally from the body of a man under a particular disease, and exciting the same kind of disease in the body of the person to whom they are applied; or *miasmata*, that is, effluvia, arising from other substances than the bodies of men, producing a disease in the person to whom they are applied." (First Lines, § lxxviii.) Now, it has been demonstrated by modern experiments, that contagious effluvia are not capable of floating in the atmosphere, to the distance of even of a few yards, without losing their infectious quality, and that the noxious powers of miasmata are similarly, though not equally, limited. (See CONTAGION.) And, although fevers are often epidemic, yet they are seen daily sporadic, *i. e.* limited to individuals, who breathe the same air with thousands who escape; and we have endeavoured to shew, that the supposition of the existence of those causes of epidemics floating in the atmosphere, is not only gratuitous, but absolutely in opposition to a number of facts. (See EPIDEMIC.) Besides, even vulgar observation has left no room for doubt, that many of the circumstances, which induce a predisposition to fever, or favour the operation of contagion, miasmata, and other exciting causes, (if such exist, are themselves the exciting causes of the simpler forms of fever, whether denominated ephemeræ, simple fever, synochus, or by some other term. That such fevers are frequently occasioned by exposure to great heat, and to cold and moisture, by fatigue, anxiety and grief, watching, intemperance, &c. is admitted by physicians in general; (see Fordyce First Diss. on Fever, p. 136 to 179. Huxham on Fevers, p. 2. &c.) and when it is considered how frequently we see individuals affected with severe and even fatal fevers, when no source of contagion was known, when no epidemic was prevalent, and when the rest of the family, whose mode and circumstances of life were in all points the same, were not affected by any disease, we can scarcely hesitate in assigning the origin of the fever to some one of the causes just enu-

merated. The statements of the ancient physicians accord accurately with those of the moderns, just quoted, on this subject. "Quod igitur ex laboribus," says Galen, "irâ, tristitiâ, et solis ardoribus, atque frigidibus, vigiliis, et cruditatibus, ebrietatibus, et crapulis, quidam febricitare conspiciuntur, nemo est qui, ipsa doctus experientiâ, non agnoscat." (De Different. Febr. lib. i.)

Contagion is, however, the exciting cause of the most dangerous and fatal forms of continued fever, whether occurring in gaols, hospitals, ships, camps, or among the dwellings of the lower classes of the people, and thence denominated gaol-fever, hospital-fever, &c. or malignant, putrid, contagious fever, typhus, &c. Of the nature, origin, and mode of communication of contagion, as well as of the means of preventing its operation, avoiding its influence, and destroying its powers, we have already treated at length in a preceding article, to which we refer the reader. See CONTAGION.

Many physicians of the last century were of opinion that intermittent fevers were produced by contagion; among these were Boerhaave, Van Swieten, Baglivi, Cleghorn, and Fordyce. It is probable that these fevers may have sometimes spread in hospitals, like erysipelas, puerperal fever, and other disorders, not in themselves contagious, before the present system of ventilation and cleanliness was fully adopted; but, we believe, that few physicians at present support that opinion. Lancisi was the first who pointed out the connection of intermitting fevers with the effluvia of marshy ground; his observations, however, were long overlooked by medical men. But, in our own country, we have now ample evidence of this connection: it is chiefly in the low and fenny counties, as in Lincolnshire, Cambridgeshire, the hundreds of Essex, &c. that agues originate; and those which are seen in London, and other parts remote from the fens, can generally be traced to those counties. In the neighbourhood of the Pontine marshes, near Rome, the fact is so universally known, that the villages are all perched upon the hills; and there are scarcely people sufficient in the levels to expedite travellers from the post-houses. The army-physicians have also obtained much decisive evidence relative to this fact. The nature of the exhalations of marshes, which give rise to intermittent and remittent fevers, is not however ascertained: it is obvious that it is not moisture alone, evaporating from the surface of the marshes; it appears to be rather the result of the decomposition of animal and vegetable matter in water. (See MIASMATA.) Sir John Pringle remarks, "that neither canals, nor even large inundations, where the water is deep, are nearly so dangerous, or exhale so much noxious vapours, as marshy grounds, or meadows that have been once flooded and but lately drained; and that fields, though dry in appearance, may yet be moist by the transpiration of the subterraneous water." (On Diseases of the Army, part ii. chap. 2.) "It has been generally remarked," Dr. Rollo observes, "that the effluvia of marshes are most active, when the water is drained off, and the earth appears, which was certainly the case in St. Lucia: the greater part of the regular intermittents, that is, of the milder fevers we had, happened when the rains were most frequent, and before the stagnating pools discovered their bottoms; but the most dangerous remittents appeared when the marshes had no water, but a slimy matter on their surface. Cairo is healthy while the Nile inundates the neighbouring lands; but when the mud is exposed, on the retiring of the river within its banks, the fevers begin to rage as the miasmata rise. These effluvia, like those of contagion, as we have already stated, are limited in their operation, we mean in the distance

stance to which they are capable of being communicated through the air, in an active state. Dr. Lind observes that, in ships lying at some distance from a swampy shore, the men escape intermittent fevers, though immersed in fogs; but when they approach near shore, or communicate with the land, they become affected. Those who were sent on shore for provisions, especially in the night, as mentioned by Dr. Badenoch, speedily perished in consequence of the fever thus induced: partly, perhaps, in consequence of a pre-disposition to be readily affected by the miasmata occasioned by the cold of night, and partly from the condensation and more active state of the miasmata arising from the same cause. These effluvia rise to so small a height, that soldiers lying in the first floors of barracks in Jamaica were less affected than those in the ground floor, as stated by Dr. Hunter: who has also affirmed, that a few hundred yards often include the limits between healthy and unhealthy ground in camps. (Observat. on the Diseases of the Army in Jamaica.) See EPIDEMIC, under the second head; where other facts are enumerated, and some observations added respecting the disappearance of intermittent and remittent fevers in London, and other large cities, in consequence of the removal of the sources of miasmata, by improvements in the structure, and cleanliness of the streets, &c. Under all these circumstances, intermittent and remittent fevers are most prevalent in autumn, in which season, especially when wet, they are the fatal endemics in low and damp countries. Of this we have a recent example in the mortality occasioned by the late unfortunate expedition to the island of Walcheren; which, indeed, might have been anticipated; (Oct. 1809,) for sir John Pringle long ago observed, when speaking of the United Provinces, "but the air is worst in Zealand, as that province is not only low and watery, but surrounded with the oozy beaches of the eastern and western Scheldt, and the most marshy parts of the country; so that almost every wind, except from the sea, adds to its native moist and unwholesome air." (Loc. cit. part i. chap. 1.) In the autumn of very wet years, intermittents have been observed to occur even in high, and at other times dry situations; thus they were produced in certain high parts of Northamptonshire, where they were not known to have existed either before or since, in the year 1782, which was remarkable for the wetness of the summer. (See the Syllabus of Lectures given at Guy's Hospital, p. 15.) The operation of heat, in augmenting the deleterious effects of these miasmata, is evident, as well from the general occurrence of intermitting and remitting fevers in the autumnal season, as from the more frequent and formidable fevers of this sort, which are generated in warm climates; witness the periodical fevers of Cairo on the retiring of the Nile, and those which occur near the other great African rivers; as on the coast of Guinea, where the country is often half depopulated by them, and some parts even quite deserted from this cause. (Ibid.) The overflowing of the Euphrates, and the stagnation of the water on the adjoining desert, have always been considered as the principal causes, especially in the hottest seasons, of the fatal remitting fever of Bufforah. (See Transact. of a Soc. for the Improv. of Med. and Chirur. Knowledge, vol. i.) Whence the Arabs sometimes inundate the desert, by breaking down the banks of the Euphrates, in order to be avenged on the Turks of Bufforah. The fevers induced by a single inundation have been known to destroy between twelve and fourteen thousand of the inhabitants of that place. (See Wilson on Fever, vol. i. p. 193.) It is fortunate, however, that the marsh miasma is not, like contagion, capable of adhering to clothes, or other substances; but is dissipated and becomes harmless in the atmo-

sphere, as we have before observed, 'at a short distance from its source.

It is worthy of remark, that both contagion and miasmata, or, to use the words of Dr. Cullen, both "human and marsh effluvia," appear at times, to operate rather as predisposing than exciting causes; while those circumstances before enumerated, as inducing a predisposition, become in fact the exciting causes of the fever which ensues. It has been observed by Dr. Lind, and others, that persons exposed to the influence of contagion, sometimes receive it into the system, in which it remains latent, or producing only slight indisposition, such as head-ache, languor, &c. for a considerable time; when exposure to cold, an act of intemperance, in drinking, eating indigestible food, fatigue, watching, or anxiety shall occur, and immediately the contagious fever is produced; which would lead us to believe that many of these persons who remain uninfected, after considerable exposure to contagion, escape in consequence of the absence of such exciting cause. "The same causes, which give rise to relapses," says Dr. Lind of Haslar, "I am inclined to think do sometimes excite, or render active, an infection, before received into the body, but so slight, as of itself to produce no bad consequences. I am confirmed in this opinion by the quick and sensible effect of infection from bad fevers, when in such a degree as of itself to communicate the disease. But if a person perceives no symptom of an infection, till many days after having left his place of abode, and is first taken ill of it immediately after having been wet with rain, exposed to cold or damp, or having been guilty of intemperance and excesses, it is probable that these causes have excited this dormant poison into action; and that, without their influence, it would never have affected the constitution." (Lind on Fevers and Infections, chap. ii. § 1.) In a similar manner, the marsh miasmata often exert no influence on the constitution, for several weeks after the person has left the fenny district, when the ague shall be immediately excited by a debauch, a quarrel, being wet or chilled, &c.

Exposure to cold is commonly mentioned among the exciting causes of fever: and it can scarcely be doubted that the simpler forms of fever do frequently originate from this cause: and as these more simple fevers are occasionally converted into the more severe or malignant species, by the confined or uncleanly situation of the patient, by improper treatment, or in consequence of some peculiar state of the constitution, so cold may justly be ranked among the common causes of fever. This notion, however, as it is popularly entertained, is carried far beyond its just extent. We have already seen that cold operates by pre-disposing the body to be acted upon by contagion and by marsh miasmata; and also, secondarily, by calling into action the dormant poison of both species. In these cases, its operation is only indirect. More commonly the popular opinion arises from a mistake, which consists in supposing the first symptoms, (viz. the shivering and sensation of cold) to be in fact the cause of the fever; these symptoms being considered as the effect of an external chill, when they are, in truth, the result of the internal condition of the circulation and nervous system, as before explained. Hence fevers have been attributed to cold, which proved to be the eruptive fever of small-pox, or measles, and, of course, originated from contagion. On the whole, exposure to cold must be considered as most commonly concurring with the noxious effluvia, and other causes, in producing idiopathic fever, and not as alone the active agent. Thousands are constantly exposed to cold in this climate, in whom no fever is excited; and in the great majority of those who are affected by cold, the diseases thus occasioned are principally

the symptomatic fevers connected with local inflammation, constituting the second class of "Phlegmasiæ" in Dr. Cullen's arrangement, as mentioned in the commencement of this article. The general effects of cold on the human body, as well as its particular effects in the production and alleviation of diseases, have been discussed at length under a former head. See COLD, in regard to its action on the living Body.

It would appear that the effluvia arising from animal, and even vegetable substances, during the process of putrefaction, have in some instances given rise to fevers of a severe and fatal kind. (See EPIDEMIC.) But under what particular combination of circumstances such fevers have been excited, it were not easy to state: it would seem, however, that animal putrefaction alone is not capable of producing these effects; since persons engaged in particular trades, in which they are much exposed to these effluvia, do not suffer from fever, as skippers, night-men, &c.; nor are students of anatomy particularly affected by fevers from the often very putrid effluvia of a dissecting room.

A redundancy of bile has been supposed to be a common exciting cause of intermitting, remitting, and continued fevers, chiefly from the circumstance, that it is often thrown up from the stomach in considerable quantity, during the sickness which occurs at the onset of these fevers. But it should be observed, that vomiting, however excited, (whether by the commencement of fever, by substances taken into the stomach, or by agitation on ship-board at sea,) if often repeated, with violent straining, generally brings up also the contents of the duodenum, and emulges the ducts, which open into that part of the intestines. Bile, therefore, and pancreatic juice, are thrown up in the last efforts to vomit, but not in the beginning. This appearance of bile, therefore, is not an essential part of the attack of fever; it is merely accidental. "If the pancreatic juice," says Dr. Fordyce, "had been blue, and had any particular taste or smell, and the bile had been colourless, insipid, inodorous, or as much so as the pancreatic juice is, in that case, whatever has been said of the redundancy of bile, as an essential part of the attack of fever, would have been said of the pancreatic juice." (First Diss. on Fever, p. 95.) Dr. Cullen remarks, that the opinion may have been partly countenanced by the fact, that intermitting and remitting fevers, being the effects of marsh effluvia, occur most frequently in the warm seasons, and the latter in warm climates, from the influence of which the bile is disposed to pass, by its secretories, in greater quantity than usual, and, perhaps, also changed in its quality; but he considers this appearance of bile, when vomiting takes place, as a circumstance accidentally concurring with the fevers, from the state of the season in which they arise. (First Lines, § 51.)

When an exciting cause of fever has once produced its operation, the constant or repeated application of that cause is not required to keep up the disease; on the contrary, the disease will then go through its course, although the cause be entirely removed; nay, farther, it will not be increased, it is said, in degree or duration, by a subsequent application of the same cause, but will go through its course unaltered. (Fordyce, First Dissert. p. 180, *et seq.* also in Transact. of a Soc. for the Improvement of Med. and Surg. Knowledge, vol. i. art. 1.) Thus, to adduce a palpable example, a second inoculation of small-pox adds nothing to the violence of the disease produced by the first insertion of the poison: thus, also, to use the words of Dr. Fordyce, "a fever taking place from infection in the most wealthy and noblest persons in the country, and treated with all attention,

with regard to infection, goes through its course in the same manner as in a patient in an hospital, where there are many others afflicted with the same disease, provided that attention is paid that there shall be an equal change of the air of the atmosphere, and freedom from putrefaction." (Loc. cit. p. 189.) On the whole, this statement may be considered as begging the question, and Dr. Fordyce seems to have generalized too far, in transferring his observation respecting small-pox to idiopathic fever. For if, with regard to contagious fever, we produce "an equal change of the air" in an hospital, as in the chambers of the rich, the contagion cannot be constantly applied in any considerable quantity. And, with respect to intermitting and remitting fevers, it is a well known fact, (even stated by Dr. Fordyce himself, though explained upon the notion of avoiding humidity,) that those fevers, although they remained obstinate while the patient continued exposed to the miasmata, which produced them, speedily yield to the same treatment, when the patient is removed. See the Transactions before quoted, p. 14.

Doctrines respecting the Nature or proximate Cause of Fever.—Physicians have been eager to explain the nature of diseases from the earliest dawn of medical history, and have too often quitted the laborious task of observation in pursuit of hypothetical speculations, which have tended to obscure, rather than to elucidate, the science of pathology, and to retard the progress of its improvement. Instead of accurately marking and comparing the phenomena of life, and thence deducing the laws of the animal economy, whether in health or disease, physicians have too often contented themselves with transferring the deductions of the collateral sciences to the doctrines of life, mispending their time and talents in finding out analogies, which existed only in their own imaginations. Hence not only the fictions of the Greek philosophy, but the principles of the more certain sciences, of mechanics, of chemistry, of magnetism, and of electricity, have been assumed in succession as explanatory of the action of living bodies, and have each contributed not a little to confuse the language and opinions of pathologists. This is more particularly obvious with respect to the doctrines relative to fever; which, from the universality of its occurrence, the striking appearances which it exhibits, and the ravages which it has committed in all ages, has always arrested the attention of mankind, and has employed the pens of the most enlightened professors of medicine for upwards of two thousand years. Nevertheless, it is at this moment a subject of discussion, and of much difference of opinion; physicians being divided in their views both of the essential nature of the disease, and respecting the seat which they assign to it in the body; and one of the latest practical writers on the subject, whom we have often quoted, has affirmed, that "what the real derangement in the system is, which produces the external appearances in fever, is not at all known." Fordyce.

Although nothing absolutely satisfactory, however, is to be obtained from an investigation of the doctrines which have been promulgated relative to fever, it will be necessary to state the outlines, especially of those of modern times, which have assumed a systematic shape, and have given colour to the various modes of practice that have been pursued.

Various gratuitous hypotheses respecting morbid derangements of the fluids of the animal body, and the generation of new morbid humours, have prevailed, with occasional modifications, from the time of Hippocrates downwards: and although in the systems of Hoffmann and Cullen, and still more completely in those of Brown and Darwin, these hypotheses are rejected, and are also exploded among British practitioners

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practitioners in general, as incompatible with more correct observation, they are nevertheless the prevalent doctrines of the people at large. (See *HUMORAL Pathology*.) Hippocrates considered the morbid heat as the essence of fever, and upon this notion he seems to have founded his distinction of the varieties of the disease; as the *causis*, καυσος, or burning fever; the *leiphyría*, λειψυρία, in which the external parts are cold, while the internal are hot; and the *epialus*, ἐπιαιλος, or mild fever, in which there is a simultaneous feeling of heat and cold. (See Hippoc. lib. i. and ii. περι νοσων, § 5 (Edit Fæsj. ac Prænot. &c.) These different forms of fever he ascribes to the superabundance of one or other of the four humours, blood, phlegm, yellow and black bile, (see HIPPOCRATES,) and he seems to consider the disease as the result of a contest on the part of nature, (the presiding principle of the animal body,) to expel the morbid humour, or to render it inert and harmless by the process of *concoction*.

Passing by the absurd notions of Asclepiades, respecting the motion of atoms or corpuscles, which, when it was free, constituted health, and, when obstructed, excited fevers, &c. which again differed according to the size of the corpuscles; (see Cælius Aurelianus, lib. i. cap. 14.) and the hypotheses of other ancient physicians, which have been imperfectly transmitted to us; we come to the doctrines of Galen, which were universally received and taught, where science existed, for the space of thirteen centuries. The hypothesis of Galen was little more than an amplification of that of Hippocrates, with which he combined other hypotheses, deduced from the philosophy and science of his age, and thus, by giving a systematic form to the doctrine, and supporting it with much learning, he at once multiplied and perpetuated the corruptions of medical science, which the inductive and experimental philosophy of our own times has not yet exterminated. (See GALEN.) He also considered the preternatural heat as the essence of the febrile state, and enters into several plausible statements explanatory of its origin. He observes that heat is excited by motion, by putrefaction, by the direct application of heat, as of the sun or fire, or by the retention of warmth, which should be dissipated, or by the addition of a sort of ferment. Whence the exciting causes of fevers are easily understood in regard to their operation: the heat of the atmosphere, which prevails about the rising of the dog-star, increases the heat of the heart, (being taken in by breathing the hot air,) and also the heat of the arteries on the surface; over-fatigue and violent exercise occasion heat by the friction of the muscles, tendons, and joints; depraved and crude aliments produce an acrid and pungent humour, which excites heat; and the putrid miasms in the air, during the periods of pestilence, when inspired, excite putrefaction and heat in the body, especially when the habit is already predisposed to putrefaction, from bad diet, &c. The fevers thus excited are modified by the prevalence or putrefaction of one or other of the four humours of Hippocrates: of the three kinds of intermittents, the quotidian arises from the corruption of phlegm, the tertian from that of the yellow, and quartan from that of the black bile. Wherever the heat begins, it extends to the heart, whence the general commotion of the vessels is excited: "and Nature is employed in exerting her powers, endeavouring to assimilate the good humours to the parts which are to be nourished, and to expel the bad humours. But if at any time Nature is unable to expel all the morbid humour, either from its thickness, its abundance, or its tenacity, or from some obstruction of the passages, or from her own want of power, it necessarily will undergo putrefaction, if it remains long in the animal body."

But by putrefaction Galen appears to mean any new combination or change of quality, for he includes *concoction* under that term. "Altera autem putrefactio, quam et coctionem esse diximus, &c." (De Differentiis Febrium, lib. i. See also Van Swieten Com. ad Aph. 730.)

This doctrine, which became known throughout Europe on the revival of learning, kept possession of the schools until the middle of the seventeenth century, when a new light was thrown upon the subject of the animal economy by the discovery of the circulation of the blood. But in the various parts of this doctrine, afterwards variously combined with the systems which originated with the further progress of the collateral sciences, we see the rudiments of most of the theories which the modern systematics advanced; until at length the phenomena, connected with the irritable and sensible properties of the living solid, were attentively investigated in the course of the last century. A humoral pathology, connected with the notions of obstruction, acrimony, lentor, plethora, or putrefaction in the vascular system, and of a regulating principle, nature, *autocratia*, *archæus*, *anima medica*, *vis medicatrix naturæ*, or by whatever term it may have been designated, was found in all the systems, down to that of Boerhaave inclusive, whether among the mathematical, chemical, or mechanical sects. (See *MEDICINE*.) Hence various means of removing fevers were suggested, and remedies were employed by one set of theorists for correcting acrimony, for resisting putrefaction, for aiding concoction, for obviating plethora, for evacuating the morbid humours, or for diluting them; and regulations were adopted by some for supporting the operations of nature, and for removing obstructions or interferences with them; while others, considering the rational soul as the directing principle, were content to look on, and trust to its wisdom, cultivating what they called the art of medicine *by expectation*; which consisted rather in renouncing all art, and in banishing all active remedies.

These doctrines, respecting the morbid condition of the humours in febrile diseases, and the conflict of nature in attempting to subdue their effects, to change their nature, and to expel them from the system, &c., originated in ignorance of the structure and operations of the animal frame, were propagated by the bigotry of learning, which would rather err with Galen, than question his authority on matters of the smallest moment; and were strengthened by the facility with which the new discoveries in chemical and mechanical philosophy combined with them, in explaining the motions of the circulating fluids. They were countenanced also by the various discharges which occasionally occur in the crises of fevers, of which the notion of concoction, or of fermentation and despumation, deduced from a chemical analogy, afforded a plausible explanation. But we have already stated, that the inferences drawn from the appearance of these discharges were incorrect; for that the latter were the signs and effects of a favourable change in the disease, and not the causes of it. (See *CONCOCTION*, and *CRISIS*.) Nor is the notion of a *materia morbi*, in the fluids in fever, sanctioned either by observation, or by the most successful plan of cure. When the discharges alledged to consist of the secreted fluids, they contain nothing which is not ordinarily present, although in less quantity; when they consist of blood, it cannot be imagined that the small portion evacuated has contained all the morbid humour with which the general mass was infected. But many fevers are cured without waiting for concoction, or evacuation; and the occurrence of absolute intermissions is not easily reconcilable with the existence of such morbid humour.

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The dawn of a more correct knowledge of the morbid actions of the animal system, of which some glimmerings had appeared in the writings of our countryman, Willis, and of Baglivi, (in their treatises "de Pathologia Cerebri et Nervorum," and "specimen de febra motrice et morbosa.") was obvious in the works of Hoffmann, before the middle of the last century. He directed the attention of physicians to the primary moving powers of the animal frame, the functions of the nervous system; functions which, had not the pernicious influence of learned authority led medical observers out of the proper train of investigation, could not have been overlooked for so many ages. The properties of the living solid were now investigated by Gaubius, Haller, and others; even Boerhaave himself began to attend to them, and in the fourth edition of his Aphorisms, (see Aph. 755.) added the words, "fortè et nervosi (scil. Jucci) tam cerebri quam cerebelli cordi destinati inertie," (a sluggishness of the nervous fluid communicated from the brain to the heart,) to the sluggishness of the arterial fluids, which he had formerly stated as the proximate cause of intermittent fevers.

From this time the phenomena resulting from the sensorial functions in disease became the subject of more attentive investigation, and hence have arisen three modern systems, in which the nature of fever is explained by a reference to these functions, to the exclusion of any supposition of disease in the fluids, except as an effect of the fever. These are the theories of Cullen, of Brown, and of Darwin. The theory which Dr. Cullen promulgated, from the medical chair in the university of Edinburgh, almost rivalled that of Boerhaave in the extent of its reception; and even continues to be adopted, with slight modifications, by some later writers (See Currie, Reports on Water, p. 165, 2d edit.) It had the merit of great ingenuity, and of according more completely with the advanced state of knowledge respecting the functions of life, than the hypotheses which preceded it. The Brunonian theory of fever is not particularly prominent in the general system of its author, who reduced all diseases to two or three very simple principles, without much regard to the variety of phenomena, by which they are characterized. That of Dr. Darwin is more complex, but much more comprehensive in its application to the varieties of fever; it is obscure, however, from the peculiar language in which it is expressed. We shall state the outlines of each of these theories.

Dr. Cullen's Theory.—The first change induced in the animal system, by the operation of the exciting causes of fever, is, in the opinion of Dr. Cullen, a "diminution of the energy of the brain;" which is indicated by all the symptoms of the first stage of fever, as we have already explained. The powers of the body and the mind, the functions of sensation and motion, respiration, circulation, and secretion, all fail, or are diminished in the general debility; but after a certain time, a morbid increase of some of these functions, especially of the circulation, takes place, with an augmentation of the heat. The three states of debility, of cold, and of heat, which regularly succeed each other in fever, in the order just mentioned, are presumed to exist in the relation of cause and effect; the first state being the result of the sedative or debilitating influence of contagion, marsh miasmata, and cold, which are the exciting causes. Dr. Cullen acknowledges his inability to explain satisfactorily, how the debility produces all the phenomena of the cold stage, especially the *spasmodic* constriction of the extreme arterial vessels, which is inferred from the suspension of the secretions, and the shrinking of parts in the cold stage, as well as from the

continuance of this suspension in the hot stage, after the action of the heart and large arteries is increased. Were the constriction of the cold stage merely the result of the weakened action of the heart, it is supposed, that, on the return of its ordinary or increased action, the constriction would be removed, and the secretions restored. Here Dr. Cullen resorts to "the *Vis Medicatrix Naturæ*, so famous in the schools of physic," the innate preserving power of the constitution, which has been appealed to for the solution of difficulties by all medical theorists, from Hippocrates downwards. This "spasm of the extreme vessels," then, is considered as "a part of the operation of the *vis medicatrix naturæ*;" at the same time, Dr. Cullen is of opinion, that, during the whole course of fever, there is an atony existing in the extreme vessels, depending on the diminished energy of the brain, and that the relaxation of the spasm requires the restoration of the tone and action of these. To this atony in the vessels of the skin, he attributes the loss of appetite, nausea, and vomiting, the stomach being affected by sympathy. The spasm induced in the extreme vessels throws a load of blood upon the central parts of the circulating system, which proves a source of irritation to the heart and arteries, and excites them to a greater action, which continues till the spasm is relaxed or overcome. The hypothesis is thus briefly recapitulated. "Upon the whole, our doctrine of fever is explicitly this. The remote causes are certain sedative powers applied to the nervous system, which, diminishing the energy of the brain, thereby produce a debility in the whole of the functions, and particularly in the action of the extreme vessels. Such, however, is, at the same time, the nature of the animal economy, that this debility proves an indirect stimulus to the sanguiferous system; whence, by the intervention of the cold stage, and spasm connected with it, the action of the heart and large arteries is increased, and continues so till it has had the effect of restoring the energy of the brain, of extending this energy to the extreme vessels, of restoring therefore their action, and thereby, especially removing the spasm affecting them; upon the removing of which, the excretion of sweat, and other marks of the relaxation of excretories take place." (Cullen, First Lines, § 46.)

Plausible as this hypothesis undoubtedly appears, it is liable to several objections; partly, because it is gratuitous in some particulars, and partly, because it is not applicable to all the phenomena of fevers. In the first place, it must be remarked, that by assuming the existence of a peculiar power or agent, such as the *vis medicatrix naturæ*, we acquire no knowledge, and advance not a step farther in our explanation of the facts, than if we stated simply that the facts occur. It is an admission, that the facts are inexplicable, that they are part of the phenomena of life, which we deem incapable of farther generalization in the present state of our knowledge. This creation of imaginary agents, to account for ultimate facts, has had a pernicious influence in every department of science. What information did philosophers acquire respecting the laws of gravitation, by the substitution of an ether; or physiologists, respecting sensation and muscular motion, by the supposition of a nervous juice? Yet upon the same footing stands this *autoerata*, or *vis medicatrix*, in regard to the laws of the animal economy. It is an imposition, by which we conceal from ourselves our own ignorance, and prematurely arrest the progress of inquiry. But this by the way.

This hypothesis, however, is not only gratuitous in the assumption of a particular agent, but also in assuming the existence of a *spasm* in the extreme vessels, and in supposing the cold stage to be the cause of all that follows. The phenomena,

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phenomena, presented by the skin in the cold stage, may arise from the mere feebleness of the heart, which is rendered unable to distend the distant and minute vessels with blood, or from a mere inaction of the cutaneous capillaries, independently of the heart, as we believe to be the case; and not from a spasmodic contraction of the extreme vessels. And the presumption of the continuance of that spasm, when the superficial vessels are filled and distended with blood to a preternatural degree, would appear to be inconsistent with observation; for spasm and distension are terms of opposite import. The same vessels, which receive little or no blood in the cold stage, and are over distended with it in the hot stage, cannot be in both cases affected with spasm. But, it is contended, the perspiratory vessels at least are spasmodically contracted in the hot stage, for no fluid is poured out. Here, however, it should be observed, that, although the poverty of language, which compels us to borrow the terms of mechanical science, in speaking of the phenomena of life, may render the use of such a word as contraction admissible; yet it is not from a mere mechanical contraction and relaxation of the extreme arteries that the perspiration and other secreted fluids pass off. These fluids are not pre-existent in the blood, and separated as through a sieve, but are produced by new combinations, effected by an unknown and inexplicable action of the secreting extremities of the vessels: this action is interrupted by various conditions of the vessels, by their over distension, it would seem, as well as by their collapse; and as we are ignorant of the process of secretion, so we know not how it is suppressed. The supposition of spasm is equally gratuitous in both cases; and the word contraction is only to be considered as expressing, by an incorrect analogy, the non-appearance of the fluids to be discharged. The contraction of the vessels in the cold stage, and their distension in the hot, are equally to be considered as part of the concurrence of the symptoms, and not an essential cause of the fever.

The hypothesis, which assumes the spasm of the extreme vessels in the cold stage, as the cause of all the following symptoms, is not merely gratuitous, however, it is also inconsistent with the various phenomena of fever. This inconsistency seems to have arisen from the assumption of a simple intermittent or ephemeral paroxysm, as the prototype of every form of fever. But in many of the forms of pyrexia, and even of idiopathic fever, there is no evidence of the existence of this spasm. The cold, it is true, generally ushers in the paroxysm of an intermittent; but it is often scarcely obvious in that of a remittent, and in various cases of continued fever it does not appear at all; so that the effect occurs without its imagined cause. Besides, there is often no proportion between the two; the cold stage may be short and slight, when the succeeding hot stage is long and severe, and *vice versa*. Even admitting, with Dr. Cullen and Dr. Fordyce, that continued fevers are but a series of paroxysms, following each other, and generally distinctly divided by exacerbations and remissions, yet a cold stage does not occur to introduce the exacerbation, and consequently the succeeding phenomena are not the result of a spasm or cold fit. A degree of pyrexia, marked by heat, quick pulse, oppression, languor, &c. is often produced by various stimuli, such as much heating food, or drink, exercise, &c. but the cold stage is wanting.

We may conclude, therefore, that the occurrence of the heat, and its concomitant phenomena in fever, depends upon some other principle in the animal economy, and not upon the existence of a cold stage, and its supposed spasm. As well, indeed, might we fix upon the heat as a cause of the phenomena, which, in continued

fevers, succeed it; such as the delirium, prostration of strength, &c.; and, in truth, the omission to notice the influence of the morbid heat upon the future progress of the symptoms constitutes, as Dr. Currie has justly remarked, an imperfection in Dr. Cullen's theory. For it is certain, that the accumulation of the heat itself is a source of much irritation to the vascular and nervous systems, as is proved by the relief which follows the abstraction of it by means of cool air, and the application of cold water to the skin; for as the heat is decreased, the pulse immediately becomes less frequent, head-ache and restlessness are diminished, sleep is induced, and even perspiration is excited.

We have yet to add, that the idea of a proximate cause, implies that, which being present, the disease is present, and being absent, the disease disappears. Now, the cold stage is only present during a small part of the progress of fever, which is another reason for considering it only as one in the concurrence of the symptoms.

The Brunonian Theory.—We have already given a brief view of the system by which Dr. Brown attempted to explain all the phenomena of the living body, whether in health or disease (see *EXCITABILITY*); and the various modifications of fever were of course included in that explanation. The increasing number of facts, which the proper study of the animal economy after the time of Hoffman produced, enabled the pupil to advance a step beyond his master, in generalizing those facts: and it cannot be doubted, that some of the dogmas of Brown were the result of a legitimate induction, and therefore some of his principles were more just than those of Cullen. But like most theorists, he overstepped the boundary of observation, and involved himself in hypothesis, to which he made facts bend by misrepresenting them. Fevers, like all other diseases, are attributed to debility, direct or indirect; and he affirms “that the distinctions that physicians have made about the differences of fevers are all without foundation, and that they are all the same, with no other difference but in degree, and that, unless in that respect, they do not differ from other diseases of the same form.” (*Elements of Medicine*, § 662. note *m*.) But he does not attempt to explain how the various succession of symptoms results from the state of debility, or how the various modifications of the pyrexia are to be accounted for upon this principle. The only approximation to such an explanation, that we have been able to discover, resembles the one given by Dr. Cullen, inasmuch as it is little more than an enumeration of the leading changes in the symptoms, but less explicit than that of Dr. Cullen. We are told, that “the debility during the cold stage is the greatest, that of the hot less, and that of the sweating stage, which ends in health for the time, is the least of all. Hence in a mild degree of the disease, as cold is the most hurtful power, its effect is gradually taken off by the agreeable heat of the bed or of the sun, and the strength thereby gradually drawn forth. The heart and arteries, gradually excited by the heat, acquire vigour, and, at last, having their perspiratory terminations excited by the same stimulus, the most hurtful symptom is thereby removed, the hot fit produced, and afterwards the same process carried on to the breaking out of sweat.” (§ 666.) We are further told that “the cause of all these diseases (i. e. fevers, from the simple and intermittent to the gaol-fever and the plague.) is the same with that of diseases not febrile, to wit, debility: differing only in this, that it is the greatest debility compatible with life, and not long compatible with it.” (§ 670.) It may appear strange that a theory so vague and inexplicit

inexplicit should have obtained the number of admirers, which the doctrines of Brown have every where gained. The most rational of its advocates however, Dr. Wilson, who has stripped the system of many of its errors and inconsistencies, not content with these general terms, has stated the proximate cause of fever, according to the Brunonian principles, to be "a change in the laws of excitability, in consequence of which the same agents no longer produce the same effects:" that is to say, the same external agents, food, light, exercise, &c. which in health produce moderate excitement, in fever produce excessive excitement. He adds, however, "how the remote causes of fever act in inducing this change, and on what *change in the living solid* this change in the laws of excitability depends, we neither can, nor ever shall be able perhaps to determine." (*Treatise on Febrile Diseases* by Al. Phillips Wilson, &c. vol. i. p. 559.)

Upon this statement, it is only necessary to remark, that Dr. Wilson has fallen into the error which is common in the discussion of proximate causes, that of mistaking the symptoms for the disease itself. The change in the law of excitability is but a general expression for the change in the phenomena of the individual life, *i. e.* for the symptoms of the fever; whereas, the change in the living solid is, in fact, the essence of the disease, *i. e.* the proximate cause of the symptoms, which he despairs of investigating successfully.

Dr. Darwin's Theory.—In the theory of this ingenious physician, the phenomena of fever are referred to those laws of organic life, which he has deduced with great acuteness from a comprehensive view of the phenomena of the living system. His theory, indeed, is much involved in the obscurity of the language, which he has chosen to adopt; it is, occasionally perhaps, aided by fancy, where observation was deficient; and it is given by its author "rather as observations and conjectures, than as things explained and demonstrated:" but it appears to afford a glimpse of the true explanation of the concurrence of symptoms in fever, under its various forms, "a foundation and a scaffolding," to borrow the author's words again, "which may enable future industry to erect a solid and a beautiful edifice." (See *Zoonomia, or the Laws of Organic Life*, by Erasmus Darwin, M.D. &c. Chaps. 4. *Suppl. ad finem.*) Dr. Darwin's system is grounded upon the same fundamental principles, as those of the Brunonian school (see *EXCITABILITY*); the incongruities of which, however, he not only in a great degree avoided, but he likewise introduced a principle, which had been overlooked by Brown, namely, the principle of *association*, or sympathy, by which, doubtless, many of the actions of the living body are regulated. It is upon the observation of this principle, that the Darwinian theory of fever is chiefly constructed; whence the author gave it the title of the "*Sympathetic Theory of Fever.*"

Two general laws of the animal economy are stated by Darwin, as well as by Brown; 1. That all excitement or action of the living organs and functions occasions a diminution or exhaustion of their power (*excitability* in the language of the latter, *senforial power* in that of the former,) according to the degree of excitement; 2. That rest, inactivity, or the abstraction of the usual stimuli, render those organs more susceptible of the action of the stimuli subsequently applied. Thus, when a small part of the capillary vessels of the skin are exposed for a short time to a cold medium, as when the hands are immersed in iced water for a minute, these capillaries become torpid or quiescent, owing to the abstraction of the stimulus of heat. The skin then becomes pale, because no blood passes through

the external capillaries, and appears shrunk, because their sides are collapsed from inactivity, not contracted by spasm; the roots of the hair are left prominent from the seceding or subsiding of the skin around them; and the pain of coldness is produced. But in this situation, if the usual degree of warmth be applied, these vessels regain their activity; and, having now become more irritable from an accumulation of the sensorial power during their quiescence, a greater action of them follows, with an increased glow of the skin, and another kind of pain, which is called the hot-ache, ensues. Here we see an epitome of simple fever beginning in the vascular system. When the same operation goes on more generally, as by immersion in the cold bath, the cold fit succeeded by the hot fit is more general, and both may be increased and prolonged by continuing in the bath, which has indeed proved fatal to some weak and delicate people, and to others who had been much exhausted by heat and exercise; the same torpor and subsequent orgasm having extended to the heart and great vessels.

Thus far the two theories nearly accord; but beyond this point the Brunonian doctrine leaves us to a general statement of debility, altogether inadequate to account for the various forms and phenomena of fever. But Dr. Darwin appeals to other established facts in the animal economy, upon which these varieties appear to depend. From these a third general law may be deduced; namely, 3. That the functions of different parts of the system are so far catenated, or associated with each other, as it were in circles, either from direct connection in structure, from the habit of acting together, or more frequently from causes at present inscrutable, (see *CATENATION*;) that an increase or decrease of the action of one organ is followed or accompanied by an increase or decrease of the action of another; sometimes by a similar change, that is, increase followed by increase of activity, or decrease by decrease; but occasionally by the contrary change, that is, increase followed by decrease of activity, and *vice versa* in the associated parts. The former of these is termed a *direct* sympathy; the latter a *reverse* sympathy. The instances of sympathy between different parts of the animal frame are very numerous. To the medical reader it were sufficient to mention the sympathies in the functions of the stomach and brain, the stomach and skin, the stomach and heart, the brain and heart, the skin and lungs, the uterus and mammæ, &c.; but for the unprofessional reader a brief illustration may be requisite.

The sympathetic action of the stomach and the brain occurs perpetually to the observation of the physician. Thus indigestion, however induced, is frequently the cause of head-ache; and head-ache, dependent upon certain states of the brain, produces loss of appetite and sickness, as in hydrocephalus. We have also instances of both direct and reverse sympathy between these organs; for when the action of the vessels of the brain is languid and feeble, as in approaching syncope, nausea and loss of appetite occur in the stomach, in which case the sympathy is direct; but when the vessels of the brain are acting with increased power, as in phrensy, nausea and loss of appetite are likewise induced, in which the sympathetic action is reversed. Similar sympathies occur between the stomach and skin. Thus, moistening the skin relieves thirst, as we have already stated; and a copious draught of warm liquor will often at once produce a perspiration on the skin. We have seen that Dr. Cullen attributed the symptoms in the digestive functions in fever almost entirely to such a sympathy; and that Sydenham removed sickness and vomiting by exciting perspiration. The stimulating influence of food on the nerves and vessels of the stomach generally excites, by direct sympathy, the

nerves

nerves and vessels of the skin, and produces a glow on the surface; but in certain debilitated constitutions, or states of the constitution, the same stimulus in the stomach occasions, by reverse sympathy, a chilliness, even a shivering, and paleness of the skin. Exposure to a cold atmosphere (which abstracts the stimulus of heat) occasions an increase of appetite and of the digestive power, in strong habits; but the same exposure often destroys the appetite, and produces even nausea, in feeble constitutions; these may be considered as instances of direct and reverse sympathy; or perhaps both as instances of direct sympathy, the sensorial power accumulating in the strong constitution, and producing increased action of the cutaneous vessels; but not in the weak. The actions of the stomach and the heart are catenated to a considerable degree: heating food and drink generally quicken the pulse, and the action of narcotic poisons on the stomach immediately diminish its frequency and strength, and often cause it to intermit. The actions of the skin and lungs are also much associated; thus cold applied to the skin, and producing torpor of the cutaneous capillaries, as shewn by the paleness, chilly sensation, &c. immediately occasions difficult and laborious breathing, probably from a similar torpor being produced in the capillaries of the lungs. The loss of appetite and nausea induced by the action of the uterus after conception, and by inflammation, or the irritation of a stone in the kidneys, may be considered as examples of a reverse sympathy between these organs. There are many instances of the sympathy of parts connected by structure, or by the habit of acting together. Thus, the irritation of a stone upon the neck of the bladder produces an action of the lower gut, with a fruitless effort to stool, denominated tenesmus; and, *vice versa*, a tenesmus, as in dysentery for instance, often excites a degree of strangury or fruitless effort to pass urine. In the same way, not only will a pungent odour, affecting the nostrils, excite tears, but the sudden impulse of strong light upon the eyes very frequently excites sneezing: which may be observed daily in the streets of London, during the summer, in persons who suddenly receive the reflected light from a white pavement, as they pass from a shade. Thus also sympathetic pains of the mammæ occur in disorders of the uterus, which organs are connected in the functions and purposes which they serve in the animal economy. See SYMPATHY, and CATENATION.

These three laws or principles of action in the animal economy, then, 1. The exhaustion or diminution of the sensorial powers by exertion; 2. The recovery or accumulation of the same powers, during quiescence or impaired action; and, 3. The direct and reverse association of parts, by which the actions of one part give rise to actions in others, are the grounds of Dr. Darwin's explanation of the phenomena of fevers. We have seen how the cold and hot fits of simple fever are produced, from the external influence of cold; the first by the torpor of the capillary vessels, from the abstraction of the stimulus of heat; the second, by the renovated activity of the capillaries from the accumulation of sensorial power during that torpor. Dr. Darwin, however, remarks, that this renovated activity of the capillaries is not owing to the renewed action of the heart, which forces them open by the mechanical impulse of blood; that the action of the capillaries often recommences sooner than the action of the heart, these vessels having a greater mobility than the heart and large arteries, as appears in the sudden blush of shame; and that, in low fevers, the capillaries acquire increased strength, as is evinced by the flush and heat of the skin, while the pulsations of the heart and arteries remain feeble. Hence simple fever is of two kinds; in our

the pulse is strong, in the other weak: in the fever with strong pulse, not only the cutaneous capillaries, but also the heart and arteries readily acquire a greater activity by the accumulation of sensorial power during the torpid state, which last is farther increased by direct sympathy with the increased activity of the capillaries; this happens in strong constitutions, and is often seen in vernal intermittents: in the fever with weak pulse, on the contrary, the heart and arteries do not acquire much increase of sensorial power, but continue in some degree in their state of torpor, while the orgasm of the capillaries is produced, whence there is a hot fit, with feeble pulse.

But when the sympathies of other parts of the system are called into action, together with this torpor and orgasm of the cutaneous vessels, and of the heart and large arteries, the fever-fit becomes more complicated and dangerous. And again, when the torpor commences, from the operation of other exciting causes of fever in other organs of the body, and extends, with the subsequent orgasm, by direct or reverse sympathy, to the organs associated with them, other various forms and modifications of febrile disease are produced. Thus, if the stomach is affected with torpor, either primarily, as from the action of contagion, swallowed with the saliva, or secondarily, by its sympathy with the cutaneous capillaries, or with some internal viscus, a total loss of appetite occurs, followed by sickness and vomiting. If the brain is affected, either primarily, as by the depressions, by exhaustion from watching, &c. or secondarily, as by the influence of contagious or marsh effluvia, received into the stomach, or the lungs, then prostration of the general powers, head-ache, delirium, stupor, tremors, convulsions, &c. are induced. In the same way, the secretions from the internal organs, as from the kidneys, are diminished when a torpor takes place in them, either primarily, or by sympathy with the cutaneous capillaries, or other parts, and are restored with the renovated action. These phenomena take place in different degrees in almost all fevers, and vary according to the nature of the organs primarily affected, and to the state of the constitution, or of the organs individually. Thus when the stomach is slightly disordered, as by indigestible food, or when the vascular system is deranged from exposure to cold, (when no inflammation is produced,) the fever which ensues is mild, the brain suffers little by sympathy, no delirium, &c. occur, and health is soon restored. If, on the contrary, a virulent contagion acts upon the stomach, and through its medium upon the brain, the sensorial powers are greatly exhausted, and the complication of dangerous symptoms, arising from the morbid condition of the nervous system, and from the total loss of powers in the organs of digestion, occurs, constituting the contagious, nervous, and malignant fevers, or *typhus*, under its various forms and denominations. The opinion that contagion operates first on the stomach, has been adopted by Dr. Lind, and other practical writers, and is corroborated by many facts. When the contagion is sufficiently powerful to produce an immediate and sensible effect, sickness, together with a disagreeable taste, which has been described as "reaching to the stomach," is its usual operation, (see Lind on Fevers and Infection, chap. ii. sect. 1.) and is followed by shivering tremors, head-ache, and a low and weak or irregular pulse, from the sympathy of the brain and the skin. The primary action of the contagion on the stomach is probably the cause of the greater virulence of the casual, than of the inoculated small-pox, which however is liable to be varied by the quantity of the contagious matter received by its virulence, and by the previous susceptibility of the constitution. When the

sensorial powers of the stomach, heart, and brain, are primarily exhausted by narcotic poisons, as by digitalis, tobacco, and contagion, (which both Brown and Darwin consider, perhaps erroneously, as exhausting by excess of stimulus,) these organs are longer in recovering their excitability, than when they suffer from defect of stimulus, or secondarily, from sympathy with the capillaries of the skin, or of some other organ. From either species of exhaustion the sensorial power in voluntary or involuntary muscles might be removed by a short quiescence; but with the heart *to rest is death*; whence that organ recovers more slowly, and thus produces fever with weak pulse. Those organs which are in perpetual action, indeed, being endowed with a greater abundance of vitality, recover their sensorial powers in the same proportion more readily, otherwise life could not continue. As the sensorial power accumulates, the actions of those organs increase; whence a degree of inflammation often occurs in the brain and its membranes, accompanied with flushed countenance, redness of the eyes, and delirium, sometimes followed by stupor; or a similar inflammatory action occurs in the stomach, or intestines, or in the lungs, or the heart. These, however, are generally secondary effects of low fever, but death is seldom produced without such an occurrence in some of those viscera. Dr. Darwin justly considers the painful or uneasy feelings, or (to use his language, the sensorial power of sensation,) excited especially when inflammation takes place, as contributing farther to augment the actions of the heart and arteries, and of all the moving system along with them; whence the pulse, under such circumstances, acquires a degree of sharpness in its stroke, unobserved in health.

When the stomach is secondarily affected, and the torpor is primarily produced in some other viscus, the actions of which, on the restoration of the sensorial power, are augmented to the degree constituting inflammation, and of course pain, or the sensorial power of sensation is also excited, as in pleurisy or peripneumony, the heart and arteries, not having been exhausted by a narcotic power, as by contagion, soon resume a strong action, the pulse becomes hard, and the disease is termed an inflammatory fever, or phlegmasia. "Thus," says Dr. Darwin, "the peripneumony is generally induced by the patient respiring very cold air, and this especially after being long confined to warm air, or after being much fatigued and heated by excessive labour or exercise. For we can cover the skin with more clothes, when we feel cold; but the lungs, not having the perception of cold, we do not think of covering them, nor have we the power of covering them, if we desired it; and the torpor thus produced is greater, or of longer duration, in proportion to the previous expenditure of sensorial power by heat or exercise. This torpor of the lungs affects the skin with shuddering, and the stomach is also secondarily affected; next follows the violent action of the lungs from the accumulation of the power of irritation, and an inflammation of them follows this violent action, &c." (Loc. cit. Supplem. i. § 16. 7.)

The theory, of which we have thus given an imperfect account, stripped of the peculiar phraseology of the author, appears to us incomplete, as it confessedly is, to afford an approximation to at least a more comprehensive and more consistent doctrine of febrile disease, than any that has yet been promulgated: more comprehensive, because it not only includes the varieties of idiopathic, but also of symptomatic fevers; while other hypotheses scarcely embrace more than one form of the first, namely, the ephemeral, or intermittent paroxysm, and have dwelt too much upon some

particular symptom, as the cause of the whole disease, such as the heat, the cold fit, or the quick pulse; and more consistent, because it is derived from those laws of the animal economy, which have been deduced from the observation of the general operations of life, both in health and disease. To the language, however, many objections arise, as well as to several collateral statements, which are employed in filling up the outline, which we have drawn: such as the notion of a retrograde action of the absorbents, of the absorbent action of the capillary veins, of the excessive stimulus of digitalis, and the matter of contagion, &c.; but these are not essential parts of the doctrine. We shall now proceed to state briefly the principal points of another theory of fever, lately published, which, from the erudition and practical knowledge with which it has been maintained, is entitled to consideration. We allude to

Dr. Clutterbuck's Theory.—Fever has usually been called a general disease, affecting all the functions, in contradistinction from local diseases, in which some particular organ is the primary seat of the disorder, and the affections of the other functions are secondary, or symptomatic. But Dr. Clutterbuck denies the existence of general disease, and maintains that all general or extensive derangement of the animal system is referrible to local derangement in some one organ. The organ universally affected in all the varieties of idiopathic fever which differ but in degree, as well as in those which arise from specific contagion, as malignant sore throat, scarlet-fever, small-pox, &c. is, in the author's opinion, the brain. This is manifest, he contends, from the symptoms, as the head-ache, the depression of strength, and other derangement of the animal functions, the delirium, the tremors, failure of vision, &c. It is manifest from the nature of the remote causes which act chiefly on the brain and nervous system, as intoxication, fear, grief, and other passions, external irritation, not to mention miasmata and contagion, of the operation of which we are ignorant; as well as from the predisposing causes, which probably consist in a deficiency of sensibility, as in idiots, negroes, old people, and infants: but it is more particularly manifest from the consequences of fever whether after recovery, or after death, ascertained in the latter case by dissection. Among the consequences of fever, which are not uncommon after recovery, are an impaired condition of the senses; such as deafness, imperfect vision, depraved taste: paralytic affections, or convulsive complaints, as epilepsy and chorea; derangement or loss of the mental powers, such as melancholy, great irritability of mind, loss of memory, or even complete fatuity. The consequences, observed by dissection after death occasioned by fever, are frequently visible disease of the brain, of which several examples are quoted by the author. He then proceeds to shew, that the local affection of the brain, thus manifest, is in fact inflammation of that organ; or that fever, therefore, "is nothing less than a species of *phrenitis*, or topical inflammation of the brain," and should be arranged in the order of *Phlegmasia*, with pleurisy, enteritis, and other symptomatic fevers: but as *phrenitis* has been generally applied to a particular form of inflammation of the brain, and implies delirium, which does not always occur in fever, although it is a frequent symptom, Dr. Clutterbuck proposes the term *Encephalitis* as the denomination for fever. The arguments adduced in proof of the notion that the topical affection of the brain, in fever, is inflammation, are, 1. The analogy between the symptoms of fever and those of inflammation, *viz.* pain, heat, throbbing, acute sensibility, &c. being common to both; 2. The occasional buff of the blood in both; 3. The similarity of several of the exciting causes of both;

both; 4. The occasional alternation of fever with inflammation; 5. The analogy in regard to the cure of the two diseases generally, as by means of blood-letting, vomiting, sweating, purging, blistering, and the application of cold; 6. The symptoms of fever not being distinguishable, on the whole, from those which belong to phrenitis, as described by authors; 7. That the morbid condition of the brain, discovered by dissection, is such as implied previous inflammation. (See an Inquiry into the Seat and Nature of Fever, &c. by Henry Clutterbuck, M. D. 1807.) The author has illustrated these arguments at considerable length, with great perspicuity, and with an ample collection of facts and observations, compiled from the records of medicine; but our limits confine us to a mere sketch of the general doctrine, and to a few observations relative to its apparent solidity and truth.

In the first place, Dr. Clutterbuck, like other theorists enamoured of a favourite doctrine, appears to have laid too great stress upon those phenomena which support that doctrine, and to have conceded less to opposing facts, than they are entitled to claim. Hence, in retracing the delineations of fever, in the words of the most creditable writers, he has distinguished by italics all those signs which indicate derangement of the encephalon, by which they are made to stand the most prominent features in the picture. Hence, also, he has assumed the position, that the derangements of the natural and vital functions, which are nearly, if not altogether, as universal concomitants of fever, as the disorders of the animal functions, are, nevertheless, in all cases, secondary symptoms, originating from the primary affection of the brain. Thus the nausea, the vomiting, the total loss of appetite, and of the digestive power, are believed to be always sympathetic of the affection of that organ; so likewise is the quickened action of the heart and arteries, and of the respiration. That this, however, is a gratuitous assumption may be shewn, 1. By attending to the very histories which Dr. Clutterbuck has quoted, in which the occurrence of the deranged condition of the stomach is as constantly mentioned, as that of the disorder of the encephalon; 2. By observing, that the sympathy between the brain and the stomach is perfectly reciprocal; so that the brain suffers in sympathy with the stomach, not less manifestly than the stomach with the brain; and, 3. By remarking, that the symptoms of disordered stomach are capable of being relieved or removed, while the supposed cause (affection of the brain) remains; the thirst being allayed, and the sickness removed, by changing the state of the skin only, the former by moistening it with water, the latter by exciting sweat, as observed by Sydenham. Whence Drs. Cullen and Darwin seem to be rather justified in attributing the derangement of the stomach, when it is affected secondarily, more frequently to its sympathy with the state of the skin, than of the brain.

Farther, the connection of many of the leading symptoms with some disorder of the brain, or common sensorium, is admitted by all, and equally favours the hypothesis of the other authors, as well as that of Dr. Clutterbuck; since whether the brain is primarily or secondarily affected, certain phenomena in the nervous system must necessarily ensue. We have just stated some reasons for believing that it is often thus secondarily affected; and it now remains to offer our reasons for supposing, that inflammation of the brain, when it does occur in fever, (to which we cannot consider it as essential,) is commonly secondary likewise.

The first symptoms of the affection of the brain are by no means those which indicate inflammation or unusual excitement of the sensorium; on the contrary, they are such as indicate an opposite state, which Dr. Cullen has termed

atony and collapse, and Dr. Darwin *torpor*: the head-ache itself, according to the observation of Dr. Fordyce, is altogether distinct from the head-ache of inflammatory excitement, or of the hot stage. Any symptoms that can be interpreted as indications of local inflammations, such as redness of the eyes, protrusion of the features, flushed countenance, throbbing of the arteries, and even delirium, are the appearances belonging to a subsequent period of the fever. But at this subsequent period, inflammatory congestions are liable to occur in the other viscera, if not so frequently, at least, not unfrequently; as in the stomach, for example, the intestines, the lungs, and other organs. This fact has been noticed by many physicians of accurate observation. Riverius long ago remarked that "acute and malignant fevers scarcely ever occur unaccompanied by inflammation in some one of the viscera;" and he has stated in another place, in most distinct terms, that we ought assiduously to recollect, that all those fevers, with which local inflammation is conjoined, are not symptomatic, but often idiopathic, and that the inflammation supervenes, not being the cause, but the consequence of the fever; "quæ febrem istam non efficit, sed illi potius succedanea est." Thus, he adds, "we frequently observe, in practice, that patients labour under continued fever for a day or two before pain of the side and other symptoms of pleurisy appear; thus also many persons on the third or fourth day of fever fall into inflammation of the brain, &c." "Sic nobis frequenter in usu practico videre licet ægotantes, ab initio febre continuâ laborantes per unam aut alteram diem, antequam dolor lateris et alia pleuritidis signa appareant: sic multi tertia vel quarta febris die in phrenitidem incidunt, &c." (See River. Prax. Med. lib. xvii. cap. 1.) Dr. Donald Monro, whose testimony on subjects of morbid anatomy is of considerable weight with Dr. Clutterbuck, remarks, when speaking of malignant fever, that "this fever occasions in general more or less redness (I do not know that we can properly call it true acute inflammation) of the membranes; and the febrile matter is apt to fall on particular parts, and there to create abscesses, particularly in the brain, the lungs, and the glandular organs." (See his Treatise on Military Hosp. vol. i. p. 237. and Dr. Clutterbuck's Treatise, p. 172.) Observations to this effect might be easily multiplied, and we have already enumerated several in a former part of this article. It is somewhat singular, that Dr. Clutterbuck, who quotes the remark of Dr. Monro, should deem it favourable to his hypothesis of exclusive inflammation of the brain; since it obviously proves an equal liability to inflammation in other organs, if it proves any thing. Now, it must be admitted, that, if fever depends upon inflammation of the brain, and is merely symptomatic of such a state, this state must be always present, when the symptoms of fever occur; one clear negative example is sorely fatal to the theory. Dr. Beddoes collected a considerable quantity of evidence from the histories of dissections, made during the prevalence of several epidemic fevers on the continent, from which it is proved, indeed, that congestion, or some other morbid appearance was frequently observed in the brain or its membranes; but it is also shewing that abscesses, gangrene, or other marks of inflammation, were not less frequently found in the viscera of the thorax and of the abdomen, especially in the stomach and liver. These facts we have detailed, when speaking of the consequences of fatal fevers, as discovered by dissection, and it is unnecessary to repeat them here. Dr. Beddoes is fairly led (supposing the facts accurately represented) to this inference, that "in idiopathic fever, the stomach and contiguous parts have been found more constantly and more deeply affected with

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NERA, AGUE, and REMITTENT.) In the synocha, or inflammatory fever, this is the principal indication to be followed; in the synochus, or sub-inflammatory fever, it is the rule of practice in the greater part of the disease; and even in typhus, originating from contagion, it is commonly to be kept in view in the first days of the complaint, and partially for a longer period. We are not in possession of any means, by which we can with safety effect a direct diminution of the actions of the animal system in fever: our measures, therefore, are limited to a negative or indirect reduction of excitement, by withdrawing or diminishing those irritations or stimuli, which are constantly applied to the body, in one degree or other, and actually excite the actions of life, (see EXCITABILITY,) or which are more particularly the consequence of the febrile state. Of the first of these irritations, the ordinary impressions made upon our senses, the exercise of the body and mind, the use of food and drink of various qualities, are examples; of the latter, the excessive heat, the thirst, and the various painful sensations, &c. The system of avoiding these as much as possible, or of moderating their force, when that is impracticable, constitutes what has been called the *antiphlogistic regimen*, which it is requisite to pursue in almost every continued fever. Although the irritations naturally occurring in health, are doubtless salutary, and support the activity of the living body; yet, in the febrile state, when the body is more sensible to the operation of stimuli, on the one hand, and more feeble, (in typhus at least,) and therefore less capable of bearing their action, without suffering exhaustion, on the other, they become exceedingly prejudicial.

1. In the hot stage of fever, the senses are generally more acute, and the ordinary impressions excite a painful irritation, and thus contribute to augment the vascular action, and to increase head-ache, restlessness, &c. Hence the obstruction of too much light is to be prevented, all noises are to be excluded, and such covering, or bed, to be employed as is least uneasy to the body of the patient. In large towns, stuffing the ears with cotton may perhaps more effectually lessen the effect of noise than laying straw in the street. But no impression is to be more carefully guarded against than that of external heat; while at the same time every other means of increasing the heat of the body is to be shunned. Both these precautions are to be observed as soon as a hot stage is fully formed, and to be attended to during its continuance; the more the morbid heat is augmented, the more necessary this attention becomes, since the uneasy sensations connected with it are the constant cause of increase to all the other symptoms. This is not less evident, than the general and speedy relief which follows the abstraction of this morbid irritation, *i. e.*, in the common phrase, the application of cold. Yet it was formerly an universal practice, to augment the heat in the early stages of fever, in spite of the instinctive feelings of the patient; partly under a notion, that sweating might thus be produced, and a crisis accomplished; and partly from an hypothetical opinion, that heat contributed to accelerate the process of concoction, and therefore to shorten the fever. Our countryman, Sydenham, was one of the first to point out the advantages of a contrary practice, which he adopted when the rest of European physicians were pursuing the hot regimen. The same notion of the humors, and with others, the fear of the subsequent debility and prostration of strength, which occur in the latter periods of typhous fever, and the doctrine that debility is the proximate cause of the disease, have also contributed to conjoin with this a stimulating mode of treatment, in fevers of this character; so that some practitioners no sooner hear the name

of fever, especially when the epithets putrid, contagious, malignant, &c., are connected with it, than they immediately ply the patient with wine, Peruvian bark, and other stimulants and cordials, whatever be the period or circumstances of the disease, for the purpose of obviating or anticipating the consequences of debility. This the experience of all enlightened and unprejudiced physicians of the present day, condemns as a pernicious error, in the early stages of fever, when there is a dry heat on the surface of the body. For not only is the general vascular action, and with it the head-ache, delirium, thirst, restlessness, &c., directly augmented, but they are also indirectly increased by the increase of the irritation of superficial heat; and the very debility, which is intended to be prevented, is, therefore, actually accelerated and augmented, in consequence of the exhaustion which over-excitement induces. Thus *petechiæ*, and other signs of putrefaction (as they have been termed,) were common results of the hot regimen; which, on the other hand, was inadequate to produce a crisis by sweating, or to shorten the febrile state by concoction, as we shall presently state.

The reduction of the morbid heat, then, constitutes an important part of the system of avoiding irritation. It is accomplished by external and internal means; the external consisting of the application of cool air, or of cold or tepid water to the surface of the body, and of surrounding the patient with light clothing, by which the animal heat is not accumulated; and the internal, of cold drink; and perhaps of what have been denominated refrigerant medicines. The human body evolves a sufficient quantity of heat to preserve its regular and agreeable temperature, in so rare a medium as the air, when the temperature of this is not under 62° of Fahrenheit's thermometer, or unless it contain moisture; and in air at 62°, the caloric disengaged from the body is neither carried off, nor permitted to accumulate so as to become unpleasant. But if more caloric be disengaged than in health, a lower temperature will be required for its due abstraction, in proportion to the greater heat and strength of the patient. A temperature of the air in his apartment of between 45 and 55 degrees will be the most grateful, perhaps, in the ordinary forms of typhus. In the synocha, in which the temperature of the body is higher, that of the patient's bed-room may be kept as low as 35° or 40° with advantage. In this country, the former temperature is very commonly attainable; if the heat of the atmosphere be higher, the evaporation of watery fluids, sprinkled upon the floor or other parts of the bed-room, especially such as are impregnated with the essential oil of aromatic plants, contributes somewhat to reduce the temperature, and feels refreshing to the patient. The free admission of pure air is at all times necessary, not only as producing evaporation and consequent coolness, but as carrying off the morbid effluvia arising from the body, and affording a pure pabulum for respiration; of which we shall have occasion to speak hereafter. The late Dr. Gregory, father of the present professor at Edinburgh, used to remark, when he had been visiting one of the richer class of people in fever, that if he had the patient in a cool ward of the infirmary, he could ensure his recovery; whereas, from the mere circumstance of the heat and closeness of the apartment, which he could not regulate according to his wish, he would in all probability, find the symptoms of the fever increased at his next visit. The writer of this article has frequently experienced the great and obvious benefit of a cool and well ventilated room, independently of medicine. He has visited patients, who had applied for admission into the House of Recovery,

Recovery, in their own close and suffocating apartments, and found them in a state of delirium, with dry black tongue, great heat, and other bad symptoms; having directed them to be removed to the House, he has found them cool and perfectly collected, with other symptoms of equal amendment, on the following morning, from the mere influence of a cool bed, and an airy apartment.

Another mode of reducing the morbid heat is the application of cold or tepid water to the skin. As the fever is now supposed to have advanced beyond the fourth day, after which period a complete solution of it is not to be expected, either the cold affusion may be employed, or the surface of the body may be washed, by means of a sponge, with cold or tepid water, or tepid water may be used in the way of affusion. The same precautionary rules, as we have already stated, are to be observed in regard to all these modes of the external application of cold water. The tepid affusion (*i. e.* of water heated to that degree which is warm, but not hot to the sensations, or from 87° to 97° of the scale of Fahrenheit,) produces a cooling effect, equal to that of cold affusion, partly in consequence of a more speedy evaporation, and partly because so great a glow, or reaction, as it has been called, does not succeed. "Where the object is to diminish heat," Dr. Currie observes, (Reports on Water, vol. i. p. 69. chap. x. 2d edit.) "that may be obtained with great certainty by the repeated use of the tepid affusion, suffering the surface of the body to be exposed in the interval to the external air; and if the beams of the sun be excluded, and a stream of wind blows over it, the heat may be thus reduced where cold water cannot be procured, even in the warmest regions of the earth, on the plains of Bengal, or the sands of Arabia." The effects of the affusion of tepid water on the skin are thus enumerated. "It very generally produces a considerable diminution of heat, a diminished frequency of the pulse and respiration, and a tendency to repose and sleep. I have also used it in feverish disorders of various kinds where the lungs are oppressed, and the respiration laborious, and where of course the oppression might be dangerously augmented by the sudden stimulus of the cold affusion. It is also applicable to every case of fever, in which the cold affusion is recommended, and those may receive much benefit from it whose fears or whose feebleness deter them from that energetic remedy. I have not, however, found its effects so permanent as those of the cold affusion, and I have never seen it followed by the total cessation of regular fever, as often occurs after the cold affusion." (Currie, *loc. cit.*)

Where the affusion of cold or tepid water is not employed in fever, benefit may be derived, though in an inferior degree, by sponging or wetting the body with cold or warm water, or vinegar and water. According to Dr. Currie's experience, however, it is not only less effectual, but in many cases less safe; for the system will often bear a sudden, a general, and a stimulating application of cold, when it shrinks from its slow and successive application. In the House of Recovery belonging to the Fever Institution of London, all these measures have been constantly employed according to the circumstances of the patient, as pointed out by Dr. Currie, and relief has been invariably the result; no individual remedy, to which we have resorted, has appeared to produce so prompt and decided a diminution of the febrile symptoms; which, though often temporary only, is in many cases permanent, and renders the future course of the disease apparently milder and shorter, than it would otherwise be.

The sensation of *thirst* is another irritation, which is often

very distressing in fever. In this instance, as in that of extreme heat, the instinctive feelings of the patient direct him to the source of relief; to simple diluent drink in the one case, as to exposure to cool air, or immersion in water, in the other. Had not the rage for hypothesis for ages, blinded the practitioners of medicine, the obvious propensities of the constitution could not have been so long and so obstinately thwarted, nor the gross inconsistency have been committed, of acknowledging the superintendance of nature, her salutary and healing exertions, her *vis medicatrix*, yet of counteracting her instinctive dispositions and operations with so much industry. Thus, drink, as well as cool air, has been denied to patients in fever by some physicians, and, when allowed, was directed to be given warm, notwithstanding their desire for it cold. The ancient physicians, indeed, with whom observation on the whole was paramount to hypothesis, generally admitted of a free use of cold drink: Galen considered it as a most important remedy in fever; and Avicenna, Rhazes, and others of the Arabian physicians, were more indulgent in this respect than the Greeks. Nevertheless, Aetius recommended total abstinence from liquids until the thirst was greatly augmented, and then to allow it to be fully gratified by copious draughts of cold drink. Celsus also recommends the use of copious cold drink in the height of the fever, "but not before the fourth day, and *after* great thirst." (De Medicina, lib. iii. cap. 7.) "In the article of drink," he says, in another place, "the struggle is great, and that in proportion to the severity of the fever; for this inflames the thirst, and demands water most importunately, when it is most dangerous." (Lib. iii. cap. 6.) After the revival of learning, when the Galenical hypothesis of concoction was universally adopted, cold drink was generally prohibited until the fever had attained its acme, under the notion that it increased the crudity of the fluids, and prevented the progress of concoction: "verum materiam morbi incrassando, atque iustus includendo," says Lommius, "longe facere coctioni rebellioem, itemque meatus, quibus ea tandem vacuari debeat, obstruere." (Lomm. de Febris contin. curandis, sect. iii. cap. 2.) The conclusion, however, which common sense would deduce from a consideration of the instinctive propensities of the constitution, is fortunately corroborated by observation and experience. Dr. Fordyce, after refuting some arguments and stating some facts, upon this point, adds this remark: "the author, therefore, concludes, that as it is of no use to restrain the patient from drinking as much as he pleases, or to compel him to drink more than he chuses, so it is of no use to prevent him from drinking it of the degree of heat that he likes best." (Third Dissertat. p. i. p. 211.) The absurd opposition to the intimations of nature, which many practitioners have been led to maintain by equally absurd reasoning, almost justifies a sarcasm of the late Dr. Moore, who said, that "between a good physician and a bad one, there was a wide difference; but between a good physician and none at all, the difference was very little." At present, however, the observation is not applicable; since the absurdities of former physicians are now adopted by the people at large, and one of the greatest difficulties which a practitioner has to encounter at present, is to prevent the mischief of popular interference, and to defend the operations of the constitution from popular interruption.

With respect to the use of cold drink in fevers, Dr. Currie ascertained that its safety and utility are dependent on the same principles, and that its administration is to be regulated by the same rules, as the external application of cold; namely, that when there is a steady heat of the surface,

face, without any sense of chilliness, or a general perspiration, it is safe and salutary, and attended by similar effects, though generally less in degree, than those of the cold washing. This principle was, indeed, long ago pointed out by Galen and others, though with less precision. The degree of corporeal heat, the strength of the patient, the summer season, &c., are stated by Lommius, from the ancients, as indicating the safety of cold drink. "Fiduciam addunt, febris admodum urens, ætas juvenilis, corpus boni habitus, firmorumque viscerum, atque his (ut fere fit) junctæ vires, ætas media, consuetudo. Ingens febris ardor sine noxâ frigidæ impetum sustinet, &c." (Loc. cit.) The effects of cold drink, when copiously taken in the hot stage, as described by the ancients, as by Aëtius, Celsus, &c. are sweating, a disposition to sound sleep, and relief from the fever. "Post quæ," says the author just quoted, after having mentioned the quantity of cold water drank (three or four pints), and occasional vomiting or diarrhœa produced by it, "reclinati ac probe operati, mox uberrimis sudoribus totas noctes, vel etiam altissime dormientes, deluxerunt, quibus linitis, omnem in poiterum amiserunt fabricitationem." Cold drink is seldom employed, at present, to this extent; but a treatise was published nearly a century ago, by the reverend Dr. Hancock, of St. Stephen's, Walbrook, entitled "Febrifugum Magnum, or common water a cure for all fevers," in which he states, that very copious draughts of cold water, drank at bed-time, at the beginning of fevers, invariably produced copious sweating, and a solution of the disease, in several cases, which he has related. He was not, however, aware, that such a practice was only safe after the hot stage was completely formed.

2. Another irritation, which it is requisite to avoid in fever, is motion, especially that which requires the exercise of the muscles; and it must be observed, that every motion of the body is more stimulant and exhausting in proportion as the body is weaker. Hence that posture is to be chosen which employs the fewest muscles, and which keeps none of them long in a state of contraction. In the horizontal position, the patient is supported in every part by the bed, and he is not obliged to exert many of his muscles to maintain an equilibrium, as when in the erect posture. Some muscular exertion is, however, required to lie on one side or the other, although it be imperceptible in health; since in the extreme prostration of strength, in the last stage of fever, the patient invariably slides upon his back. Speaking, which as it also tends to accelerate respiration, should be particularly refrained from.

3. The exercise of the mind also adds much to the excitement of the body, more especially when there is considerable debility, as in fever, and when, therefore, the exercise of the mental powers requires more exertion on the part of the patient. Hence as soon as a febrile attack has come on, every circumstance that can lead to thought, and especially to such as is connected with anxiety, or may tend to excite passion or emotion, is to be carefully shunned. It is scarcely necessary to warn the practitioner against exciting anxiety in the mind of the patient about his disease, by making it the subject of conversation in his presence; but it should be inculcated to nurses and friends, and all unnecessary attendants and visitors should be excluded, that the subject of business, and all other interesting conversation may be avoided.

4. A very important part of the antiphlogistic regimen relates to the nature and qualities of the food and drink to be given to persons labouring under fever, particularly in the early periods of it. The presence of recent aliment in the stomach always proves stimulant to the system, and the more so in proportion to the quantity received; to the soli-

dity of its texture, and therefore the difficulty of its digestion, &c.; in all these points the irritation ought to be moderated as much as possible, consistently with the safety of the patient. In the beginning of continued fever no great quantity of nourishment is immediately required, the system being able to support itself for a time, without any thing being thrown in to be formed into chyle and blood. Total abstinence from food, for the first few days of continued fever, was much practised by the ancients, who have left us a great many precepts respecting the regulation of the diet in febrile diseases. A considerable degree of abstinence in fact is rendered absolutely necessary by the loss of appetite, and even aversion to food, which prevail through the greater part of the course of fever; but some aliment becomes requisite to prevent the patient from sinking under the exhaustion of the disease. In the first place, however, no principal meal should be employed under these circumstances, even were the organs of digestion capable of retaining a large quantity of food, or of converting it into chyle, on account of the irritation which it would induce: small quantities, therefore, should be given, and repeated more frequently than in health. In the second place, no solid animal food ought to be given during the existence of continued fever, however slight. The effect of such food, when taken, if the stomach do not altogether reject it, is to increase the heat of the patient, not only to his own sensations, but still more to the feel of the by-stander, and frequently, though not always, to the thermometer; to increase the frequency of the pulse and respiration; to excite great restlessness and a sense of uneasiness, and to augment the depression of strength, during the time that it remains in the stomach and intestines. In short, it totally deranges the fever, and often produces the appearance of a fresh paroxysm. (Fordyce.) If the same kind of food be persisted in, it increases the evening exacerbations extremely, brings on delirium much more rapidly, and to a much greater degree than it would otherwise arise, and in every way aggravates the danger of the disease. Dr. Fordyce presses a farther caution strongly upon the attention of his readers: "even after the disease has been terminated by a crisis," he says, "animal food, in a solid form, should be rejected, there being no cause which has produced relapses, as far as the author's observation has gone, so frequently as using solid animal food too soon," from a notion that it would speedily restore the strength of the patient. And he properly suggests that under such circumstances, the fever being gone, the depression of strength no longer existing, and no farther cause of weakness remaining, "the patient, with very moderate nourishment, and the sleep and rest which are so apt to ensue after the fever has been completely carried off, will have his strength restored in a very short time, without using any thing that shall run any risk of reproducing the disease." (Third Dissert. part i. p. 184.) The most proper nourishment in fever, then, consists of light, fluid, vegetable matters; especially the farinaceous substances, coagulated by heat. Decoctions of barley have been employed for this purpose, as the simplest nourishment, from the earliest ages; and the seeds of oats, and other farinaceous grain, with the husks removed, afford similar food by decoction in water. The various forms of vegetable starch, which are prepared under the names of sago, tapioca, arrow-root, &c. answer the same purpose of furnishing aliment, which gives the least disturbance to the organs of digestion. The *polenta* of the ancients, which was composed of a decoction of baked flour, or of bread twice baked, which we call *rufks*, was much recommended in acute diseases. All vegetable substances, however, are not to be employed indiscriminately as food, in fevers. Even the farinaceous

farinaceous substances, if dissolved in water, without being coagulated by heat or otherwise, afford a very viscid food, which is not easily digestible, and disturbs the stomach and the constitution at large: all such vegetables as cabbage, lettuce, green pease, and the like, are to be rejected, on account of their disposition to run into the vinous and acetous fermentations, which the stomach, having its powers depressed, is not strong enough to counteract, whence a considerable quantity of vapour is extricated, which distends the stomach and intestines, and produces partial spasmodic contractions in them. All kind of food which is adhesive to the stomach produces irritation in the system, such as strong solutions of gum Arabic, jellies, formed from the flesh of young animals, or from the membranous parts, which should therefore be avoided. The fruits, especially the sub-acid or summer fruits, or such of them as, from containing less mucilage, are not very prone to fermentation, (Fordyce,) afford a light and agreeable nourishment, as grapes, &c.; those which consist of much acid, and little sugar, although agreeable in small quantities, do not contain sufficient nourishment to be depended upon, such as lemons. Another class of fruits, which contain, besides native vegetable acid, a fermentable mucilage, sugar, and a quantity of farinaceous matter, such as apples, pears, apricots, peaches, &c. should have their mucilage coagulated by heat, when given to patients in fever: baked, boiled, or roasted, they constitute a light and nutritious food. If animal food be employed at all during the progress of continued fever, (and the prejudice in favour of it in this country is so strong, that it is almost impossible to prevent the attendants on the sick from giving it, or to convince them that the patient can be sustained through the fever without it;) it should be used only in solution in water, and solutions only of the muscular parts of full grown animals. These afford a less viscid fluid than the flesh of young animals, or than the membranous, tendinous, or ligamentous parts: the fat or oily part should be removed by cooling and skimming it off, before the solution be given to the sick.

5. The nature of the *drink* which is proper to be given to persons labouring under fever requires some consideration. We have already observed, that, with respect to quantity, it is useless either to force the patient to drink more than his thirst requires, or to debar him from drinking as much as it urges him to take; and also, with respect to its temperature, that it may be taken cold, even in large quantity, under the same circumstances as the application of cold externally; namely, when the patient is in a steady heat, without any sense of chilliness on the one hand, or profuse general perspiration on the other. In regard to the quality of his drink, the principle of avoiding irritation or excitement of the arterial action is to be constantly kept in view, at least in the early stages of fever. When there is considerable heat of the body, water from the spring is generally most grateful to the palate of the patient, and is not, perhaps, to be excelled in wholesome qualities by any combination of art. The slight empyreumatic flavour given to it by toasted bread, or the impregnation of it with a small quantity of the essential oil of the plants of the class *didynamia* of Linnæus, such as sage, balm, &c. must be deemed altogether indifferent in their effects on the digestion of the palate of the patient. All fermented and spirituous liquors, as directly stimulant to the system, should be interdicted during the early and middle stages of continued fever, of whatsoever denomination. Dr. Fordyce, misled by a piece of hypothesis respecting the process of

digestion, and misconstruing the meaning of the word *fermentation*, has recommended "weak vinous fluids" as drink in fevers. As these are in a state of fermentation, he says, "and as substances in a state of fermentation are apt to excite any other fermentation that the same substances are capable of, are perhaps useful to excite in the stomach the fermentations by which the food is converted into chyle; they are, therefore, so far, perhaps, better than pure water." (Third Dissert. part i. p. 216.) But this is an abuse of terms; for there is no analogy between the process of the vinous fermentation in vegetables, and that of animal digestion; and the same author had already cautioned his readers against the use of those vegetable substances as food, which were prone to fermentation, on account of the ill consequences which such fermentation produces. A more free use of vinous liquors is resorted to, with great detriment to the patient, by some practitioners, who suppose that fever is a disease of mere debility, and therefore think of stimulating from the moment the idea of fever occurs: and the same pernicious practice is pursued by the people in general, at least the uninformed part of them, from the truly English prejudice, that if a person cannot eat, (*i. e.* cannot take *solid* food,) he cannot live; and that wine and spirits are therefore requisite to *nourish* him. These notions are so general among the uninformed, whether in or out of the profession, that it requires the constant vigilance of the practitioner to prevent the practical mischief resulting from them: we have hence thought it necessary to speak strongly upon this point; and regret that Dr. Fordyce, whose opinion is by some deemed little less than oracular on this subject, allowed himself to be misguided by an hypothesis, so as to give any countenance to the practice. While the indication of avoiding irritation is to be pursued, fermented liquors, even of the lowest quality, such as small beer, are scarcely admissible, unless the febrile excitement be very moderate.

6. There are other irritating powers which are occasionally applied, and require to be removed in fevers; these are especially a collection of crude and undigested food in the stomach, and of feces in the intestines. If food had been taken a short time previous to the attack of fever, it must remain undigested, and therefore tend to aggravate several of the symptoms, especially the uneasiness about the præcordia, the head-ache, the heat, and the velocity of the circulation and respiration. This, therefore, is another reason for the administration of an emetic, as well as for the free use of diluting liquids. And the stimulus of retained feces in the bowels equally suggests the propriety of laxative medicines or glysters, by which they may be removed; for, while present, they occasion a sense of fulness and weight in the abdomen, and of uneasiness and restlessness in every part of the body, and augment the fever considerably. Of the effect of purgatives, as a general evacuant remedy, we shall have occasion to speak immediately. "The avoiding of irritation in all these particulars," Dr. Cullen observes, after a brief enumeration of the same circumstances, "constitutes the antiphlogistic regimen, absolutely necessary for moderating the violence of re-action; and, if I mistake not, is proper in almost every circumstance of continued fevers." (First Lines, § 132.)

To enable us to fulfil the first indication of "diminishing excessive action" in the system, several remedies are commonly used in aid of the antiphlogistic regimen: these are chiefly such as produce an evacuation of the circulating fluids directly, or of the secretions from them through their respective emunctories: for, as it is believed that the activity of the system depends, in a great measure, upon the stimulus

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of the fluids descending the vessels through which they circulate, it is inferred, that the diminution of the quantity of the fluids must diminish the activity of the sanguiferous system. The fact is proved by experience, whatever explanation may be adopted.

Blood-letting, by opening a vein in the arm, or any other part of the body, is the most direct means of diminishing the quantity of fluids in the system, and has been resorted to from very ancient times; its effects have been explained by various hypotheses, which it is not necessary to enumerate or discuss. To abstract that fluid, which is the immediate pabulum of life, cannot, it is obvious, be a matter of indifference to the constitution: if it be the most powerful means of influencing the vital actions, so it is the most dangerous when improperly employed: if the most effectual mode of diminishing excitement, it is consequently the most apt to induce extreme debility. A cautious consideration of many circumstances is, therefore, requisite in determining on the propriety of blood-letting in fever. Dr. Fordyce affirms, speaking of fever in the sense in which we have defined it, (as distinct from the *plegmasia*, or local inflammations,) that, "the taking blood from a large vein, in any part of the body indiscriminately, never diminished, shortened, nor carried off a fever, in any case he has seen, nor has he found any upon record in which it had this effect." (Dissert. Third, part ii. p. 4.) A statement which may, perhaps, render the extent of his reading very questionable; but which, as it relates to the fevers of this country, we are disposed to consider as correct. A pure inflammatory fever, or synocha, is never seen, we believe, in this country; patients are seldom destroyed by a more general excitement, without topical congestion; but commonly by the subsequent exhaustion, together with local injury of some particular organ. In the fevers which we are acquainted with in this climate, then, blood-letting is generally to be avoided, on account of the danger of the subsequent debility which it occasions; more especially when we consider that this debility is to be expected, at all events, to ensue, in consequence of the failure of the digestive powers which support the waste of the body; of the loss of sleep necessary to restore the vital energy; and of the constant over-action of the whole system, which is followed by proportionate exhaustion. In typhus, under all its modifications, these observations demand attention; and it is now generally admitted that blood-letting is a pernicious practice in that form of fevers. It were not easy, indeed, to comprehend how the practice in low fevers could have been so generally and so long pursued, did we not know the influence of authority in perverting observation. While the precepts of Galen and Celsus were followed by Sydenham, Huxham, and others, these sagacious observers did not fail to remark the occasional injuries which the practice produced; (see Wilson on Febrile Diseases, vol. i. p. 671, *et seq.*) yet they did not escape from the trammels of authority, but repeated the practice, expressing "great concern and astonishment" at the failure and mischief, which were often most evident. (See Huxham on Fevers.)

As the employment of blood-letting, in idiopathic fevers, requires much caution and discernment, the following circumstances were suggested for the consideration and guidance of the practitioner by Dr. Cullen. 1. The nature of the prevailing epidemic; from which we learn the nature of the symptoms which are to be expected, as well as the influence of different remedies. 2. The nature of the remote cause: all fevers arising from contagion, whatever be the state of the patient, or the appearances of the disease in the commencement, will soon assume the form of typhus,

and therefore blood-letting is seldom admissible, although the excitement in the beginning be considerable. 3. The season and climate in which the fever occurs; for the symptoms are much more violent, and the changes more sudden in sultry than in temperate climates, in the autumn than in the spring. The practitioners in hot climates have been divided in their opinions respecting blood-letting; but in this, as in most other cases, the extremes are to be avoided; and it seems probable, that blood-letting is only to be employed in tropical climates, when the violence of the excitement threatens to prove speedily fatal, or to induce extreme debility, and then only to push it to that extent, which the urgency of the symptoms absolutely requires. (See FEVER, *yellow.*) 4. The degree of phlogistic diathesis, or of high excitement; which, however, it is difficult to define. The same degree of excitement, which warrants blood-letting in an epidemic, which partakes much of the *synocha*, or inflammatory character, or in a fever from cold, violent exercise, or rage, does not warrant it in a typhoid epidemic, nor in fever from contagion. 5. The period of the disease. In the most ardent fevers, as soon as the symptoms shew any tendency to decline, the proper period for blood-letting is past. Even Huxham, prejudiced as he and most of his contemporaries were in favour of this remedy, admits that "bleeding, unless in the beginning, seldom did service." 6. The age, vigour, and plethoric state of the patient. 7. The patient's former diseases, and habits of blood-letting; if he has been subject to inflammatory complaints, more vigorous remedies may be employed; and if he has been in the habit of losing blood, he bears the loss of it better, as habitual blood-letting produces habitual plethora. 8. The appearances of the blood drawn; which are chiefly the firmness or loose consistence of the coagulum, the presence or absence of the *buffy coat*, the proportion of serum to the crassamentum, &c. (See BLOOD, *morbid alterations of the.*) 9. And, lastly, the effects of the blood-letting that may have been already practised; namely, the continuance or alleviation of the symptoms, the occurrence of debility, &c. (See Cullen loc. cit. § 142, and Wilson on Fevers, vol. i. pp. 648, and 668, where this subject is fully and ably discussed.) On the whole, however, few cases of fever in this country require venesection, and in no case, perhaps, under any circumstances, is this remedy admissible after the first five days of the disease.

But the use of *local blood-letting*, by means of leeches, or cupping, is often of great advantage in certain conditions of fever, more especially in relieving local congestions of blood in the head, and the symptoms thence resulting. Thus, when there is much head-ache, or delirium, accompanied by flushing of the countenance, and redness of the eyes, the application of a few leeches to the temples, or the scarificator and cupping-glasses to the same part, or to the nape of the neck, or even taking four or five ounces of blood from the jugular vein, has often diminished these symptoms considerably, sometimes carried them off entirely, and with them the whole fever. Under the same circumstances bleeding from a part distant from the head has been of no manner of use. If the strength of the patient be much diminished by the fever, or otherwise, the application of one leech to each temple is often of considerable use. (Fordyce.) We are disposed to believe, that the local evacuation of blood is a remedy too much neglected in the general practice in fever.

Sweating is another mode of diminishing excessive vascular action in fevers. The observation, however, that a free sweating commonly takes place in the crisis of intermittent fevers, and in those which occasionally occur in continued fevers,

wards necessary during the whole progress of the fever; and in the weakest condition the use of a clyster may be resorted to. The second operation, with a view of emulging the biliary ducts, and of evacuating the morbid secretion of the liver, and of the other glands, and clearing the whole canal, is often required during the continuance of the disease. This is indicated, 1. By the appearance of the stools, whether they are of a highly bilious colour, which implies a copious extrication of bile from the liver; or of a dark brown or green hue, and very offensive odour, which implies a morbid state of the secretion; 2. By prais in the abdomen, especially when there is at the same time a degree of fulness and tension in the epigastric and hypochondriac regions, and a tenderness perceived on pressing the abdomen; or when there is also a degree of *tenesmus*, or frequent desire to go to stool. 3. When, together with these symptoms, the tongue is much loaded and parched, or sometimes when there is a considerable spitting, when the countenance is of a dirty or leaden hue, and the breathing more oppressed than the state of the circulation would lead us to expect. Sometimes with this state of the abdomen and countenance a great languor takes place, even to fainting, although there are no other symptoms of extreme prostration of strength, and the pulse, though quick, is not equally languid; under such circumstances we have seen the languor speedily removed by a copious evacuation from the bowels. A degree of dysenteric affection is not unfrequently seen in the advanced periods of fever, that is, a frequent discharge of loose or slimy stools, with some griping and tenesmus; this is most effectually relieved by purgatives with which opiates are combined, in order to obviate the irritation and exhaustion which the operation of the cathartics might induce. Calomel and opium combined in small doses seem to answer this purpose very effectually. Where the mere emptying of the bowels is the object of the medicine, and especially where extreme weakness has already come on, or is to be speedily expected, the milder neutral salts, as the sulphate of magnesia, the Cheltenham, or Rochelle salts, castor oil, magnesia and rhubarb, &c. are the most proper remedies; but the more active agents, as calomel, and jalap, in moderate doses, (Dr. Hamilton's formula consists of three or four grains of the former, with six, eight, or ten of the latter,) are requisite; and these, indeed, may almost supersede all other laxatives; or senna, rhubarb, &c. may be given with the calomel. It is not very important to dilate on the different remedies; for when the indication is understood, the means of fulfilling it will readily occur. An active purgative, during a state of extreme debility, may be productive of great mischief; and in the last stages of contagious typhus such a medicine is to be abtained from altogether: even the mildest cathartic operation has, at such times, occasionally produced a dangerous sinking of the vital powers. But from this fact it were an error to infer, that active purgatives are to be discarded altogether from our practice in typhus, as the Brunonians have asserted.

The humoral pathologists, from an hypothetical notion of the remains of the *materies morbi* being retained in the constitution after the cessation of fever, have directed the administration of cathartics to carry them off, and to preserve the convalescent from their future influence; and sir John Pringle has suggested the propriety of using them, during the state of convalescence, with a view to prevent a too hasty repletion, which an indulgence of the appetite is sometimes apt to produce; but, he observes, cathartics at that time seem otherwise necessary. But Dr. Fordyce remarks, that he has observed more relapses to take place

when purgatives have been used after the cessation of fever, than when they have not been employed. Indeed, the notion of the humorists, that by partial evacuations, whether by bleeding or purging, the remaining fluids could be deprived of the morbid matter, supposed to be diffused in them, is too absurd to require a serious refutation. Nevertheless, this practice of purging, "to carry off the dregs" of fever, small pox, &c. is still generally prevalent among the ignorant, both in and out of the profession.

Blisters the skin has been resorted to as a remedy in fever, upon two very different principles, which are scarcely consistent with each other, and neither of them, perhaps, is much entitled to our confidence. Inflammation, and suppuration, or some other discharge, having been observed to precede the cessation of fever in certain cases, this process was attempted to be imitated by the application of blisters or irritants, composed of cantharides, mustard, &c.; and the humorists, with their usual absurdity, supposed that these applications would, like a magnet, attract the morbid matter to this irritated part, by which it might be carried off. On the other hand, the inflammation, thus excited, has been considered by others as stimulant to the system, and therefore as useful to support the strength in the last stage of prostration, the discharge being altogether overlooked.

Had the recommendation of blisters, as a general remedy in the early stages of fever, rested only upon the principles and practice of the humorists, we should have dismissed the subject briefly: but it has been maintained by several eminent observers, and by none more strongly than by Dr. Lind of the Haftar hospital, whose experience and abilities are entitled to the highest regard. "I do not know a more certain proof," says this respectable author, "of a prevailing infectious fever, than that of twenty patients in fevers *blistered* at night, sixteen will next morning be entirely free from heat, head-ache, pain, and fever." (Loc. cit. chap. ii. sect. 1.) And he denies the stimulating effect of blisters in contagious fevers, and affirms that, "according to the nurses' phrase, the patient generally *received a cool* from the *blisters*." (Ibid.) These encomiums, however, are very far from being corroborated by general experience, or by the authority of many able physicians; on the contrary, the testimony of the majority tends to prove, that little is to be expected from blisters in fevers unaccompanied by local affections. We have seen numerous instances in which large blisters had been applied between the shoulders in the early periods of fever: but we never witnessed any marked effect, either good or bad, in those cases. Like the local blood-letting, however, they are decidedly beneficial in relieving local pains and congestions; and every practitioner has experienced their utility, when the brain, stomach, lungs, &c. have been thus affected. Sir John Pringle observes, that blisters were only of service in the gaol fever, when the patient was threatened with an inflammation of the brain. "Blisters, before *useless*, became then of service:" and in the synocha, or inflammatory fever, he was led by experience to confine their use to those cases where the head-ache was considerable, which they seldom failed to relieve. In fevers attended with coma or delirium they are often employed with advantage, being applied over the shaven scalp; for the nearer they are applied to the part affected, they are the more powerful in giving relief, like all other local remedies.

Dr. Cullen was likewise a strong advocate for the use of blisters in fevers; but he considered them as most beneficial in the advanced periods of the disease, "when the re-action being weaker, all ambiguity from the stimulant power of blistering is removed." We are disposed to believe, however,

ever, that the stimulus of a blister is productive rather of irritation, than of support to the sinking system; and the inflammation thus occasioned, when the vital powers are low, is liable to terminate in gangrene. Rubefacients are safer than blisters in this state of the system, but do not seem to be of much benefit where there is no local affection. Sinapisms, or mustard poultices, are sometimes applied to the feet, especially where there is coma, or great failure of the *vis vite*: this, like the old practice of bleeding from the feet, probably originated in the obsolete doctrine of revulsion, and might be more efficacious, if the sinapisms were applied to the region of the stomach, or to the head.

The second indication is, "to increase the actions that are defective." It has been seen, in tracing the history of the progress of fever, that the symptoms, which occur in the latter stages of the disease, are principally the result of a general failure of the vital power, or nervous energy: and that such a failure is the necessary result of the previous over-excitement, and the privation of the ordinary means of support, from aliment, sleep, &c. Hence, then, the means of preventing this failure of life consist partly in fulfilling the first indication, or diminishing the over-excitement, and partly in using those remedies which tend to support and increase the vital actions, when the symptoms of their failure appear. It must be obvious, therefore, that the early employment of stimulants, cordials, and tonics, (which was resorted to by the humoral pathologists, in order to accelerate the *concoction* of the morbid matter; by the disciples of Brown, with a view to obviate debility, and by others to prevent putrefaction,) must be extremely pernicious. It is a practice founded on the same grounds as the vulgar error of the people in forcing food upon a person in fever. They forget that, in order to nourish the body, the food must be digested, converted into chyle, and assimilated; but that, while the system is incapable of performing these functions, the food introduced tends but to increase the weakness, by increasing its cause, the febrile state. In like manner, these practitioners no sooner hear the name of fever, than they immediately ply the patient with wine, Peruvian bark, and various cordials, regardless of the period and circumstances of the disease, and thus accelerate the debility, the consequences of which they are most anxious to avoid. This treatment cannot be too strongly reprobated; especially as it is still adopted by many in the profession, who practise by rote, notwithstanding the proofs of its injurious consequences, which experience has amply ascertained. And it is most particularly to be condemned, when there are symptoms of considerable local congestion, especially in the head.

When, however, the means of moderating the excitement, in the former stages of the fever, have been omitted, or have failed to terminate the disease, and the symptoms of exhaustion and defective action begin to appear, it then becomes requisite to administer those remedies which possess a stimulant power over the actions of the arterial and nervous systems. Of the medicines which support and increase the actions of the animal body, those which are possessed of strong sensible qualities, and excite an obvious and immediate action, are denominated *stimulants*; and those which slowly, and by repeated exhibition, increase the power and force of these actions, or the *tone* of the moving parts, have been called *tonics*. Of the former class are wine, spirits, volatile alkali, the æthers, &c.; of the latter are the bark of cinchona, cascarilla, and other vegetable bitters, the metallic salts, and oxyds of iron and zinc, &c. Now, as the operation of the latter is comparatively slow,

they are less useful in the late stages of continued fever than the articles of the former class. The principal tonic medicine that has been employed in continued fever is the cinchona, or Peruvian bark; which has probably been given in these fevers, in consequence of its success when administered in the intervals between the paroxysms of intermittents. Between this operation, however, and the cure of a continued febrile state, it is obvious that there is not much analogy; and experience has evinced accordingly, that the practice is not beneficial; but that, on the contrary, it more frequently increases the symptoms of continued fever, and that its use is most likely to be detrimental, especially when the tongue remains foul, the pulse frequent, and the skin not yet become soft, cool, and moist. Dr. Fordyce has accurately described the consequences which we have occasionally witnessed from the exhibition of the bark, even when the favourable remission of the symptoms seemed to justify its use. "The relaxations which began to take place in the disease have been much diminished, the pulse has become more frequent in the morning, the head-ache more considerable, the skin drier, the tongue covered with a thicker fur, the cost-veins greater, if the patient was not thrown into a purging, the oppression upon the præcordia greater, and likewise the difficulty of respiration greater. On the following evening the head has been also much more affected, that is, the confusion and delirium have been much more considerable, and the patient altogether worse than he probably would have been, if no remedy whatever had been exhibited, and there has been less chance of crisis in the fever, and it has been longer of being worn out." (Third Dissert. part ii. p. 148.) Where there are marks of congestion in the head, lungs, or other viscera, the administration of bark is at all times to be deprecated. In a word, the most accurate experience has taught us, that the cinchona, especially in substance, is seldom beneficial, and often injurious, in continued fever of any kind; and that it is most useful in restoring the strength in the convalescent state, when the symptoms of fever have altogether disappeared. The only cases in which we have seen any advantage from it, are those in which there is an obvious remission and exacerbation, especially at tertian periods; a form which we have sometimes observed the continued fever of this country to assume.

A great variety of stimulant remedies have been employed for the purpose of obviating debility in the late periods of continued fever; of these wine is generally the most grateful, and not less efficacious than most of those which have been recommended. But this, we believe with Dr. Gregory, has been often given in too large quantities, to the amount of two or three bottles in the day. We have certainly seen the strength roused by powerful stimuli in great quantity; but we have also seen this new excitement immediately followed by a fatal inflammatory condition of the brain. Perhaps a pint in the day may be generally sufficient. When wine cannot be procured, cyder, porter, or spirits diluted with water, sweetened and acidulated, are tolerable substitutes. Dr. Cullen was of opinion that the last mentioned compound and opium produced all the effects of wine; but opium does not appear to support the pulse like wine. With respect to opium, it is generally inadmissible while any considerable excitement exists, and especially when the skin is hot and dry, the tongue very foul, the bowels bound, and marks of congestion in the head, or elsewhere, appear: under these circumstances it neither diminishes restlessness, nor tends to induce sleep; but, on the contrary, it increases the watchfulness, and disturbs the mind with excessive and frightful dreaming, it creates the delirium, and the tedious

beat and thirst. When the skin is moist and cool, and the head but slightly affected; when the tremors, subfultus of the tendons, or other spasmodic affections manifest themselves; when the bowels are excessively relaxed, and the evacuations watery; opium may be usefully employed. Under the same circumstances camphor is frequently administered as a stimulant: but it may be justly doubted, as Dr. Fordyce has observed, whether the very small dose contained in what is called the camphor mixture, usually given, produces any decided effect: since much larger quantities have been given without any sensible operation. Musk, castor, and other substances of powerful odour, have been often given in the last stage of fever: but the effects have been differently represented by different practitioners, some believing them to be very effectual stimulants, while others have deemed them almost inert. Dr. Gregory considers them as no farther active, than by their strong impression on the senses, and much less efficacious antispasmodics than wine and opium. The *serpentaria*, or snake-root, *contrayerva*, and other cordial and aromatic vegetable substances are often administered with advantage. It must be remembered, however, that where there are marks of considerable congestion of the brain, all powerful stimulants, which will tend to augment that condition, will ultimately fail to produce strength; but, on the contrary, will increase the most dangerous symptoms of the disease.

Much has been said relative to the prevention of putrefaction in the last stages of infectious fevers. This, however, as chiefly the result of extreme prostration of strength, is principally obviated by the means of support already pointed out. These marks of putrefactive changes exist principally in the excretions of the patient; which it is important to remove, as their presence seems to augment the depression of the vital powers: hence the utmost attention to cleanliness is requisite, and clean air, if we may so speak, or air free from the noxious exhalations, admitted by a constant ventilation, contributes to support the patient. The putrid fordes contained in the stomach or bowels are often evacuated with great advantage, where that can be effected by gentle means, which do not contribute to farther exhaustion. With a view to correct the putrescency of these contents of the alimentary canal, various antiseptics have been recommended, especially the mineral acids. That these acids, especially the vitriolic or sulphuric, which has been principally employed, are sometimes useful, cannot perhaps be questioned; but it is probable that their administration was suggested upon the principle of being chemically antiseptic to dead animal matter. A chemical explanation of the operation of a medicine on the living body is somewhat suspicious; and Dr. Fordyce has remarked, that no antiseptic can be applied in that proportion to the living solid, as would be requisite to prevent putrefaction in dead animal matter. (Loc. cit. part ii. page 172.) These acids, however, tend to quench thirst, and to settle the stomach, and are grateful to the patient.

Dr. Gregory is in the habit of concluding his lectures on the subject of fever by strongly cautioning his pupils not to do too much to patients labouring under the disease; for he justly averred that, in many cases, little more would be requisite, after the proper evacuations at the commencement, than cool drink, and the antiphlogistic regimen already pointed out. And this is unquestionably true of fevers not occasioned by a virulent contagion, and where no considerable local congestion occurs; in which case it becomes us to watch rather than to be active. This, however, will seldom satisfy a patient, or his friends; and hence the bustling mischievous empiric is often preferred to the expe-

rienced observer, as Sydenham, who attributes some of the worst symptoms occasionally to the "nimia medicorum diligentia," feelingly laments. "Sed, quod dolendum omnino est, ægrorum quamplurimi, haud satis gnari, quod perinde sit medici peritè quandoque nihil agere, atque alio tempore efficacissima adhibere remedia, prohibitatis atque fidei fructum hunc capere nolunt, sed vel negligentia vel ignorantia id imputant, cum empiricorum infulmissimus quilibet medicamenta medicamentis adjicere æque novit, ac solit magis quam medicorum prudentissimus." (Sydenham, Opera, sect. v. cap. 6.)

Division of Fevers.—Having discussed the nature, causes, and cure of fever in general, it remains for us to notice the various forms of the disease, which have been distinguished by particular appellations. From the earliest periods of medical history, a great number of names have been applied to the varieties of febrile disease, which, as they were often deduced from hypothetical notions, respecting the nature and cause of the fever, often mere indications of the violence or absence of particular symptoms, and often very vague in their signification, have tended to introduce much confusion into the writings of physicians on this subject. The majority of the names, which have been thus invented, are applicable to the same fever; at least to a fever arising from one and the same source; whence, it has been justly remarked by Dr. Lind, that physicians, who have had the most frequent opportunities of seeing numerous patients in fevers, have always found great difficulty in arranging their cases under the common appellations, and that the attempt has frequently led them into absurdities. (On Fevers and Infections, chap. ii. sect. 2.) For to the same fever the terms putrid, petechial, malignant, miliary, nervous, bilious, typhous, verminous, &c. are often equally applicable. It is obvious, however, that accidental symptoms of local affection, or the accidental violence or mildness of any particular symptom, do not mark a fundamental change in the nature of the disease, and are therefore not the proper grounds for multiplying names, which tend to confound disorders that are essentially the same, and therefore to mislead us in our practice.

The least ambiguous division, which is now generally adopted, is into three orders, of *intermitting*, *remitting*, and *continued* fevers; which are again distinguished by their leading symptoms. The intermitting fevers are those which occur in distinct paroxysms, or fits, in the intervals between which there is a complete *apyrexia*, or absence of all febrile symptoms; this is termed an *intermission*. In the remitting fevers, which also consist of repeated paroxysms, there is no entire intermission between the paroxysms, but only a considerable abatement or *remission* of their violence; the return of a new paroxysm, however, being generally marked by chilliness, and some other symptoms of a cold stage. By *continued* fever is understood, a fever which goes on day after day, without any intermission or decided remission of the symptoms; not in an uniform progress, however, but with an obvious aggravation or *exacerbation* of the symptoms of a hot stage, once in the twenty-four hours, and generally in the evening. Most of the ancient and modern writers, indeed, down to the time of De Haen and Cullen, have described a continued fever, proceeding in one uniform and unvarying tenor, without exacerbation or abatement of any symptom, in a word, consisting of one lengthened paroxysm: this they denominated a *continent* fever, in contradistinction from the *continued* fever, just described. By the Latin writers the former is called *febris continens*, the latter *febris continua*; by the Greeks the former was denominated *πυρετος συνεχης*; *synochus*; the latter

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πρότερος συνεχής; synchees. By some writers, again, the *continent* fever is called continued, and what we now understand by continued fever is called *continued-remittent*. Our countryman, Morton, whether through mistake or design is not evident, has reversed the common acceptation of the terms, (as has been justly remarked by Burferius, *Inst.* vol. i. § 194. and by Selle, in his *Rudim. Pyretologiae*.) and describes the *continent* fevers, or *συνχης*, as remittent. (See Morton, *Pyretologia*.) De Haen, however, and Cullen, denied altogether the existence of a continent fever, without periodical exacerbation, as it never occurred to them in the course of a long experience; and their opinion is now generally admitted as correct. Burferius and Selle maintain the ancient doctrine.

The confusion which has enveloped this subject does not, however, end here. For Dr. Cullen, Burferius, and others, who have still farther reduced the orders of fevers to two only, *viz.* intermittent, and continued, (deeming the *remittent* fevers different only in degree,) have nevertheless widely disagreed in their arrangement of the latter. Cullen has classed the remittents with the intermittent fevers, considering the remission as a lesser intermission; while Burferius has placed them with the continued fevers, considering it as a greater exacerbation and abatement: so that we find the same identical diseases among the continued fevers in the writings of Burferius, which are placed among the intermittents of Dr. Cullen. The arrangement of Dr. Cullen, however, would seem to be the most correct; first, because the intermission and remission more nearly accord in their phenomena; and, secondly, because both these fevers arise in general from the influence of marsh effluvia.

We shall now proceed to enumerate the principal appellations of fever which are to be found in the writings of physicians; referring for the full explanation of the majority of them to their places in the alphabet, as more consistent with the nature of a dictionary. See also *FEBRIS*; where the Latin and Greek names, for which we have no corresponding English terms, are enumerated.

FEVER, Acute, a term of indefinite application; sometimes used to denote idiopathic fever, and sometimes indicating a fever with violent symptoms, whether idiopathic, or symptomatic of local inflammation.

FEVER, Ardent, *Febris ardens* of the Latins, the same with the *caufus*, *καυσος*, of the Greeks, signifies those forms of fever in which the heat in the early stage is excessive. The words are from *ardeo*, and *καυω*, *I burn*. The terms have been variously applied to intermittent, remittent, and continued fevers, in which this symptom prevailed. The yellow fever of hot climates is the most *ardent* fever with which we are acquainted. (See *FEVER, yellow*.) The word *ardent* is nearly synonymous with *inflammatory*. See Sennertus de *Febris*, lib. ii. cap. 12.

FEVER, Bilious, a term applied to the autumnal fevers, whether idiopathic, as the remitting fever, and those continued fevers in which there is a considerable discharge of bile, or to cholera, and dysentery. (See Pringle on *Diseases of the Army*, part ii. chap. 1. and part iii. chap. 4.) Hippocrates considered all autumnal epidemics as originating from a corruption of the bile, and the term has been often used, perhaps, upon his authority, without any evidence of a morbid state of this fluid. In hot climates and seasons, however, there is generally a tendency to superabundance of the bilious secretion; and the *yellow fever*, which is so named on account of the bilious tinge of the surface, may be considered as an example of bilious fever in its most violent form.

FEVER, Catarrhal. See *CATARRH*.

FEVER, Contagious, is a term applicable to any febrile disease which is propagated by contagious effluvia, as measles, scarlet-fever, &c.; but when the term is used alone, by modern writers, it is generally understood as applying to *typhus*, or the common contagious fever of temperate climates. See *TYPHUS*.

FEVER, Continent, and *continued*; these terms have been explained above. See *Division of Fevers*.

FEVER, Depuratory. See *DEPURATORY*.

FEVER, Diary. See *DIARIA*, and *EPHEMERA*.

FEVER, Dysenteric, sometimes used as synonymous with *dysentery*; but Sydenham speaks of a dysenteric fever which prevailed during and after the continuance of an epidemic dysentery in the year 1669, in which the true symptoms of dysentery, the frequent dejections and tenesmus, did not appear; the term, therefore, is almost a solecism. (See his works, *sect. iv. cap. 5*)

FEVER, Ephemeral. See *EPHEMERA*.

FEVER, Epidemic. See *EPIDEMIC*.

FEVER, Erratic, a variety of intermittent fever, constituting the fourth genus, of the third order, of the class of fevers, in the nosology of Sauvages; and defined as consisting of fevers, "which occur in similar paroxysms at a longer interval than four days, or altogether of an uncertain type:" the intervals mentioned are *quintan*, or of five days; *septan*, or of seven; *nonan*, *nonan*, and *deciman*. But Dr. Cullen considers all these as modifications of tertian or quartan intermittents. (See Sauvages, *class. ii. genus 12*. Cullen *Synopf. Nosol. class. i. genus 1*.) The last species of Sauvages is *erratica vaga*, the paroxysms of which occur at uncertain and irregular intervals. See *ERRATIC*.

FEVER, Eruptive, any fever accompanied by an eruption on the skin; it is the same with *exanthema*; which see.

FEVER, Erysipelatous. See *ERYSIPELAS*.

FEVER, Hætic. See *HECTIC*.

FEVER, Hospital, is the typhus, or contagious fever, so named, because it frequently occurs in crowded hospitals. See *TYPHUS*.

FEVER, Goal, the same fever occurring in crowded prisons.

FEVER, Inflammatory, a term sometimes used to denote that species of febrile disease which is secondary, or symptomatic of local inflammation; such as pleurisy, *enteritis*, or inflammation of the bowels, &c. In this sense sir John Pringle employs it, when, speaking of the diseases of an army, he says, "upon first taking the field, as well as during the winter, pleurisies and peripneumonies are the most common forms of the inflammatory fever." (Part iii. chap. 1.) But more commonly the term is used to denote that form of idiopathic fever in which the symptoms of the hot stage are severe, and are not succeeded by the symptoms of extreme debility, which characterize typhus. In this sense, the epithet *inflammatory* is put in opposition to the term *nervous*, which applies to the varieties of the latter. "Sometimes we can perceive no part more affected than another," says sir John Pringle, "and only some general inflammatory symptoms: the distemper is then called simply an *inflammatory* fever, though probably some of the more indolent parts may at this time be affected with inflammation." *Loc. cit.*) Dr. Cullen has applied the term *typhus* to this modification of fever, not anxious to employ the appellation according to the ancient acceptation of the term, but relying on his definition for conveying a clear notion of the disease. The *typhus* is that species of fever in which "the heat of the body is greatly augmented; the pulse frequent, strong, and hard; the urine high-colored; and the several functions little disturbed." (Cullen, *Synopf. Nosol.*)

F E V E R.

class i. gen. 4) Under this definition it corresponds with the *synocha non putris*, and *continua non putrida*, of feveral authors, and the (absurdly named) *ephemera plurium dierum*, or diary fever of several days, of others. (See Senner. De Febr. lib. i. cap. 6. Boerhaave, 728.) Such divisions, however, cannot be regarded as accurate, or as discriminating forms of fever essentially different in their nature; for, in fact, a pure *synocha*, or fever with no other but inflammatory symptoms, is scarcely ever met with, as we have already remarked; nor is a purely opposite, or *typhous* fever, which is characterized only by symptoms of prostration of strength; almost every continued fever being inflammatory, or marked by some degree of excitement in the beginning, and nervous or typhoid, *i. e.* marked by debility in the latter stages. This constitutes an intermediate genus, which Dr. Cullen has called *synochus*. Thus the *causus*, or *febris ardens* of the ancients, and the *yellow fever* of modern times, is characterized by the highest excitement in its first stage, but is perfectly typhoid in the last.

The symptoms of the *synocha*, or inflammatory fever, as it is commonly described, are as follows. The depression of strength, which precedes and accompanies the attack, is not so great as in contagious fever, and the cold stage is more frequently absent, and less marked. The pulse, even in the cold stage, is seldom small or very frequent; after the heat commences it becomes full, rapid, and, as it has been termed, vibrating; still, however, its frequency is less than in those fevers in which debility prevails. The respiration is frequent, hurried, generally oppressed, and attended with a dry cough. The heat is greater than in other continued fevers, and although burning to the feeling of a bystander, it does not excite that pungent or acrid sensation which is observed in the severe cases of typhus. Dr. Moore remarks, speaking of the latter, "on pressing the skin of the patient a sensation of a peculiar penetrating heat remains on the hand for some minutes after; whereas, the heat communicated by the skin of a patient in the inflammatory fever is more transient." (See his Medical Sketches.) Dr. Huxham, as well as Pringle, and others, has remarked the "peculiar biting heat" in malignant fevers, and observes that Quesnay calls it "*la chaleur d'acrimonie*," and very justly distinguishes it from *la chaleur d'inflammation*. The sensation in truth is as different as touching a very hot piece of dry wood, and dipping your finger into tepid spirit of hartshorn. The head-ache in inflammatory fever is generally considerable, accompanied with throbbing of the temples, and noise in the ears: the face is full and florid, and the eyes inflamed, and incapable of bearing the light. The deprivation of the senses, however, is less frequent than in fevers with debility, nor is delirium a common symptom; but when it does occur in *synocha*, it rises to a degree which, from the debilitated state of the system, we scarcely ever meet with in typhus: the patient becomes frantic, and is with difficulty retained in bed. This constitutes the delirium *ferox* of authors. (See DELIRIUM.) When the delirium is obdurate in *synocha*, we have reason to suspect an inflammatory affection of the brain, which there is still more reason to dread, if the patient be oppressed with coma. In truth, between this form of disease, and inflammation of the brain, the diagnosis is difficult, if there be any essential difference. The secreting powers are more completely suspended than in most cases of typhus; the skin, mouth, and throat are dry, and the mucus covering the tongue becomes foul and viscid; the urine is high-coloured, and the bowels costive. In a word, it is obvious that the inflammatory fever is chiefly characterized by a higher degree of the symptoms of the hot stage of fever.

When *synocha* proves fatal within a few days of its commencement, (which, if it ever happens, is a rare occurrence,) the pulse, it is said, does not become weak or intermitting before death; the patient seems to be carried off by the violence of the excitement. When the disease continues for a longer time, however, and the remissions are at all evident, the pulse during these (although the fever has not yet assumed the form of typhus) becomes weak and languid, the patient appearing to be exalted by the foregoing paroxysm; which is renewed, however, in a short time, with all its former violence, or even stronger marks of excitement. The hæmorrhages, which frequently occur in inflammatory fever, are generally from the nose, ears, lungs, rectum, (if the patient be subject to the hæmorrhoids,) or from the uterus, and are almost always favourable; the blood discharged has the healthy appearance, except that the coagulum is frequently covered with the buffy coat. Hæmorrhages from the upper parts of the intestines, kidneys, urethra, skin, eyes, &c. are rarely, from the two last perhaps never, observed in inflammatory fever.

Such are the symptoms of most-marked *synocha*; they vary in different cases from those just enumerated, to the mild febrile symptoms attending a common catarrh or ephemera. After they have continued for some time, if they do not terminate the patient's life, they always, at least in this country, begin to be changed to those of typhus; so that the whole disease is a *synochus*. The proportional duration, as well as violence of these respective stages of the disease, is different in different cases; and proves an endless source of variety: but the symptoms which follow the state of increased excitement are the most dangerous as well as the most varied part of the fever.

The principal indication in the cure of inflammatory fever, it must be evident, is that which we have stated above as the *first* indication, in the general cure of fever, (see FEVER, *Method of Cure*), *viz.* "to diminish excessive action." The means of fulfilling this indication, by the antiphlogistic regimen, and evacuant medicines, in other words, by removing or diminishing all sources of irritation, and by diminishing the quantity of the circulating fluids, have been detailed at length, and need not here be repeated. The higher the degree of inflammatory diathesis, the more requisite will it be to employ active evacuation, at an early period of the fever, and there will be the less hazard of carrying it to an injurious degree. In this country, however, as we have already stated, such a degree of *synocha* is seldom seen, as requires, or is benefited by general blood-letting. In the ardent, or yellow fever of tropical climates, the inflammatory excitement is more rapid and more severe, and the activity of the antiphlogistic practice must be necessarily greater. (See Wilson on Febrile Diseases.) See FEVER, *yellow*.

FEVER, *Intercurrent*, a denomination given by Sydenham and others to those forms of fever which constantly occur *sporadically*, that is, independent of the particular epidemic season, or of the reigning contagion.

FEVER, *Intermittent*, a fever which occurs in distinct fits or paroxysms, with an interval of health, or complete absence of fever, between them: from the shivering which commences the fit, the disease has been called *ague*, which see; and according as the fit recurs, every day, every alternate day, or once in three days, it has been termed a *quotidian*, a *tertian*, or a *quartan* ague. See these words below.

FEVER, *Intestinal*, a term applied by some writers to those varieties of continued fever in which there is much diarrhœa, with fetid stools, &c. pain of the belly, distension, or other symptoms of abdominal disorder. Other authors

ctors have used the epithets *gastric* and *mesenteric* with the same intention: and the febræ *stercorales* and *excrementose* of others are the same. This multiplication of names is altogether useless, since they do not imply any difference in the essential nature of the fevers, and it gives rise to great confusion in medical language.

FEVER, *Lenticular*, the same with *petechial*. See below.

FEVER, *Malignant*, a vague and improper term generally applied to fevers of a contagious origin, with symptoms of extreme prostration of strength, petechiæ, hæmorrhagies, fœtid discharges, &c.; in a word to typhus, in its worst forms; and also to scarlet fever in its most severe modifications, the plague, and other dangerous epidemics.

FEVER, *Miliary*, a modification of common fever, accompanied with an eruption of spots not larger than millet seeds. See *MILITARY eruption*.

FEVER, *Milk*, a fever affecting puerperal women, and accompanied with distension of the mammæ. See *MILK-Fever*.

FEVER, *Morbilious*, *Felvis morbillosa*, a term given by Sydenham, perhaps with the same impropriety as in the case of *dysenteric* fever, (see above,) to a fever occurring during the prevalence of epidemic measles, but without the eruption, or with very little of it. See *MEASLES*.

FEVER, *Nervous*, a name given by some writers to all the varieties of fever, accompanied with debility, in contradistinction to those which are characterized by arterial strength, which they call *inflammatory*. But Dr. Huxham, and after him many other physicians, have appropriated the term nervous to a particular form of fever with debility, which goes through a long and slow course, unattended by the excessive excitement of inflammatory fever, on the one hand, or by the extreme prostration of typhus on the other. At the same time, as it is accompanied by great loss of muscular powers and mental inactivity, without the marks of putrefecency in the fluids discharged, it was supposed to be a disease of the "animal spirits," or nervous fluid, and not of the blood; whence the term *nervous* was adopted. Dr. Huxham's description is considered as a very masterly example of medical history, and we shall give the outline nearly in his own words.

The patient at first grows somewhat listless, and feels slight chills and shudders, with uncertain sudden flushes of heat, and a kind of weariness all over, like what is felt after great fatigue. This is always attended with a sort of heaviness and dejection of spirit, and more or less of a load, pain, or giddiness of the head; a nausea and dis-relish of every thing soon follows, without any considerable thirst, but frequently with urging to vomit, though little but insipid phlegm is brought up. Though a kind of lucid interval of several hours sometimes intervenes, yet the symptoms return with aggravation, especially towards night. The head grows more heavy or giddy, the heats greater, the pulse quicker but weak, with an oppressive kind of breathing. A great torpor, or obtuse pain and coldness, affects the hinder part of the head frequently, and oftentimes a heavy pain is felt on the top, along the coronary suture; this, and that of the back part of the head, generally attend nervous fevers, and are commonly succeeded by some degree of delirium.

In this condition the patient often continues for five or six days, with a heavy, pale, sunk countenance, seeming not very sick, and yet far from being well; restless, anxious, and commonly quite void of sleep, though sometimes very drowsy and heavy; but although he appears to those about him actually to sleep, he is utterly insensible of it, and denies that he doth so. The pulse, during all this time, is

quick, weak, and unequal, sometimes fluttering, and sometimes for a few minutes slow, nay, intermitting; and then, with a sudden flush in the face, immediately very quick, and perhaps soon after surprisngly calm and equal; and thus alternately. The heats and chills are as uncertain and unequal, sometimes a sudden colour and glow appear in the cheeks, while the tip of the nose and ears is cold, and the forehead at the same time in a cold dewy sweat. Nay, it is very common, that a high colour and heat appear in the face, when the extremities are quite cold. The urine is commonly pale, and often limpid, frequently of a whey colour, or like rapid small beer, in which there is either no manner of sediment, or a kind of loose matter, like bran, irregularly scattered up and down in it. The tongue at the beginning is seldom or never dry or discoloured, but sometimes covered with a thin whitish mucus; at length indeed it often appears dry, red, and chapped, or of the colour of pomegranate rind; but this mostly at the close of the disease; yet, however dry the tongue and lips seem, the patient scarcely ever complains of thirst, though sometimes of a heat in the tongue.

About the seventh or eighth day, the giddiness, pain, or heaviness of the head become much greater, with a constant noise in it, or *tinnitus aurium*, which is very disturbing to the sick, and frequently brings on a delirium. The load on the præcordia, anxiety, and faintness grow much more urgent, and the patient often falls into an actual deliquium or fainting; especially if he attempts to sit up; coldish sweats suddenly come on in the forehead, and on the back of the hands, (though at the same time there is too much heat in the cheeks and the palms,) and as suddenly go off. If the urine now grows more pale and limpid, a delirium is certainly to be expected, with universal tremors and subsultus tendinum. The delirium is seldom violent, but as it were a confusion of thought and action, the sick muttering continually to themselves, and faltering in their speech; sometimes they awake only in a hurry and confusion, and presently recollect themselves, but forthwith fall into a muttering dozy state again.

The tongue grows often very dry at the height of the fever, especially in its middle part, with a yellowish list on each side, and it trembles greatly when the sick attempt to put it out. When the tongue at this time grows more moist, and a copious spitting comes on, it is always a very good sign; but where a difficulty of swallowing, continual *gurgling*, or choking in the throat supervene, it is a very dangerous symptom, especially if attended with any degree of hiccup. Frequently profuse sweats pour forth all at once about the ninth, tenth, or twelfth day, commonly coldish or clammy on the extremities; oftentimes very thin stools are discharged, both the one and the other are generally colliquative and very weakening. However, a warm moisture of the skin is generally salutary, and a gentle diarrhœa frequently carries off the delirium and comatose disposition.

Now nature sinks apace, the extremities grow cold, the nails pale or livid, the pulse may be said to tremble and flutter, rather than to beat, the vibrations being so exceedingly weak and quick, that they can scarcely be distinguished; though sometimes they creep on surprisngly slow, and very frequently intermit. The sick become quite insensible and stupid, scarcely affected by the loudest noise or the strongest light; though at the beginning strangely susceptible of the impressions of either. The delirium now ends in a profound coma, and that soon in eternal sleep. The stools, urine, and tears run off involuntarily, and denounce a speedy dissolution, as the vast tremblings and twitching of

the nerves and tendons are preludes to a general convulsion, which at once snaps off the thread of life. In one or other of these ways are the sick carried off, after having languished for fourteen, eighteen, or twenty days, nay sometimes much longer.

All persons grow deaf and stupid towards the end of the disease, some extremely deaf, though too quick and apprehensive in the beginning, inasmuch that the least noise or light greatly offended them. Many, from their immoderate fears, seem to hurry themselves out of life, where little danger was apparent at the beginning; nay, several will not suffer themselves to sleep, from a vain fear of dozing quite away; and others from the vast hurry, anxiety, and confusion which they are sensible of in it, or at awaking. Where the deafness ends in an imposthume of the ear, it is generally a good symptom; and so it is when a *parotis* suppurates, or a large pustular angry eruption breaks out about the lips and nose.

The nervous fever attacks persons of delicate constitution, who have suffered great evacuations, a long dejection of spirits, immoderate watching, study, or fatigue, as well as those who have used much crude unwholesome food and drink, or have been long confined in damp foul air, or exposed to other causes of debility.

It is obvious that, in this species of fever, there is no opportunity of using strong measures, especially great evacuations, either by bleeding, or active purging, nor is the cold assuasion admissible, where the heats are moderate, partial, and transient. A very mild emetic or gentle laxative may be advisable in the early stage of the fever; as a little rhubarb, Epsom salt, manna, &c. But Dr. Huxham affirms, "if you give any thing *drastic*, be assured your patient will rue for it, and you will repent it." Moderate diaphoretic medicines, with a well regulated diluent, but nutritious regimen, are the remedies principally applicable to this form of fever. This regimen itself, judiciously managed, Dr. H. remarks, "will go a great way in the cure, assisted by well timed and well applied blisters, and a due care to keep the patient as quiet as possible both in body and mind." He rejects strong opiates, as commonly pernicious; but where the lowness and dejection are very considerable, allows of a little more stimulating plan; as the use of camphor, callos, and saffron, with thin wine whey, or gruel with a little wine; and as the disease advances, a little chicken broth, sago and wine, &c.; the wine being especially serviceable where profuse colliquative sweats occur. As no violent measures can be adopted in this fever, with a view to hasten its termination, the principal treatment necessarily consists in supporting the strength, without adding much to the excitement; for which purpose a gentle cordial diaphoretic regimen is requisite, especially towards the decline of the disease. There is seldom any very marked crisis; and time only seems, in general, to wear off the fever. A gentle diarrhoea is sometimes of manifest service, indeed, towards the end of the complaint, and the patient is always most easy, when in a gentle perspiration; but when these discharges are great, they are never advantageous; but on the contrary sink the strength of the patient extremely. There is no evacuation of a more favourable portend, than a pretty free salivation without *aphthæ*; where this happens, Dr. Huxham observes, "with a kindly moisture of the skin, I never despair of my patient, however weak and stupid he may seem; indeed, the deafness many times makes the sick at the close of the distemper appear much less sensible than they really are; not but that many, under these circumstances, escaping the grave, degenerate into mere idiots." (See Huxham

on Fevers, chap. vii. Manningham on the Febricula.) The disease, above described, is the *typhus mitior* of Dr. Cullen's classification.

FEVER, *Pestilential*, a fever which spreads rapidly and extensively, and is destructive to numbers, whether typhus, the plague, scarlet fever, &c. See EPIDEMIC, and PLAGUE.

FEVER, *Petechial*, called also *peticular*, *puncticular*, and *lenticular*, is a term applied to typhus, or other fevers, in which the purple spots, resembling flea-bites, and denominated *petechiæ*, *peticulæ*, &c. appear upon the skin. These spots are considered as marks of malignancy and putrescency, as above mentioned, in the description of the symptoms of the advanced stage of continued fever. See PETECHIÆ, and PURPURA.

FEVER, *Puerperal*, or *child-bed* fever, a fever which occurs within a few days after parturition, and is connected with an inflammation of the *peritoneum*, or membrane lining the cavity of the abdomen; hence its nosological name of PERITONITIS *puerperarum*, which see: also PUERPERAL fever.

FEVER, *Purple*, the same with *petechial*, (see above) so denominated from the ordinary colour of the petechiæ, which, in the language of the nurses, are called the *purples*. See PURPURA, and PETECHIÆ.

FEVER, *Putrid*, a term applied to all the forms of fever, whether typhus, remittent fever, scarlet fever, the plague, yellow fever, &c. in which there is extreme prostration of strength, with black and offensive discharges, hæmorrhages, and purple spots; with what propriety will be discussed under the head PUTRID diseases, which see.

FEVER, *Quartan*, and *quotidian*, appellations of inter-mittent fever, when the fit occurs every third day, or every day in succession. The word *quartan*, signifying *fourth*, might appear to be erroneously applied; but physicians reckon the day on which a disease commences the *first*, and consequently the third day *after* this is the *fourth* of the disease; in continuing the calculation, therefore, the day of every successive paroxysm is twice reckoned, *viz.* as the fourth of the preceding period, or cycle, and the first of the succeeding cycle. In like manner, the inter-mittent, which occurs on the alternate days, is denominated a *tertian*. The common people, however, denominate the *quartan* a *third* day ague, and the *tertian* a *second* day ague, not being acquainted with the more complicated medical calculation. See AGUE.

FEVER, *Remittent*, a fever consisting of periodical increase and abatement, but without an interval of freedom from the symptoms, as in the inter-mittent. See REMITTENT.

FEVER, *Rheumatic*, a term applied to rheumatism, when accompanied by a general febrile condition, and which is then more commonly and correctly termed *acute* RHEUMATISM, which see.

FEVER, *Semi-tertian*, that form of remittent fever in which there is daily exacerbation and remission, (see FEBRIS *amphemerina*;) but on alternate days the exacerbation commences with rigors, or great chilliness and shivering; as if a tertian were joined with an amphemerine fever. This is the *hamitriteus* of the Greek writers: and the *Amphimerina hamitriteus* of Sauvages. (Nosol. Method, class. ii. genus 6. species 7.)

FEVER, *Ship*, is the typhus occurring in crowded vessels. See TYPHUS.

FEVER, *Scarlet*, a fever of the exanthematous or eruptive class, which, like the small-pox, measles, &c. is propagated by a specific contagion, and occurs but once during the life of the individual. It is characterized by a close efflorescence, of a scarlet colour, appearing on the surface of the

body,

body, or within the mouth and fauces, usually on the second day of fever, and terminating in about five days, but without certainty of a crisis to the fever. Being a disease, observed only by the moderns, we have no classical appellation for it; and the nosologists have adopted a barbarous term, first applied to it by British writers, namely, *scarlatina*, from the *scarlat* colour of the rash which accompanies it. Dr. Heberden calls it *Febris rubra*.

The *scarlet fever* occurs under three different forms or varieties: there is also a fourth form of disease, originating from the same contagion, namely, the ulcerated sore throat, which, being unaccompanied by the scarlet rash, cannot with propriety receive the same denomination. The three varieties, first mentioned, are 1. The fever, with the efflorescence only, and no affection of the throat, which is commonly a mild disease, and has been termed *scarlatina simplex*: 2. The fever and efflorescence with an accompanying sore throat, or *angina*, a more severe disorder, which has been denominated *scarlatina anginosa*: and, 3. The same combination, in which the fever assumes a typhoid type, *i. e.* is marked by great prostration of strength, a gangrenous disposition in the ulcerations, fetid discharges, &c. and has been called *scarlatina maligna*. The fourth modification of the disease has been called the putrid sore throat, the malignant ulcerated sore throat, *angina maligna*, *cynanche maligna*, &c. We shall briefly describe the course of symptoms under each of these modifications of this disease, which, in its malignant forms, has at different times raged like a plague, and carried off multitudes.

1. The *scarlatina simplex*. This form of the disease consists merely of the rash, and a moderate degree of fever for three or four days, not being, like the other species, attended with any local swelling, inflammation, or ulcer. The first symptoms are general debility, nausea, and slight successive shiverings, terminated at length by considerable heat and thirst. On the second day numerous specks, or minute patches of a vivid red colour, appear about the face and neck; within twenty-four hours a similar efflorescence is diffused over the surface of the body, likewise in the nostrils, on the inside of the lips, cheeks, and eye-lids, over the tongue, palate, and the whole fauces. These internal parts being red, the effects of the disease upon them do not perhaps attract attention, till the high scarlet flush be produced. The eruption on the skin is at first composed of innumerable red points, which spread into a diffuse redness on the third day, and the efflorescence becomes almost continuous on the limbs and cheeks. Several papulæ, or pimples, are scattered on the back of the hand, breast, arms, and lower extremities, producing a roughness, like the *cutis asperina*. On the trunk of the body the efflorescence is seldom universal, but in patches, or forming a sort of net-work, like vessels injected with wax. On the loins and nates, and within the flexures of the joints, the scarlet colour is most strong and general; and in these situations it also remains the longest. The rash is always less florid in the morning than at night, its colour being highest on the third and fourth evening. On the fifth day it begins to decline in colour; on the sixth its appearance is very indistinct, and it is wholly gone by the end of the seventh. Between the fourth and fifth day there is often a scattered eruption of miliarv vesicles on the temples, neck, breast, and shoulders. On the fifth day a slight scurfiness sometimes appears on the same parts; but a more general separation of the cuticle takes place on the eighth and ninth days, large pieces of the cuticle sometimes coming off entire, especially from the hands, fingers, and feet, a new cuticle having been previously formed underneath.

The pulse, during the eruptive stage of simple scarlatina, is usually very quick and feeble. The tongue exhibits on its upper surface a whitish fur, through which the elongated papillæ extend their scarlet points; the sides of the tongue are of a darker red colour. The urine is clear, and of a bright straw colour. The face is considerably tumefied. There is usually great restlessness, with a sense of itching or tingling in the skin, and often slight delirium. These symptoms continue with more or less violence from three to seven days. A few patients escape without fever, pain, or any particular uneasiness.

This disease, although now known to arise from a distinct species of contagion, has been considered by many authors as a variety of the *measles*, and, as the two diseases resemble each other, so as to be occasionally mistaken, we shall recapitulate the diagnostic characters, as pointed out by Dr. Willan.

1. The efflorescence in scarlet fever generally appears on the second day; in the measles it is seldom visible till the fourth. 2. It is much more full and spreading in the former than in the latter disease, and consists of innumerable points and specks under the cuticle, intermixed with minute pimples, in some cases forming continuous, irregular patches, in others coalescing into an uniform flush over a considerable extent of surface. In the measles the rash is composed of circular dots, partly distinct, partly set in small clusters or patches, and a little elevated, so as to give the sensation of roughness when a finger is passed over them; these patches are seldom confluent, but form a number of crescents, or segments of circles, with large intervening portions of cuticle, which retain their usual appearance. The colour of the rash is also different in the two diseases, being a vivid red in the scarlatina, like that of a boiled lobster's shell; but in the measles a dark red, with usually the hue of a raspberry. 3. During the eruptive stage, the measles are distinguished by an obstinate harsh cough, with expectation of a tough acrimonious phlegm, by an inflammation of the eyes and eye-lids, with great sensibility to light, by an increased discharge from the lachrymal gland, sneezing, &c. The scarlet fever is also frequently attended with a cough, and with redness of the eyes from an extension of the rash to the tunica albuginea, circumtarses which render the distinction between this complaint and the measles particularly difficult, if other symptoms be not clear and decisive. On minute examination, however, it will be generally, perhaps always found, that the cough in scarlatina is short and irritating, without expectation; that the redness of the eye is not attended with intolerance of light, that the ciliary glands are not affected; and that, although the eyes appear shining and watery, they never overflow. 4. When the rash appears on the third or fourth day, being scattered, and of a dark shade of colour, as frequently happens in the second and third form of scarlatina, the disease may be distinguished from measles by the appearances in the throat, by the rigidity of the muscles of the neck, and other peculiar symptoms hereafter to be described.

For the *cure* of *scarlatina simplex*, it seems only requisite to keep patients in a moderately cool and equable temperature, in clean open apartments; to prescribe light diet, without animal food; and to give cooling liquors to drink. When there is no morbid appearance or sensation in the throat, our chief care should be to prevent needless applications; since, according to Sydenham's observation, "more die of this disorder except from a too great officiousness in the practitioner." It is but normally a disease, he says, unless the patient is imprisoned in bed, and medicines are poured in "nimis doctè et secundum artem;" then "mor-

bus statim intenditur, et æger non raro nulla alia de causa, quam nimia medici diligentia, ad plures migrat." (Sect. vi. cap. 2.) We wish that this were popularly understood; for, we have already remarked, when concluding the article FEVER in general, that friends and nurses will not be content without more *decisive* proofs of the learning and art of the doctor, whose most difficult task is, therefore, to prevent their active interference in such cases, by seeming to be active himself.

II. *Scarlatina anginosa*, or *scarlet fever with sore throat*, is more severe than the preceding. In this species of the disease there is superadded to the fever and efflorescence a considerable swelling of the tonsils, velum pendulum palati, and uvula, accompanied with a florid redness of their whole surface, often terminating in numerous slight ulcerations. The primary febrile symptoms are in this species the same as in the former, but more violent. The affection of the throat sometimes begins with the fever, at other times is not perceptible till the scarlet efflorescence has arrived at its height; most frequently it is felt when the rash appears, and increases and declines with it. A sudden sensation of stiffness in the muscles of the neck, and lower jaw, takes place at the beginning of the disease. On the second day of fever the throat is rough and straitened, the voice becomes hoarse, and deglutition is performed with pain and difficulty. These symptoms are attended on the second, third, and fourth day, with nausea, vomiting of bile, headache, delirium, restlessness, and great heat, with a feeble fluttering pulse, a quick respiration, and extreme languor or faintness. On examining the throat there appears a considerable enlargement of the tonsils, and a florid redness of their surface, which extends over the palate and the posterior part of the throat. The tongue also assumes a high red colour, and the papillæ over its whole surface are greatly elongated.

In some cases no further change is observable in the fauces, neither do the appearances above-mentioned continue beyond the fifth or sixth day: no deep or considerable ulcer forms in the tonsils. Slight superficial ulcerations are very frequent, and more especially at the latter end of the year. They occur at an early period of the disease, as on the second or third day, sometimes later. The formation of them is preceded by a very quick and unequal pulse, with lowness and great inquietude. Small white patches are then visible over the pendulous part of the palate and the tonsils; at the same time, the red colour in those parts becomes darker in some places than in others, so that the whole surface has a peculiar speckled appearance. Soon afterwards, fissures or excoriations take place at the centre of the white patches, which are almost immediately covered with whitish sloughs. When these are numerous, the throat is constantly clogged with a large quantity of tough viscid phlegm: hence the difficulty of swallowing is increased, and much pain is felt upon pressure externally applied. The sloughs are in some cases removed about the fifth or sixth day, at the decline of the efflorescence; in other instances they continue to the eighth day, or even later; and when they separate, partial excoriations remain, which may, however, be readily healed.

The efflorescence, in this form of scarlet fever, differs in a few particulars from that described under the head of *scarlatina simplex*. 1st. It does not appear so early in the disease, but is often delayed to the third day. 2dly. It does not so constantly extend over the surface of the body, but comes out in scattered patches on the back, sides, neck, and breast, or about the joints. 3dly. It sometimes wholly vanishes the day after its appearance, and re-appears partially

at uncertain times. Hence, 4thly, the whole duration of it is longer than in *scarlatina simplex*. These variations are most frequent during the autumnal and winter months, when the disease is in general most severe.

During the state of extreme debility, which usually succeeds the *scarlatina anginosa*, some patients are affected with anasarcaous swellings of the face and hands, but more especially of the lower extremities. The swelling becomes conspicuous about the eighth or tenth day from the disappearance of the rash, and continues for two or three weeks. In cases exhibiting a very full and vivid efflorescence, the anasarca takes place more frequently, and to a greater degree. When the throat is much ulcerated, and the rash not extensive, and when no desquamation of the cuticle succeeds, dropical swellings rarely occur. Occasionally, though very rarely, effusions of serum into the abdomen, or thorax, or the ventricles of the brain, take place. An enlargement of the parotid glands happens frequently in adults, and continues a long time without suppurating. Children, at every period of the disease, are liable to tumours both of the parotid and sub-maxillary glands, sometimes ending in tedious and painful abscesses. With these they have, during the latter stage of the complaint, ulcerations at the corner of the mouth, strumous ophthalmia, swelling of the upper lip, and purulent discharges from the ears, sometimes accompanied with deafness: they are also subject to pustules or small ulcerations of the tongue, which prove troublesome for some days, but without any serious consequences.

During every epidemic scarlet fever many cases occur in which the efflorescence is confined to the throat and mouth, there being no appearance of a rash on the skin: but the febrile symptoms, vomiting and delirium, continue violent for several days. A crimson colour of the throat is perceptible often before the fever commences; in the course of which numerous small specks of ulceration are formed on the tonsils, &c. and become, in many places, confluent, when the increased secretion of phlegm, the tumour, pain, and difficulty of swallowing, occasion great distress. This complaint seems peculiar to adults, and is evidently a species of *scarlatina*, because it affects some individuals of large families, while the rest are labouring under other forms of the disease, and because it is capable of communicating, by infection, all the varieties of it. Persons who have previously gone through the *scarlatina anginosa* experience, while convalescent with the sick, very uneasy sensations in the throat; they remain, however, free from fever, although the swelling and inflammation of the tonsils be considerable.

The cure of *scarlatina anginosa* requires a more active administration of remedies. Although blood-letting has been recommended by Morton, De Haen, and others, the experience of our later writers on this subject coincides in deeming it injurious. Dr. Wilson says, wherever it had been employed great depression and faintness were the immediate consequences, the pulse becoming more weak and frequent, and often irregular. And Dr. Withering discounts even local bleeding. "Sometimes, where the fiery redness of the eyes, and the state of delirium seemed to demand the application of leeches to the temples," he observes, "I have seen them applied, but never with any good effect."

Emetics are recommended by all the best writers on this disease, among whom, indeed, there is very little difference of opinion on the subject. "In the very first attack," says Dr. Withering, "a vomit seldom fails to remove the disease at once: if the poison has begun to exert its effects upon the nervous system, emetics stop its further progress, and the patients quickly recover. If it has proceeded still farther, and occasioned that amazing action in the capillaries which

which exists when the scarlet colour of the skin takes place, vomiting never fails to procure a respite to the anxiety, the faintness, and delirium." "In autumn, when the throat was more affected, when the tumefaction of the fauces was such that the patients could not swallow, but with the utmost difficulty: when the peripneumonic symptoms threatened suffocation, and bleeding was ineffectual, an emetic opened the gullet, and unloaded the lungs, so that deglutition became easy and respiration free. But it is necessary to add, that a vomit only sufficiently strong to evacuate the contents of the stomach is by no means adequate to these effects. The vomit must be powerful, and, in ordinary cases, repeated once in forty-eight hours; in those with more urgent symptoms daily; and in the worst cases twice in twenty-four hours. The patients never fail to express the relief they find after the operation, and the physician soon discovers it in the countenance and pulse. As to the form of the emetic, the practitioner may vary it as he pleases; but I generally combine tartar emetic in solution with ipecacuanha powder, that I may be more certain of their full effect on the stomach, and avoid the danger of their acting as a purgative. I also give them in much larger doses than usual, in order to secure a certain violence of action upon the system." (Withering on Scarlet Fever, page 75-8.) Dr. Rush recommends this repetition of vomiting, but he also "gave calomel in moderate doses in every stage of the disorder." Dr. Willan agrees with these physicians, in the propriety of administering emetics, but has never found it necessary to repeat them so often as Dr. Withering has advised.

With respect to *purgatives*, Dr. Withering, it is obvious from the above quotation, considered them as dangerous; and Dr. Willan affirms, that they "have nearly the same debilitating effect as blood-letting. They are indeed very seldom necessary;" he adds, "for though a few patients may, on the first day, be afflicted with bilious vomiting and diarrhoea, the state of the bowels is more uniform than in other febrile complaints." Nevertheless, he thinks the occasional stimulus of a small dose, as two or three grains, of calomel, very useful. Dr. Binns expresses an acknowledgment to a brother practitioner, "for his removal of a prejudice against laxatives in the early stage of the disease, imbibed from various authors, and confirmed by the dreadful consequences I had seen when a diarrhoea came on in this fever. By his persuasion small doses of calomel and other laxatives were occasionally given; and so far from producing injury, I believe, that by evacuating the acrid matter, which is often swallowed, they had a tendency to prevent excoriation of the intestinal canal, and the consequent diarrhoea which I dreaded." (See Willan on Cutaneous Diseases, part iii. p. 357.)

Dr. Hamilton of Edinburgh has, however, shown us that such prejudices were completely unfounded, and that moderate purgatives of calomel and rhubarb, or jalap, in the early stages of scarlatina, are as beneficial as in simple fever; and he even considers them as superseding the exhibition of emetics. We believe that both the remedies are advantageously administered; and that a lax state of the bowels, produced by medicine in the early stage, tends to prevent the diarrhoea of the succeeding periods, as Dr. Binns remarks, and as is also probable in common fever.

In cases of scarlatina anginosa where the throat is inflamed and swelled, so as to occasion very painful deglutition, *blisters* applied to the external fauces, or between the shoulders, afford considerable relief.

It is proper to enjoin the same adherence to the antiphlogistic regimen as in the simple form of scarlatina, or

as mentioned under the head FEVER, particularly with regard to cool air, cool drink, and light coverings; the cutaneous heat arises to a higher degree in this than in any other febrile disease in this country. "If the thermometer be applied to the surface of the body," Dr. Currie observes, when speaking of this fever, "after the sensation of heat has become steady, the mercury will be found to rise to 105 and 106 even in mild cases, and in the more violent cases to 108, 110, and 110°. I have known it rise as high as 112, the greatest heat I ever observed in the human body." (See his Reports on the Effects of cold Water &c. vol. ii. p. 428.) Accordingly the experience of this excellent physician, as well as that of professor Gregory of Edinburgh, and of several intelligent correspondents, has ascertained that the external application of *cold water* to the skin is the most certain and effectual method of removing this disease. (See *Cold, effects of, as a remedy.*) In this case, as in that of idiopathic fever, already described, the *cold affusion* actually terminates the disease, when applied before the appearance of the efflorescence, and the cold washing, at subsequent periods of the disease, while the skin remains hot and dry, invariably diminishes all the febrile symptoms, and gives great relief to the feelings of the patient, as we have witnessed in numerous cases. Dr. Stanger, when speaking of the same general washing of the body, among the children of the Foundling Hospital, 71 of whom went through the scarlet fever, remarks, that "its effects in cooling the skin, diminishing the frequency of the pulse, abating thirst, and disposing to sleep, were very remarkable. Finding this application so highly beneficial," he adds, "I employed it at every period of the fever, provided the skin were hot and dry." (See Dr. Willan's treatise, above quoted, p. 360.) With what success the cold affusion was employed by Drs. Currie and Gregory, in completely annihilating scarlet fever in its commencement, in their own children, will be remarked with pleasure by the readers of Dr. Currie's second volume, p. 442, and 435. While this remedy is used, Dr. C. observes, cold water and lemonade should be used as drinks, and the bowels opened, if necessary, by calomel. "If I sit to myself I use no other means." We can add, that we have seen several cases, in which the patients speedily recovered from a smart attack of the disease, in which the cold washing, by means of a sponge, repeated from time to time as the heat was great, and a dose of calomel, were the only remedies employed.

We have before stated, that the effects of cold, applied to the skin, when there is excessive heat, and action of the cutaneous capillaries, is the most effectual mode of inducing *spontaneous*, (see *Cold*,) which, whether as a cause or a consequence and sign of the reduction of fever, has been generally an object of the practice of physicians. Many of them endeavour, in the first six days of scarlet fever, to excite perspiration by antimonials, camphor, aromatics, diluted spirits, and volatile alkali saturated with vinegar or juice of lemons. But Dr. Willan justly remarks, that before the decline of the efflorescence, such remedies and oppressive coverings, for the most part, fail to produce their usual effects, and often increase the heat, anxiety, and restlessness, which they were intended to relieve; and that before that decline he never succeeded in the endeavour to excite perspiration, yet perspiration is the almost certain result of the external use of cold water, properly employed.

The mineral acids have been found serviceable in scarlatina anginosa, and acidulated gargles are generally useful, where the throat is much affected, and seem to carry off the virus with which the saliva is tainted, and thus to pre-

vent the irritation of the bowels, which it occasions when swallowed. The use of bark in the first days of scarlatina anginosa is now given up by the majority of practitioners as detrimental; but it is generally admitted that, at the decline of the efflorescence, if the fever also declines, and is not succeeded by a cough, the bark, mineral acids, wine, and nutritious diet, obviate the debility and oppressive languor, which remain after the disease, and contribute to prevent the accession of dropsy. (See Willan, loc. cit.)

III. The symptoms of the *scarlatina maligna* on the first day, according to the author just quoted, are nearly the same as in the scarlatina anginosa; but some of the following peculiarities are afterwards observable; 1. A small, indistinct, and irregular pulse, a brown or black incrustation of the tongue, teeth, and lips; 2. A dull redness of the eyes, a dark red flushing of the cheeks, deafness, delirium, or coma alternating with fretfulness and violence: 3. Breath extremely fetid; a rattling and laborious respiration, partly occasioned by a thick tough phlegm clogging the fauces; a contraction of the jaws, and painful deglutition; a fulness and livid colour of the neck, with retraction of the head: 4. Ulcerations on the tonsils and adjoining parts, covered with dark sloughs, and surrounded by a livid base: 5. An acrid discharge from the nostrils, causing soreness, or chaps, and even blisters, about the nose and lips, the fluid being at first thin, but afterwards thick and yellowish: 6. The rash is usually faint, excepting in a few irregular patches; and all of it presently changes to a dark or livid red colour; it appears late, is very uncertain in its duration, and often intermixed with purple spots, or petechiæ. In some instances the rash suddenly disappears a few hours after it is formed, and comes out again at the expiration of a week, continuing two or three days.

Patients who withstand the violence of the first attack of *malignant* scarlatina have nevertheless to struggle through a series of most untoward circumstances, continued far beyond the usual febrile period. The ulcerations gradually spread from the throat to the gullet, larynx, and wind-pipe. Violent pains of the bowels, and excoriations about the nates succeed; also hecical paroxysms, with suppurations of the glands, a teazing cough, great difficulty of breathing, pains in the side, and a remarkable alteration in the sound of the voice. A few recover after having been harassed, almost incessantly, for six or eight weeks. In the year 1786, when the scarlatina maligna was epidemic in London, more than two thirds of those affected with it died between the seventh and nineteenth day of the fever. The symptoms portending danger are, continued coma, dulness of the eyes, laborious breathing, diarrhœa, petechiæ, vibices, and hæmorrhagy. The degree of danger in the complaint does not depend on the greater or less extent of the rash on the skin; the faintest redness affords no decided security, nor is the total absence of it incompatible with a mild disease. Many patients sink under this disease, unexpectedly, at a very early period, as on the second, third, or fourth day, no symptoms having preceded, which could excite an apprehension of immediate danger. It has been thought that so sudden a mortality is owing to a gangrenous state of the throat, gullet, stomach, intestines, or lungs; and this opinion seems to be confirmed by dissections.

In the treatment of *scarlatina maligna*, a bold and persevering course of emetics, as recommended by Dr. Withering, is considered by Dr. Willan and others as the most effectual mode of obviating the singular malignity of this distemper. When administered in due time, says the last-mentioned author, they very generally prevent the transition from the milder to the more virulent forms of scarlatina,

and remove the febrile symptoms at the earliest possible period. In dubious cases, if powerful doses of ipecacuanha, either alone, or combined with tartarized antimony, entirely fail to produce their usual effects, it may be concluded that the most unfavourable state of the disease has begun, and that the patient's situation is extremely dangerous. Blisters are seldom useful in this form of scarlet fever, and sometimes prove injurious. Bleeding and purging are always hurtful, according to Dr. Fothergill, Dr. Willan, and others; a strong cathartic, or even the application of a few leeches to the throat, says the latter, has been known to produce an immediate sinking, and sometimes death within a few hours, in cases which seemed previously favourable. But from the confession of Dr. Binns, above noticed, we learn that unreasonable prejudices have existed against purging, in other forms of this fever; and we cannot easily reconcile the encomiums on strong and reiterated vomiting, with the extreme fears of moderate purging, at least in the commencement of the disease.

Fumigation of the throat with nitrous acid is recommended by Dr. Willan as useful in keeping the throat clean, and often superseding the necessity of gargles; but he admits that gargles remove the viscid and offensive matter from the throat, and thus preserve the stomach and bowels from its disagreeable action. Those prepared with contrayerva, according to the directions of Dr. Fothergill, (Treatise on the Ulcerous Sore-throat, p. 64.) are the most grateful and advantageous; and gargles of a more stimulating quality have been used with benefit. In the West Indies the favourite gargle is made with caplicum or Cayenne pepper, which, though productive of much pain, is said to be very efficacious. Occasional immersions in warm water are recommended in this form of scarlatina by some practitioners. Dr. Currie remarks that the affusion of cold water is scarcely applicable to the scarlatina purpurata, and that the tepid affusion makes little impression upon it. Dr. Willan has observed considerable advantage from the application of warm vinegar and brandy to the limbs, and to the greater part of the body.

When emetics have not been exhibited at a proper period, it becomes necessary, as the disease advances, to direct cordials, wine, opium, Peruvian bark, mineral acids, &c. according to the circumstances of the case. In this point, almost all authorities, foreign and British, coincide. The disease is then to be treated as other fevers of extreme debility, or malignancy, as it has been termed, which the gangrenous tendency of the ulcerations, as well as the other symptoms, manifestly indicate.

IV. In the *ulcerated sore throat*, which affects adults without any efflorescence on the skin, emetics, given early, according to Dr. Willan, prove of great advantage, and the treatment recommended in the scarlatina anginosa will be found effectual. Gargles, whether acid or detergent, if very sharp, or if injected forcibly enough to remove the sloughs, occasion much pain, and often protract the disease. Dr. Wall, Dr. Johnstone, Dr. Rush, and others, recommend the inhalation of the vapour of myrrh and vinegar. Dr. Willan is of opinion, that Dr. J. Carmichael Smyth's mode of fumigation, by pouring heated oil of vitriol on powdered nitre in a proper vessel, is entitled to a preference. The refreshing antiseptic vapour, he says, detached by this process, and circulated through the room, presently clears the patient's throat, and at the same time removes the fetor both of the breath and perspiration. (Loc. cit. p. 368.)

It is truly singular, that the slightest of all eruptive fevers, and the most violent, the most fatal disease known in this country, should rank together and spring from the same origin.

origin. Experience, however, has decided, that the simple scarlet fever, the scarlatina anginosa, the scarlatina (or angina) maligna, and the scarlet ulcerating fore-throat without the efflorescence on the skin, are merely varieties of one disease. That all of them proceed from the same source of contagion is evident; because under the same roof, in large families, some individuals have the disease in one form, some in another, about the same period. According to the state of the air, the soil, climate, or season of the year, one form predominates over all the rest, and gives the general character to every epidemic scarlatina. Hence arise the various accounts and opinions respecting it, which are to be found in medical writers. Dr. Currie, however, remarks, "that the varieties of scarlatina are, in fact, not greater than the varieties of the small-pox, to which they bear a very strict analogy." (Reports, vol. ii. p. 422.) It is now understood, that the scarlet fever is liable to attack the same individual but once in his life; an occasional exception only occurring in this, as in the small-pox, measles, and other eruptive fevers. (See Dr. Binns' account, in Dr. Willan's Treatise, p. 283.) Dr. Withering says, "I have never yet seen an instance of the same person having the scarlet fever twice, and I believe it to be as great an improbability as a repetition of the small-pox." (p. 53.)

The *scarlet fever* spreads rapidly by contagion, especially among children, (adults are not very susceptible of its influence,) and the symptoms often commence on the third or fourth day, and the eruption appears on the fifth or sixth, after exposure to the contagion. Not only does the contagion extend itself rapidly, but when it once finds its way into large families, schools, &c. it is with great difficulty arrested in its progress, even by keeping the infected separate from the rest, by strict attention to ventilation, and to cleanliness throughout the house. (See CONTAGION.) This was strongly exemplified in the year 1803, in the seminary founded by the quakers at Ackworth, in which, notwithstanding the active adoption of these measures, under the judicious management of Dr. Binns, 171 persons were affected with scarlatina, and the disease continued there upwards of four months. (See the whole account in Dr. Willan's Treatise before quoted, p. 380, *et seq.*) Nevertheless, these measures of prevention are advisable in all similar instances, and in smaller academies than that of Ackworth they have been found effectual, when carefully pursued. Dr. Haygarth relates an instance, in which thirty-seven boarders in the family of a clergyman at Chester were preserved from the infection, brought to the school by one boy, by immediate separation of the latter. "My patient's chamber was situated in the middle of the house," Dr. Haygarth observes, "at the landing of the first pair of stairs. All the scholars went close past this door several times a day. The rules of prevention were placed on the door, and rigid attention to their faithful observance was required. The event fully justified my hopes. Though all the thirty-seven scholars remained in the same house and family during the whole disease, yet not one of them was infected." At this time Winchester, and several other large schools in England, sent home and dispersed their scholars, on account of this disease, which had alarmingly spread among them. (See Dr. Haygarth's letter to Dr. Percival, p. 81. See also Dr. Withering on Scarlet Fever, p. 67. and Dr. Blackburne on the same, p. 21.) All these writers give a caution against the usual practice, on the appearance of the disease, of hastily dispersing the scholars, who may, after returning home, diffuse contagion in their respective families and neighbourhoods. As we deem this subject of high public importance, we shall make no apology for transcribing the

active measures which were adopted, under the superintendance of Dr. Blackburne, with success in a large academy.

"In a numerous school, near town, where the scarlet fever had infected several young gentlemen, in consequence of one of them being suffered to associate with his school-fellows, in a few days after his recovery from the complaint, which he had brought with him from home, it was effectually extinguished, and was attended with no unpleasant consequences, by adopting the following means. When it became evident that the convalescent had infected the school, he was withdrawn, and apartments allotted to him completely separated both from the healthy and the sick: to which apartments, it will be seen, the sick were removed after a certain period of convalescence. The infected were then conveyed to an adjoining house, and the doors, which communicate between it and the bed rooms of the school, were closed up, to preclude the possibility of any intercourse. The sick were there attended by nurses, the regular servants of the family being kept entirely from them; and to prevent effectually the progress of any farther mischief, not only their linen, but even their knives and forks, and plates, &c. were appropriated solely to their use; and nothing belonging to them was suffered to enter the house, where the healthy still remained. One of the family, who was necessarily called to superintend the management of the sick, went at no time during the illness near the school, from an apprehension of conveying the infection, but confined herself to the care of the invalids. The school-room, dining-hall, and all the bed-rooms, supposed to be infected, were immediately cleared out, and nothing but the bare walls left; they were then white washed and distempered; the young gentlemen in the mean time occupying apartments, which were known not to be infected, and which were afterwards also distempered with the same colour for the sake of uniformity. All the blankets, counterpanes, &c. throughout the house were scowered: the rooms and staircases were sprinkled with vinegar; the bedsteads were taken down, well scrubbed, and sponged with vinegar; and for some time the feather-beds were exposed to the open air, and also sprinkled with vinegar. During this period, however, and for several days, some, who had originally taken the infection, but had not shewn the symptoms so early as the others, were successively taken ill. They were of course removed from the school, and their bedding, clothes, &c. sent with them to the sick house. Thus, it being generally imagined, that no infection is communicated in the first stage of the complaint, it was concluded, that such young gentlemen as had escaped in the first instance were, by the afore-mentioned precautions, now secured from all possible danger; and the event satisfactorily proved, that none of those who fell ill in the school had, at the time, infective influence. The young gentleman, who was last taken ill, shewed the symptoms on the eleventh day in the middle of the school, and with him it stopped." (See Facts and Observations concerning the Prevention and Cure of Scarlet Fever, &c. by W. Blackburne, M. D. 1803, p. 21. *et seq.*)

The origin of the disease in this school, namely, from a convalescent boy, leads us to an important question respecting the period after the cessation of the fever, when the patient ceases to carry infection about his person: as well as to the consideration of the means of diminishing his infectious power. Dr. Willan remarks, that "in making the separation here recommended, we may safely act on the supposition, that persons under the influence of contagion do not communicate it till they are actually affected with the fever and efflorescence."—He adds, "it is to be remarked, that convalescents from scarlatina, notwithstanding

ing a minute attention to cleanliness and change of apparel, remain, for *two or three weeks*, capable of infecting persons susceptible, especially children, with whom they have intercourse. These periods I have been able to ascertain in several instances." (Loc. cit. page 387—8.) He therefore recommends the processes adopted by Dr. Binns, for purifying convalescents previous to their intercourse with the healthy, as not more than sufficient for the purpose. "When the fever and sloughs in the throat were wholly removed," says Dr. Binns, "the patients stayed a few days in the convalescent rooms, and had an opportunity of walking in the garden, at the front of the house, to clear themselves from infection by repeated exposure to the open air. After this they went across the garden to a wash-house, about equally distant from the fever-house and the school, where they were entirely stripped, and washed with soft-soap, particular attention being paid to cleaning their hair. They then put on fresh clothing, and went up to the rooms in the school; being, however, kept apart for some time longer. Their bed and body linen was frequently changed on their return, as it before had been in the sick-rooms. When they had continued thus about a week, and appeared to have recovered their strength, the general ablu-tion was repeated; and after rambling in the fields for some hours, they were permitted to mix with the other children." (See Dr. Willan's Treatise, p. 383—4.)

From these details, the principles upon which the prevention of the spreading of the active contagion of scarlet fever may be accomplished will be obvious; and in order to be effectual, they must be pursued in the strictest and most rigid manner: for, as we have already pointed out, the extent to which infection is communicated through the air is extremely limited; (see CONTRACTION,) and therefore a perfect separation and interruption of intercourse by persons, clothes, utensils, or other things, will infallibly prevent its communication. And as all the forms of the disease may be produced in the same family, from any one source of the contagion: the precautions above specified should be observed on the appearance of the simple scarlatina, as well as when our attention is called to the more dangerous forms of the distemper.

With respect to the history of *scarlet fever*, our limits will not allow us to enlarge greatly on this curious and interesting part of the subject: we must content ourselves with a brief sketch, and refer the reader, who may be desirous of a more comprehensive view of the progress of the disease, to Dr. Willan's elaborate detail of the facts, in his treatise on Cutaneous Diseases, to which we are indebted for much of the information contained in this article.

The scarlet fever does not seem to have been known in this country more than 150 years; for Sydenham and Morton are the first English writers who mention it. Sir Robert Sibbald, physician to king Charles II., for Scotland, says, in the year 1680, this disease had appeared so lately at Edinburgh, and was so little understood, that he could not venture to give any observations respecting it. Sydenham only mentioned the simple form; but Morton has described the symptoms of scarlatina anginosa, and some cases of the malignant form, which he considered as a variety of measles. (See his treatise De Morbillis et Febre Scarlatina, cap. iv—v.) During the 18th century the disease was frequently epidemic in Britain, and has been amply described by Huxham in 1734; Fothergill in 1748; Cotton at the same time; and subsequently by several other authors. On the continent of Europe, however, from a much earlier period, it has frequently raged, and ravaged towns and districts, with all the virulence and fatality of a

true plague. It has been described again and again, by successive observers in different situations, as a new and unknown disease, and under a great variety of denominations.

The first account of scarlatina on record is that of Ingrassia, a Neapolitan physician, about the year 1500; it was then known by the name of *Rossalia* at Naples. (See his Treatise de Tumor. præter naturam, tract. i. cap. 1.) We next find the disease epidemic in Holland in 1517, in its malignant form, as described by Forellus; and through Lower Germany in 1565 and 6, as described by Wierus, as a pestilential sore-throat. A few years afterwards the same disorder was epidemic at Paris, and called by *Balbinus rubiola*, which he carefully distinguishes from the measles, *morbilli*: the mortality of the distemper in the autumn of 1575 was dreadful, especially among children. The scarlet fever and sore-throat is to be traced again in the *garrotillo* of the Spaniards, which occurred after the influenza of 1580, and remained among them forty years, spreading to all the sea-ports of Italy, Sicily, and Malta, and reaching Naples in 1618, where, as in Spain, it was described as a new disease, under a variety of new appellations, and is said to have destroyed 500,000 persons within two years: it was particularly fatal to children. This statement, however, is doubtless exaggerated. During this period, we find, from the writings of Sennertus, Doringius, and others, that the milder forms of scarlet fever prevailed in different parts of Germany; and were described under the titles of *morbilli ignei*, *rossalia*, *erysipelata*, and universal erysipelas. It was again described as a new disease under the title of "*febris miliaris rubra*," which is said to have appeared at Leipsick about the middle of the seventeenth century. It was also called "*febris coccinea*," and "*febris purpurea*," by other writers at Leipsick. The scarlatina spread through Poland in the year 1665, and has been well described by Schultzius under the denomination of "*purpura epidemia maligna*." (See Act. Acad. Natur. Cur. dec. i. ann. 6, 7. p. 206.) It was extremely fatal among infants and children. A few years after this it was noticed by various authors in Denmark, Holland, Switzerland, Lombardy, Bavaria, Austria, England, and Scotland. It raged at Berlin, under the form of scarlatina anginosa, from 1694 to 1701, and has been well described by its proper title, in the *Acta Med. Berolin.* decad. i. vol. 2, and dec. ii. vol. 5. § 3. Its subsequent appearances in different parts of Germany and Italy, until the middle of the last century, are noticed by several writers on the *febris miliaris*, *purpura miliaris*, *purpura rubra*, *purpura febrilis*, *morbilli maligni*, &c. And Dr. Willan has, in another part of his work, stated reasons for believing the "*putrid measles*," described by Sir William Watson, as in fact a malignant scarlatina. (See Dr. Willan's Treatise on Cutaneous Diseases, pp. 284—350. p. iii.)

FEVER, *Spotted*, the same with *petechial*, and *purple fever*. See above.

FEVER, *Tertian*, an intermittent fever, the paroxysms of which occur on alternate days, as explained above. See FEVER, *Quartan*.

FEVER, *Typhoid*, or *typhous*, or substantively typhus, *febris typhodes*, *πυρετός τυφώδης*, of the Greeks, the opposite of inflammatory fever, or fever with debility, including the nervous, contagious, malignant, and putrid fever of authors; as well as the varieties denominated, from the local circumstances of its origin, *gaol*, *hospital*, and *ship-fever*; or, from the predominancy of particular symptoms, *brain-fever*, *intestinal*, *gastric*, and *mesenteric fever*, *purple*, *spotted*, *petechial fever*, &c. It is the ordinary fever of temperate climates,

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climates, and its symptoms, causes, nature, and treatment, may be considered as having been discussed above, under the general head of FEVER. See TYPHUS.

FEVER, *Vesicular*, a term applied to a febrile disease, of the exanthematous class, which is principally characterized by an eruption of large watery vesicles; it is more commonly denominated *Pemphigus*, which see.

FEVER, *Worm*, an appellation given by some writers to the febrile disorders of children, connected, or supposed to be connected, with the irritation of worms in the intestines. See INFANTS, *Diseases of*, and WORMS.

FEVER, *Yellow*, a name given to the endemic fever of hot climates, from the yellowness of the skin, which commonly occurs in the latter stage of the disease.

This fever, which has rendered the West-Indian islands, at different periods the grave of Europeans, and has ravaged the cities of America, has been the subject of great difference of opinion among those writers who have had an opportunity of witnessing its phenomena: it were therefore not easy to decide, at a distance, upon the points which they have left in dispute. We shall endeavour to give a succinct view of those facts which appear to be most satisfactorily ascertained; beginning with the symptoms of the fever.

The approach of the *yellow fever* is often announced by a feeling of lassitude, heaviness, oppression, loss of appetite, and slight head-ache, which in a few hours, or on the following day, is succeeded by the violent symptoms of the disease. Sometimes, however, the attack is sudden and violent from the first; the patient is seized with a faintness and giddiness of the head, with a slight degree of chilliness and horror, but never with a complete rigor or shivering; these feelings are immediately followed by a high degree of fever, an arid and scorching heat of the skin, accompanied by acute darting pains in the head and back, and often down the thighs and legs, and a strong beating of the arteries, particularly of the carotid and temporal arteries; the face and neck are flushed and tumid, the eyes red and protruding, with a sense of burning heat in the eyeballs, and the countenance is grim; great anxiety and oppression are felt at the præcordia, with an intense burning pain at the stomach, and almost continual sickness, which increases as the disease advances, with violent reachings, in which bilious matter is brought up, afterwards a dark coloured, and sometimes a bloody fluid. There is extreme restlessness, and a heavy respiration, with much sighing; the pulse is quick, generally full and strong, but soft; in some cases quick, low, and vacillating. The urine is deep coloured, and in small quantity. These symptoms continually increase; the reaching and vomiting become almost incessant, the anxiety excessive, the sighing frequent, and the restlessness such that there is a continual tossing, and no ease in any posture, little or no sleep, and that disturbed, uneasy, and without refreshment to the sick. These symptoms generally continue to the third day, but sometimes not longer than the first, or second day, or even a few hours, and in others to the end of the fourth day, and may be considered as constituting the *first stage* of the disease.

The *second stage* begins with an abatement of many of the preceding symptoms, often with a deceitful appearance of a general remission of the fever. The vomiting, head-ache, and burning heat, greatly abate or nearly disappear; the pulse loses its strength, and falls to nearly the usual frequency of health in many instances, but is always low and feeble. "Sometimes," says Dr. Moseley, "in this period of the disease, the symptoms are so mild, and the patient so tranquil, that the disease is supposed at an end, and all

means neglected, or thought unnecessary, until the storm appears that succeeds this fatal calm, arrayed in those dreadful forms, which are characteristic of the concluding stage, and completes the catastrophe." (Treatise on Tropical Diseases, page 411.) This interval, however, is often extremely short, so that the disease passes at once from the inflammatory stage to the black vomiting. At all events, either a repetition of similar violent symptoms soon takes place, accompanied with marks of greatly diminished energy, or the patient sinks at once into a comatose state, only interrupted by vomiting of a dark coloured, porraceous fluid. The stomach rejects every thing; the thirst, which in some is excessive, in others is moderate; and the skin is moistened with partial clammy sweats. The eyes, which were before red and inflamed, now become tinged with yellow; and this yellowness begins to appear round the mouth, eyes, temples, and neck, and soon afterward diffuses itself over the whole skin, varying in intensity from a fallow hue to a deeper orange tint: in many cases, however, it is altogether absent. The yellowness seems to usher in the concluding and most fatal symptoms of the disease; and growing deeper coloured, as the other symptoms become aggravated, is the immediate forerunner of death. The last symptoms are a deep coma, with a heavy respiration or convulsive kind of sighing, a low, creeping, and intermitting pulse, delirium, and constant restlessness and struggling, faltering speech, trembling, starting of the tendons, vomiting of a black, bloody cruor, and stools of a similar nature, hæmorrhagies or oozing of blood from the mouth and nostrils, sometimes from the corners of the eyes and ears, black urine, livid spots or blotches about the skin, great coldness of the extreme parts, muttering,—and death, either in a convulsive struggle, a state of torpid apathy, or sometimes in a calm and collected resignation of life. (See Hillary on the Diseases of Barbadoes, 2d edit. p. 150. Moseley, loc. cit. Lining, in the Edinburgh Phys. and Literary Essays, vol. ii. art. 29.)

The preceding description corresponds, with the general order and manner of the disease, when the patient dies from the third or fourth to the seventh day. But many patients do not experience all the symptoms above mentioned. Some have no chilliness at first, nor faintness, nor flushings in the face, and the pulse is sometimes deeply depressed, and not quick; and there are gross habits of body, which have been attacked in damp situations in very sultry weather, in whom the inflammatory period has been only of a few hours duration, and the transition so rapid, that the black vomiting, and the gangrenous condition have unexpectedly appeared, and terminated the life of the patient in twenty-four, or thirty-six hours. And, on the contrary, there are some instances where the disease has been protracted to the eighth, ninth, or tenth day; and others where it has never passed from the inflammatory stage; but being checked, though not extinguished, it has been lengthened out, and at last converted into a remittent of great duration, of most difficult cure, and tedious recovery. (Moseley.) In other cases, it does not pass through those stages, nor put on the most characteristic symptoms of the disease. Speaking of the yellow fever, in December, Dr. Pinckard says, "Many of the sick now fall into a state of coma, and without exhibiting any other striking mark of illness, without uttering a complaint or a groan, sink very rapidly into the arms of death. The countenance becomes pale; the skin assumes a clay or lead-coloured hue; a stupor supervenes; the patient lies in a state of tranquil insensibility; and without yellowness, or the other common marks of the fever, and in the course of a few days he drops to wake no more!"

Sometimes only a few hours complete the course of the disease." (Notes on the West Indies, vol. iii. p. 198.) These various anomalies in the fever arise from the different season in which it occurs, the difference of constitution, and habits of life of the patients, as well as of the predisposing and occasional causes, the early treatment, &c.

The greatest distress, it would appear, during all the periods of the *yellow fever*, arises from the state of the præcordia; the burning heat, the anxiety and oppression, the constant vomiting, the extreme forebells and uneasiness, complained of from the least pressure at the pit of the stomach, all point to that region, which, in the words of Warren, "seems from the beginning to be the chief seat and throne of the furious conqueror." (In a treatise on this fever addressed to Dr. Mead.) Hillary ascribed this particular and uniform suffering about the præcordia to the vicinity of the liver and gall-bladder; but it seems to be attributed with more correctness to the state of the stomach by others. For as Dr. Moseley observes, "this viscus seems to bear the chief burden of the disease, while life remains, and the principal internal vestiges of its effects after death." He observes, in another place, "on inspecting many dead bodies, I have always found some part or other of the stomach, and frequently the superior part of the duodenum in a gangrenous state, and never without evident marks of injury from inflammation, let the disease have been of ever so short duration. These appearances are universally produced by a mortal *yellow fever*; but from the appearance of the liver, and gall bladder, though both must be materially affected in this disease, there is no inference to be drawn that can be depended on." (Loc. cit. p. 414.) Dr. Pinckard's observations accord with the preceding statement; he says "the appearances were not precisely such, as from conversing with other practitioners, and reading a variety of authors, we had been led to expect. The stomach was found to be the organ which exhibited the strongest marks of derangement. The inner coat was surcharged with blood, appearing very red, and at one spot near the upper orifice it was of a livid hue, and its texture so weakened, that the finger was passed through it by only a slight pressure." (Loc. cit. vol. ii. p. 226.) This author states in other parts of his book, that similar appearances were observed in other cases, which were examined by dissection. (Ibid. p. 322, &c.) Dr. Rush, however, affirms, and from what we know of other fevers, we believe truly, that the morbid appearances of the internal parts of the body, as they appear by dissection after death, from the yellow fever, are different in different countries, and in the same countries in different years: as the same disease during different epidemic seasons assumes very different aspects. From the observations of several physicians, quoted by Dr. Rush, it appears that the liver and gall-bladder have been often diseased in the yellow fever, marks of inflammation and gangrene, and a morbid colour and consistency of the bile, having been detected. The dissections of Dr. Mitchell, Dr. Mackiltrick, Dr. Physick, and others, coincide in the discovery of inflammatory disease in the stomach. "The stomach was inflamed both on its outside and inside;" says the first of these physicians, "its villous coat, like that of the duodenum, was covered with fuzzy and slimy matter." The second, after stating that the liver was differently affected in different cases, says "the stomach, the duodenum, and ilium were remarkably inflamed in all cases." The two last mentioned gentlemen remark, "that the stomach, and beginning of the duodenum, are the parts that appear most diseased," and inflammation of the villous membrane at the pyloric end of the stomach extending into

the duodenum, was the disease in some; extravasations of blood in others; the former in those who died early in disease, the latter in those who died at a more protracted period. In those cases in which the brain was examined by Dr. Mitchell, "it was not affected," and the two last-mentioned physicians affirm, "that the brain in all parts has been found in a natural condition." (See Dr. Rush's Account of the Bilious Remitting Yellow Fever of Philadelphia, in 1793, 2d edit. pp. 114—122.) We may remark, by the way, that these facts are somewhat adverse to the doctrine of fever, lately promulgated by Dr. Clutterbuck, on which we have animadverted above, when treating of the doctrines respecting the nature of *fever* in general.

The *yellow fever* has been asserted by some writers to be a new disease, the product of modern times, and even unknown till within a very recent period. We believe, however, with Dr. Moseley, Dr. Miller of New York, and others, that it is a modification of that disease which was familiar to Hippocrates, Aretæus, Galen, and other physicians of antiquity, the characteristic symptoms of which have been described by them, and the prognostic indications well pointed out. It is, in fact, the *καύσος, caufus*, and *febris ardens* of the ancients, aggravated by the exceeding heat of climate. Hippocrates observes, in the ninth section of his book of Crises, "in burning fevers (the *caufus*), a *yellowness of skin appearing on the fifth day*, and accompanied by hiccup, is a fatal symptom." The terrible symptom of *black vomiting* is also frequently mentioned by Hippocrates, and represented as being of fatal import. In the twelfth section of his *prognostics*, he asserts, that if the matter vomited be of a livid or black colour, it betokens ill. In the first section of book i. of his *Cran prognostics*, he enumerates black vomiting in a catalogue of the most fatal symptoms. And also in the fourth section of the same book, he considers porraceous, livid, or black vomitings, as indications of great malignancy. These maxims imply the familiarity of their great author with those symptoms which are not known except as belonging to the yellow fever. (See a Paper by Dr. Miller of New York, in the Edinburgh Med. and Surg. Journal, for July, 1807.)

This destructive fever has never been known to appear, except either in tropical climates, or in those seasons, in the more temperate climates, in which the atmospheric heat has for some length of time been equal to the tropical heat, that is, at or above 80 of Fahrenheit's thermometer. This fact, Dr. Blane asserts, is incontrovertibly established by observation; for there is no instance, either in North America or Europe, of the yellow fever appearing, except at these degrees of heat, nor of its surviving after the atmosphere had fallen to a lower degree of temperature. This is left to be wondered at in North America, where the winters are extremely severe, but it holds equally true at Cadiz, Malaga, Gibraltar, and other parts of Spain, where the winters are warm, and where this disease spontaneously disappeared, in degrees of heat equal to the usual summer heats in the north of Europe. (See Dr. Blane's Letter to Baron Jacobi, respecting the Prevention of the Yellow Fever, in the Edinburgh Journal, for October, 1807.)

It seems to be well ascertained, then, that the *yellow fever* is an endemic of hot climates, or an epidemic of hot seasons in other climates; and this fact will enable us to explain the history of the disease, as well as to dispel our fears, that it may ever be brought to this country. By Dr. Moseley it is called the "*endemic caufus*" of the West Indies.

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It is a well known fact, that when Europeans first take up their residence in tropical climates, it is usual for them, sooner or later after their arrival, to undergo an attack of the endemic fever of the country. This fever of the visitors of the West Indies, in times of tranquillity, when the "new comers" are few, is termed a "*seasoning fever*;" but Dr. Pinckard observes, "in times of war, when, from great multitudes arriving at the same time, its destructive effects are more striking, it is baptized with the terrific name of *yellow fever*." This circumstance serves to explain the origin of the opinion that this fatal fever is the product of modern times; when the system of colonial war has only multiplied the victims whom it might sacrifice. (See Notes on the West Indies, vol. iii. p. 416 and 445.) The ordinary yellow fever seems to be justly considered by the most accurate observers as an aggravated form of the "bilious remitting fever," common to hot climates, especially where a particular condition of the soil, or some other source of effluvia, co-operates with the heat. The natives, or old residents in those situations, become habituated to the influence of these causes, and are less liable to be affected by this fever; and when they do suffer it, it is in a less severe degree. Creoles and negroes, Dr. Pinckard remarks, are not often affected with the disease, and are not subject to it in its continued or most malignant form, but when it does invade them, it more commonly assumes an intermittent or remittent type. Europeans, who have resided during a period of several years in the West Indies, have become in a great measure habituated to the climate, and have acquired a state of constitution approaching to that of the natives; they are seldom attacked by the fever in its continued form; it commonly affects them in a remittent type. It is almost exclusively in strangers, and in those from a northern climate, that the disease assumes the malignant and *continued* form. In North America, the inhabitants, who constantly reside in the most southern states, are seldom attacked with the fever in its more violent or continued form; while those of the north-east states are destroyed by it in great numbers. In a word, it appears that persons suffer the fever of hot climates in the different degrees of violence and severity of form, according as they are more or less seasoned or habituated to the temperature under which it occurs. Hence it has been properly suggested, that, in order to preserve our troops sent on service to the West Indies, they should be prepared for the climate gradually; for example, by first letting them serve for a time at Gibraltar, and afterwards employing them for a year or two in the more windward islands, as Barbadoes and Antigua, before they were sent to the other colonies.

Among the Europeans attacked with the ardent fever of the West Indies, the disease varies according to the state of the constitution. Thus the strong and plethoric, those of rigid fibre and rich blood, are the most liable to be attacked, and suffer the disease most violently and fatally. Hence, those who persevere in their accustomed strong and stimulating diet suffer in like manner more severely than those whose vigour of habit is somewhat reduced by extreme temperance. It is observed that persons are most frequently attacked during or after exposure to great heat or fatigue, and to the night air, when it becomes cold and moist. Hence, on the one hand, those employed as cooks and blacksmiths are particularly liable to be seized, and sentinels, men occupied in fishing, and boat parties, on the other. We have before mentioned, when speaking of the causes of *fever*, a fact related by Dr. Lind, that a boat's crew was three times destroyed and replaced, after going on shore for provisions

in the night, the whole being as often seized with remitting fever, on the coast of Africa.

This endemic *causus*, like the remittents of northern climates, is more particularly prevalent in seasons when moist and marsh exhalations co-operate with great heats, or cold and damp nights alternate with hot days. Hence, in more northern climates they have occurred only in the autumnal seasons, as at Cadiz in 1800, and at Malaga in 1803, and commonly at similar periods in New York and Philadelphia. After investigating the cause of an excessive prevalence of yellow fever in Demarara, in the month of July, Dr. Pinckard concluded that it was "probably the mere effect of the season, resulting from the increased heat of the days, the damp chilliness of the evenings, and the offensive miasmata exhaled from half-eposed mud."—"The quantity of rain that now falls is not sufficient to cover the feculent sediment of the numerous ditches, nor to prevent their unwholesome vapours from rising into the atmosphere; and the partial showers, which occur during the evening and night, by softening the half-dried surface, favour the exhalation, while they produce a chilling dampness, which perhaps contributes to render the body more than usually susceptible of impression. The evenings are now so much colder to our feelings than we have found them during the preceding months, that we have lately been able to sit with the door shut, and have even thought that a blanket, during the night, might have been supportable." (Notes, vol. iii. p. 52.) Writing again from Demarara, in the ensuing month, (August,) Dr. Pinckard says, "the present moment may be said to be the high season of the *yellow fever*. It now rages in its utmost violence, and with sorrow I remark that great numbers perish from its malignity. Until the partial rains of the present period have ceased, and the dry season be well set in, it is said that we are to expect a continuance of sickness, &c." (Ibid. p. 83.) In this respect the disease is altogether analogous to the autumnal remittents of our temperate climates, or of the warmer extra-tropical countries, when moisture succeeds or alternates with warmth, as we have already mentioned, when treating of the *causes of fever*. We have there seen that moist weather, after heat, generally produces a remittent fever, in countries where the soil is favourable to the formation of miasmata, and this is milder in its symptoms in the more northern and more violent in the southern degrees of latitude; thus it is an ague, or a remittent of moderate severity in England and Holland, but a severe and fatal ardent fever on the banks of the Nile and the Euphrates, after inundations have left the ground moist and slimy. On the shores of the Mediterranean, where Hippocrates practised, and frequently saw the yellow skin and black vomit of the ardent fever, Dr. Cleghorn found that the common tertian fever, when it attacked Englishmen, put on the usual symptoms of the *yellow fever*. (On the Diseases of Minorca, p. 176.) Dr. Ruth, and other physicians of Philadelphia, and also those of New York, Dr. Miller, &c. are satisfied that the *yellow fever*, which has appeared in those cities in the autumnal seasons of hot years, *originated* in those cities, and was but an aggravation of the ordinary remitting fever. In Philadelphia the origin of the fever has been traced to the streets adjoining the docks and wharfs; in 1793, it was more particularly attributed to the putrefaction of a large quantity of damaged coffee, which was exposed in July on a wharf in the dock, in the vicinity of which the fever commenced. In New York, in 1805, Dr. Miller says, "on the whole, the low grounds on the margin of the two rivers certainly produce a chief part of the cases." The different

degrees, then, of fever originating from miasmata, according to the heat of the climate or season in which they occur, appear to be in the following scale; 1. Common mild intermittent fever, 2. Common remitting, or bilious remitting fever, and, 3. The yellow fever. These seem to bear the same relation to each other, as, 1. The simple continued fever. 2. The contagious typhus, or gaol-fever; and, 3. The plague. (See Dr. Rush on the Fever of 1793, in Philadelphia, 2d edit. p. 178. Dr. Pinckard, loc. cit. vol. iii. p. 417. Dr. Miller, Report to the Governor of the State of New York, in the Edin. Med. and Surg. Journal, before quoted.) Dr. Miller puts the identity of the ordinary remittent fever and the *yellow fever* in a strong light; "as the materials of putrefaction, and the degrees of heat in a large city," he observes, "greatly exceed what is found in the adjacent country; so the disease arising under such circumstances must be proportionably more malignant. The pestilential fevers of our city differ only in grade from the bilious and remittent fevers of the country. They prevail in the same climates; they come on at the same season of the year; they are chiefly disposed to attack persons of the same constitution; they commit their ravages on the same organs of the body, and produce symptoms differing only in degree, and they decline and disappear at the same season, and under the same circumstances. In the city we often see in the same family, and under equal circumstances of exposure, the malignant forms of pestilence, and the mild forms of remittent fever; and in the country, while the great mass of cases are usually mild, we occasionally meet with some, which exhibit the violent attack, the intense malignity, and the rapid dissolution, which more frequently mark the pestilential fevers of the city." The identity of the yellow and bilious remitting fevers is maintained, in equally strong terms, by Dr. Rush, and twelve other physicians, who presented a memorial to the governor of Pennsylvania on the subject. Their reasons for this opinion are the following: 1. The sameness of their origin; both being the offspring of putrefaction. 2. The yellow fever makes its appearance in those months chiefly in which the bilious fever prevails, and is uniformly checked by the same causes, viz. heavy rains and froils. 3. The symptoms of the bilious and yellow fever are the same in their nature. 4. The common bilious and yellow fever often run into each other; and the improper use of remedies will mutually convert them. 5. The common bilious and yellow fevers are alike contagious, under certain circumstances of the weather, &c. 6. They mutually propagate each other. 7. And, lastly, the yellow fever affects the system more than once, in common with the bilious fever. (Rush. loc. cit. vol. v. p. 45, *et seq.*) These reasons are satisfactorily illustrated at some length.

Is the yellow fever contagious? It might appear rather extraordinary to the general reader, that the eye witnesses of so fatal a pestilence should be at variance with respect to the existence or non-existence of contagion connected with it; were it not recollected that a similar disagreement and discussion have occurred with regard to the contagious nature of the plague itself, and more particularly among the physicians of the 16th and 17th centuries, who had the most frequent opportunities of witnessing its devastations. Some of the writers who contend for the identity of the yellow and remittent fevers deny the existence of contagion in both; while others maintain that these two fevers are essentially distinct, the latter being void of contagion, and the yellow fever being propagated by contagion only. Most of the West Indian physicians deny the contagion of

yellow fever; while Dr. Chisholm, and several of the Americans, consider the disease as generally imported and extremely contagious. We commonly find truth between the extremes. It has been well understood, at least since the time of Dr. Lind, that the effluvia of human bodies, even in health, when accumulated in close and crowded situations, become capable of exciting fever, or, in other words, become *infectious*; and that those which arise from the bodies of persons labouring under febrile diseases still more readily become infectious, and propagate the original disease, whether idiopathic fever, dysentery, erysipelas, &c. (See CONTAGION.) Upon these grounds, it would seem, Dr. Rush and his colleagues maintain the occasional contagious influence of both the yellow and bilious remittent fever. "In a West India climate," he says, "where the accumulation of the effluvia from sick people is prevented by open doors and windows, it is easy to conceive this (yellow) fever cannot be often propagated by contagion. Even in our own country, (Pennsylvania,) it has rarely been observed to be contagious in the months of July and August. But after cool weather renders it necessary to exclude the fresh air from sick rooms, it is as easy to conceive the same effluvia may be so accumulated and concentrated, as to produce the disease in other people. In this way it was propagated in some instances during the year 1797, but by no means so often as in 1793, under equal circumstances." (Med. Inq. and Obs. vol. v. p. 37.)

The testimony of many other writers might be adduced, in corroboration of the fact, that *yellow fever* has been often propagated by contagion, especially under the circumstances just alluded to; we shall content ourselves with stating the following facts and observations. "Some late authors," says the veteran Dr. Wright, "who have written on West India diseases, have roundly asserted, that in tropical countries fevers are not contagious; but whoever has had the care of crowded hospitals, of gaols, of ships of war, or of transports full of troops, must have seen numerous and fatal instances of contagion in the West Indies; more especially where cleanliness and free ventilation have been neglected. From causes of this sort a most fatal and destructive disorder broke out in the West Indies in 1793, and soon after in Philadelphia, viz. the *yellow fever*. From Dr. Rush's book, and from the numerous letters of my correspondents, there remains not a doubt in my mind of the yellow fever being typhus, exalted to a great degree of virulence from climate, situation, and other adventitious circumstances." (See Practical Observations on the Treatment of Acute Diseases, particularly those of the West Indies, by Wm. Wright, M.D., &c. in the Med. Facts and Obs. vol. vii. p. 6.) Dr. Chisholm has advanced some strong evidence to prove, that the malignant yellow fever, which Dr. Wright alludes to, was generated on board a ship on the coast of Africa (at Bulama or Boulam), and the contagion imported to Grenada; whence it was afterwards carried to the other leeward islands, and to Philadelphia. We cannot here follow out the whole detail of circumstances as given by Dr. Chisholm; the following are some of the leading facts. The ship Hankey sailed from England, laden with stores, and upwards of 200 adventurers, for the projected colony at Boulam. The project failed, and they all lived on board during nine months on this coast. In this crowded vessel a malignant fever broke out, and destroyed three-fourths of the crew, leaving only the mate and two seamen to navigate the ship when she failed. Four men were put on board from ships of war at St. Jago to aid in navigating her to the West Indies. On the third day after leaving

leaving St. Jago, the men they procured from the ships of war were seized with the fever, and two of the four died; the remaining two were put on shore at Grenada and St. Vincent in a wretched state. No method was taken to purify or ventilate the ship, or the clothes, bedding, &c. From the period at which the Hankey arrived at Grenada, viz. the 13th of February, 1793, Dr. Chisholm dates the commencement of the destructive yellow fever, the progress of which he describes in the following manner. A captain Remington was the first person who visited the Hankey after her arrival in St. George's bay. He went on board the evening after she anchored, and remained three days, at the end of which time he left St. George's, and proceeded in a coasting vessel to Grenville bay, where his own ship lay. He was seized with the malignant fever on the passage; and the violence of the symptoms increased so rapidly, as on the third day to put an end to his existence. The crew of the *Defiance* were the next who suffered by visiting this ship; the mate, boatswain, and four sailors went on board the day after her arrival; the mate remained either on deck or in the cabin, but the rest went below, and stayed all night there. All of them were immediately seized with the fever, and died in three days. The mate was also taken ill, but, probably from his having been less exposed to the virulence of the infection, he recovered. The crew of the ship *Baillies*, from the same imprudent civility or curiosity, were the next who suffered. These communicated the infection to the ships nearest them; and it gradually spread from those nearest the mouth of the Carenage, where the Hankey for some time lay, to those at the bottom of it; not one escaping in succession, whatever means the captains took to prevent it. Had the disease arisen from the exhalations from the Lagoon, or the mangroves around that piece of water, it must have originated of course among the ships in the inner part of the harbour, Dr. Chisholm remarks, and its progress would have been outward towards the mouth of the Carenage, and not inward towards the bottom of the harbour. In the short space of time from the beginning of March to the end of May, 200 of about 500 sailors, who manned the ships of the regular trade, died of this fever. About the middle of April the disease began to appear on shore. The first house in which it shewed itself was situated close to the wharf, and the infection was evidently introduced, Dr. C. says, by a negro wench, who took in sailors' clothes to wash; it extended to every individual of the family, a few negroes excepted. Among the troops, it first appeared in that part of the garrison quartered nearest to where the Hankey lay. One of the officers visited the ship, and with two or three soldiers who rowed his boat, remained on board some time. The consequence of this imprudence was fatal to himself almost immediately after; and in a little time to many of the men; the officers and men were successively seized, but it proved fatal only to recruits who had lately joined. (See an Essay on the Malignant Pestilential Fever, introduced into the West Indian Islands from Boulam, on the coast of Guinea, as it appeared in 1793, 4, 5, and 6, interspersed with observations and facts, tending to prove that the epidemic existing at Philadelphia, New York, &c. was the same fever introduced by infection from the West India islands, &c. by C. Chisholm, M.D., &c. vol. i.) How far the latter part of the statement in the title page is proved, we cannot pretend to decide.

Dr. Blane has stated a circumstance, very clearly shewing the propagation of *yellow fever* by contagion. "The prevalence of yellow fever being limited by a determinate range of atmospheric heat," he says, "and also by a certain degree of purity of air, many people of the best under-

standings, who either did not know, or had not maturely considered the whole facts, have contended that it is not of an infectious nature. The doubts respecting this are founded on arguments similar to what have been employed in support of the paradoxical opinion entertained by some authors, even of our own times, that the plague itself is not contagious. The infection of both may be aptly compared to the seeds of vegetables, or the eggs of animals, which require a nice concurrence of certain degrees of heat, moisture, rest, nutriment, &c. to animate them. Infectious matter has, by a very appropriate metaphor, been termed the *seeds* of the disease; and by a similar propriety of expression, it has been said, that a certain *nidus* is necessary to give it effect. The *nidus* of the yellow fever is a given range of atmospheric heat, and a certain concentration and corruption of animal effluvia, but equally indispensable. It would be too tedious to enumerate the various proofs, derived from my own observation, and the testimony of others, in proof of the infectious nature of yellow fever; I shall content myself with citing one, taken from my letter to Mr. King, minister of the states of America to this court, who applied to me on this subject in the year 1798. On the 16th of May, 1795, the *Thetis* and *Hussar* frigates captured two French armed ships from Guadeloupe, on the coast of America. One of these had on board some men ill of the yellow fever; and out of fourteen hands sent from the *Hussar* to navigate and take care of her, nine died of this fever before she reached Halifax, on the 28th of the same month, and the five survivors were sent to the hospital sick of the same distemper. Part of the prisoners were sent on board the *Hussar*; and though care was taken to select those seemingly in perfect health, the disease spread rapidly in that ship, so that near one-third of the whole crew was more or less affected with it." (Letter to Baron Jacobi, before quoted.)

These facts, and many others that might be adduced, leave no doubt, we apprehend, that a *contagious yellow fever* often exists; which may be, in some instances, the remitting bilious fever rendered infectious by the close, crowded, and unventilated situation of the patients; and, in others, the ordinary *typhus*, ship or hospital fever, aggravated by the influence of a hot climate on the European constitution, or at least on a constitution habituated to cold in the winter, as in the inhabitants of North America. At the same time, it cannot be questioned, that the bilious remitting fever, which is endemic in hot climates, is not ordinarily a contagious disease. (See Lind on Fevers and Infection, chap. ii. sect. 5.) The advocates for the universally infectious nature of the yellow fever, when it has appeared as an epidemic and pestilential disease, have attempted to lay down the diagnostics of the remittent and the epidemic, but, it appears to us, with little success. They admit of the yellowness in both, of the black vomit, and of petechiæ in both; (see Chisholm, loc. cit. vol. i. chap. 6, 7. Dr. Currie of Philadelphia, quoted by Dr. Rush, loc. cit.) but an occasional difference in the degrees of severity can scarcely be considered as marking an essential difference in the two diseases. The name of *yellow fever* has, indeed, led some physicians to suppose that a yellow colour of the skin was essential to this fever; but this mistake has been pointed out by Drs. Moseley, Rush, Pinckard, and others. "The yellowness of the skin," Dr. Moseley observes, "like the black vomiting, is not an invariable symptom of this fever; those who are fortunate enough to recover seldom have it; and many die without its appearance. Besides, the yellowness alone leads to nothing certain; it may arise from an inoffensive suffusion of bile." (On Tropical Diseases, p. 399.

See also Dr. Pinckard's notes, &c. vol. ii. p. 227. Dr. Rush, loc. cit. p. 238.) As those who have been daily occupied in the midst of the devastation of the yellow fever have disagreed as to the mode of its propagation, it is impossible to decide, at a distance, in what instances it was combined with contagion, or when it was the result of the season and miasmata only. It would seem, however, that while the probability of infection arising in the close and crowded parts of a large city, when a fever is by any means introduced, is very great; the actual progress of the fever of Philadelphia, for instance, appears to favour the notion of an existing contagion. (See an Account of the Fever of Philadelphia, in 1793, by Matthew Carey.)

The violence and rapidity of the symptoms of yellow fever render the *prognosis* extremely difficult and uncertain: no particular symptom affords any accurate prognostic; and it is only from attention to the general state of the patient, or the result of a combination of all the signs, that any idea of what the event may be is to be obtained. The state of the eyes, the change of voice, the general aspect of the countenance, and the degree of torpor or insensibility of the system, afford the most important information. Dr. Childholm remarked, "that the longer the symptoms of the inflammatory diathesis continued, provided their violence was not progressive, the event became more favourable; and, on the contrary, that when the sudden disappearance of these was immediately succeeded by a seeming state of apyrexia, the worst symptoms, such as coma, delirium, clammy cold sweats, vibices, and death, might be soon expected. In the first case, the patient was gradually thrown into an agreeably warm and universal diaphoresis; irritability of stomach ceased; the eyes became more lively; and, in a little while after, the signs of returning health were evident." (Childholm, loc. cit. chap. v.)

Dr. Rush presents us with the following combinations of symptoms, as indicating a more or less favourable issue of the disease.

Signs of moderate danger.—1. A chilly fit accompanying the attack of the fever. The longer this chill continues, the more favourable. 2. The recurrence of chills every day, or twice a day, or every other day, with the return of the exacerbations of the fever. A coldness of the whole at the above periods without chills, a coldness with a profuse sweat, cold feet and hands with febrile heat in other parts of the body, and a profuse sweat without chills, or coldness, are all less favourable symptoms than a regular chilly fit, but they indicate less danger than their total absence during the course of their fever. 3. A puking of green or yellow bile on the first day of the disease is favourable. A discharge of black bile, if it occur on the first day of the fever, is not unfavourable. 4. A discharge of green and yellow stools. It is more favourable if the stools are of a dark or black colour, and of a foetid and acrid nature, on the first or second day of the fever. 5. A softness and moisture on the skin, in the beginning of the fever. 6. A sense of pain in the head, or a sudden translocation of pain from internal to external parts of the body, particularly to the back. An increase of pain after bleeding. 7. A fore mouth. 8. A white or a yellow tongue. 9. An early disposition to spit freely, whether excited by nature, or the use of mercury. 10. Blood becoming fizy, after having exhibited the usual marks of great morbid action in the blood-vessels. 11. Great and exquisite sensibility in the sense of feeling coming on near the close of the fever.

Signs of great danger.—1. An attack of the fever, suddenly succeeding great terror, anger, or the intemperate use of venery. 2. The first paroxysm coming on without any premonitory symptoms, or a chilly fit. 3. A coldness over

the whole body, without chills for two or three days. 4. A sleepiness on the first and second days of the fever. 5. Uncommon paleness of the face, not induced by blood-letting. 6. Constant or violent vomiting without any discharge of bile. 7. Obstinate costiveness, or a discharge of natural or white stools. 8. A diarrhoea towards the close of the fever. 9. A suppression of urine. It is most alarming when without pain. 10. A discharge of dark-coloured and bloody urine. 11. A cold, cool, dry, smooth, or shining skin. 12. The appearance of a yellow colour in the face on the first or second day of the fever. 13. The absence of pain, or a sudden cessation of it, with the common symptoms of great danger. 14. A disposition to faint upon a little motion, and fainting after losing but a few ounces of blood. 15. A watery, glassy, or brilliant eye. A red eye on the fourth or fifth day of the disease: it is more alarming if it become so after having been previously yellow. 16. Imperfect vision, and blindness in the close of the disease. 17. Deafness. 18. A preternatural appetite, more especially in the last stage of the fever. 19. A slow, intermitting, and shattered pulse. 20. Great restlessness, delirium, and long continued coma. 21. A discharge of coffee-coloured or black bile from the stomach after the fourth day of the fever. (Rush. Med. Inq. &c. vol. v. p. 129—133.)

The *methods of cure* adopted in the yellow fever have been very dissimilar, and not very successful, on the whole. That the practice pursued in different countries, and in the same country at different times, must be dissimilar, if judiciously chosen, cannot be doubted; for the same disease, when epidemic at different periods, and under different circumstances of climate, constitution of the people, seasons, &c. is wont to assume very different characters, and to demand a corresponding difference of treatment. It has been too much the practice with medical men to prescribe for the name of a disease, neglecting the varieties of type and character which it puts on; but it is sufficient to mention the modifications of small-pox and scarlet fever, to prove the error of such sweeping rules of treatment. Between the mild distinct small-pox, and the virulent confluent small-pox, there is hardly any analogy (in a practical view): and between the simple scarlet fever, which is scarcely a disease, if the busy hand of art does not interfere with it, and the pestilential scarlet fever with the malignant ulcerated sore throat, the practical difference is as wide as possible: yet they are the same disease, originating from the same poison. In like manner, the yellow fever, when it occurs as a remittent among the natives or long inhabitants of hot climates; as a more severe remittent or continued fever, among the emigrants from northern latitudes, or the people of countries where a tropical degree of heat is only casual; or as combined with a typhoid contagion: in all these cases it assumes a form varied in point of severity and fatality; not to mention the varieties of the same form, according to the different epidemic constitution, as the phrase is, the cause of which we cannot explain. Thus, in one epidemic season the inflammatory symptoms, or morbid excitement may run high; in another the succeeding failure of the vital powers may be more prevalent, &c. Perhaps a consideration of these circumstances, and of the different hypothetical notions which individuals adopt, may enable us to explain both the dissimilarity, and the general want of success, in the treatment of yellow fever, unless the cathartic and mercurial treatment may be excepted.

Two opposite modes of practice have been pursued in this fever; the one dictated by an opinion that the disease was highly putrid, and the other that it was of a highly inflammatory nature. Other practitioners again have, to

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a certain degree, combined these plans, instituting moderate evacuations in the first stage, as on the first or second day of the fever, and afterwards supporting the vital powers by bark, wine, laudanum, and aromatic tonics; not to mention the exhibition of mercury, so as to excite salivation, which others have employed. The practice suggested by the notion that yellow fever is of a highly putrid nature, *viz.* the use of bark, wine, and other cordials, from the moment the disease was seen, shall be first briefly noticed, and dismissed as a baneful mode of treatment, which has been happily exploded by practitioners in general.

Dr. Chiholm remarks, that, "from the history of the disease it will not appear extraordinary that practitioners should have recourse to bark very early in it; and before they become sufficiently acquainted with its true nature and peculiarities. The suddenness of the changes, and the apparent sinking of the vital powers, a few hours after the accession of the fever, naturally incline us to consider it as a disease wherein tonics and antiseptics, with the whole tribe of cordials, could alone be useful. But *no indication can be more fallacious* than this; and innumerable instances occurred of the fatal consequences of adopting it. The use of the bark in the violent cases of the malignant pestilential fever, immediately after the operation of the evacuating medicines, was hurtful in the extreme, &c." (Loc. cit. vol. i. p. 365.) Dr. Rush affirms, that, "had the whole *materia medica* been ransacked, there could not have been found any three medicines more opposite to the disorder than bark, wine, and laudanum. In every case in which I prescribed bark it was offensive to the stomach. Wine was nearly as disagreeable as the bark to the stomach, and equally hurtful. I tried it in every form, and of every quality, but without success: it was either rejected by the stomach, or produced in it a burning sensation. Laudanum has been called by Dr. Moseley "a fatal medicine" in the yellow fever. In one of my patients, who took only fifteen drops of it, without my advice, to ease a pain in his bowels, it produced a delirium, and death in a few hours." (Med. Inq. and Obs. vol. iii. p. 298, *et seq.*) At the commencement of the destructive epidemic of 1793 in Philadelphia, Dr. Rush used this plan fully, until his want of success compelled him to turn his attention to other measures. "I had recourse to a gentle vomit of ipecacuanha on the first day of the fever, and to the usual remedies for exciting the action of the sanguiferous system: I gave bark in all its usual forms, of infusion, powder, and tincture. I joined wine, brandy, and aromatics with it. Finding them all ineffectual, I attempted to rouse the system by wrapping the whole body, agreeably to Dr. Hume's practice, in blankets dipped in warm vinegar. None of these remedies appeared to be of any service; for although *three* out of *thirteen* recovered of those to whom they were applied, yet I have reason to believe that they would have recovered much sooner, had the cure been trusted to nature." (Ibid. p. 193.) Dr. Rush, having requested the advice of a West Indian physician, accidentally at Philadelphia, was recommended to add the cold affusion to the large administration of bark; but the bark was offensive to the stomach, or rejected by it in every instance. The affusion of buckets full of cold water frequently upon the sick was grateful, and produced relief in several cases, by inducing a moisture on the skin. But *three* out of *four* of the patients thus treated died: some physicians lost all their patients, and whole families were swept off, where these medicines were used.

In a word, this early use of stimulant medicines is in this, as we believe in all other fevers, decidedly prejudicial.

And, although season and climate vary all diseases, we are disposed to apply still more generally Dr. Rush's observation, when he says, "without fear of being refuted, I will notwithstanding assert, that the proper remedies for this fever, at all times, and in all places, in its *first* stage, *must be* evacuations." (Ibid. p. 335.)

The success which Dr. Rush, and many others upon his suggestion, experienced from commencing the cure by evacuations, especially *purging*, was remarkable; and we cannot but enter into the heartfelt gratification of this distinguished physician, when, in the forlorn state of ignorance as to the means of alleviating the distresses of his fellow citizens, in the commencement of a raging pestilence of unexampled fatality in that city, he was accidentally directed to an useful remedy; and in his note-book of the 10th of September wrote the following: "Thank God! out of one hundred patients whom I have visited, or prescribed for this day, *I have lost none.*" This remedy consisted of a combination of calomel and jalap, employed as a speedy *purgative*, in the dose of ten grains of the former with fifteen of the latter: "even this dose was slow and uncertain in its operation. I then issued three doses, each consisting of fifteen grains of jalap and ten of calomel; one to be given every six hours until they procured four or five large evacuations. The effects of this powder met only answered, but far exceeded my expectations. It perfectly cured *four* out of the first *five* patients to whom I gave it, notwithstanding some of them were advanced several days in the disorder." (Ibid. p. 201.) The success of this remedy was communicated to the College of Physicians, and the plan was immediately adopted by several physicians with a great and decided superiority over all other means hitherto employed. Large families were altogether recovered by it. From this moment Dr. Rush gained a great accession of business, and the demand for the purging powders became greater than could be easily supplied. Together with this evacuation, Dr. Rush employed other means of abstracting excess of stimulus from the system: these were blood-letting, cool air, cool drinks, low diet, and applications of cold water to the body. By these measures Dr. Rush publicly asserted that a greater proportion than ninety-nine out of a hundred of all who applied to him on the first day of the disorder, before the 15th day of September, were cured. And others were in a similar manner successful. "Dr. Pennington assured me," he says, "on his death bed, that he had not lost one out of forty-eight patients whom he had treated agreeably to the principles and practice I had recommended. Dr. Griffiths triumphed over the disease in every part of the city, by the use of what were called the new remedies. My former pupils spread, by their success, the reputation of purging and bleeding wherever they were called." Not only is the general success of this plan of treatment thus shewn; but it is farther evinced by the great confidence which was excited in it. "Twenty men," says Dr. Rush, "employed constantly in putting up this medicine, would not have been sufficient to have complied with all the demands which were made on me for it. Hundreds who were in health called or sent for it, as well as the sick, in order to have it in readiness, in case they should be surprised by the disorder in the night, or at a distance from a physician."

It is sufficient here to have stated these facts; we must leave the reader, who is anxious to learn the objections, which were urged against this practice, and the confutation of them, which Dr. Rush has added, to refer to his book.

With respect to the propriety of clearing the bowels at the commencement of *yellow fever*, by *cathartics*, the most experienced and intelligent practitioners agree, although they differ as to the extent to which this evacuation should be carried. Dr. Hillary is satisfied with the use of a glyster, or very gentle laxative; and Dr. Chisholm is of opinion, that it is never necessary to excite a larger discharge by stool, than is barely sufficient to remove the acrid and offensive humours from the stomach and bowels; "and from the wonderful aptitude of the persons of the sick, in the malignant pestilential fever, to sink into an irremediable state of debility, under alvine evacuation carried beyond this, I have considered it unjustifiable, in every respect, to adopt such practice." It is probable, indeed, that the nature of the epidemic in the West Indies was such as to bear severe evacuation, even in its commencement, with less safety than the epidemic of Philadelphia. "Some practitioners in the West Indies I find," says Dr. Chisholm, "have adopted the plan of Dr. Rush, but by no means with the wonderful success he has attributed to it. The hospitals have afforded, I fear, but too many proofs of its disastrous consequences in a hot climate. In the year 1796, at Fort Royal, where the malignant pestilential fever was epidemic, many of the practitioners gave calomel and jalap in the manner recommended by Dr. Rush, and consequently excited a most profuse discharge. The event was, however, very different from the statement of Dr. Rush; for the mortality among the inhabitants was very great; some ships were entirely stripped of their crews, and many lost more than one half. I am well assured, that five out of six perished on this occasion of the whole seized with this dreadful malady. A hypercatharsis was induced, under which the sick immediately sunk." (Vol. i. p. 169.) Although the plan, which was successful in North America, might be too violent within the tropics, when carried to the same extent, it would seem, however, that the *principle* was usefully applied, and that Dr. Chisholm himself, notwithstanding his favourite object of exciting mercurial action in the system, adopted the principle in a great measure. His first practice consisted of clearing the bowels by neutral salts and antimony; on the re-appearance of the disease, in 1794, he gave calomel alone, "repeating it till the intestinal canal was cleared of its contents;" and he afterwards increased its activity by the addition of jalap, or any other purgative medicine of quick operative effect. "The great rule, in short," he affirms, "is to empty the intestinal canal as speedily and as completely as possible, so as to prepare it for the reception and absorption of mercury." Whatever be the mode of *reasoning* on the subject, it is obvious that, in point of *fact*, this practice is essentially the same, except in degree and extent, with that of Dr. Rush; and we may therefore conclude, that *purging*, in the attack of *yellow fever*, has been found the most efficient remedy that has hitherto been employed.

Dr. Chisholm, however, administers the calomel with a view to its influence on the constitution as a mercurial, not merely as an evacuant; but it is obvious that, in the quantity in which he employs it, it must produce considerable evacuation in general. "My mode of using the *calomel*," he says, "after the re-appearance of the malignant pestilential fever in 1794, was to give *ten grains*, either alone, or with an equal or a double quantity of *jalap*, to an adult patient as soon as possible after I saw him. This generally acts as an evacuant in the degree required, about an hour or two after it is given. At the end of three hours I repeated the dose of calomel. At the end of three hours more, the

same quantity is given, adding opium or not, as the preceding doses have acted. In this manner ten grains of calomel were given every three hours, till the salivary glands became affected, which generally happened in less than twenty-four hours from the commencement of the treatment, it was faithfully conducted. The effect of the medicine, given in this manner, may be perceived after the third dose in general; the patient becoming calmer, less restless, less anxious; his skin being softer, and possessed of an agreeable heat; the stomach being perfectly retentive, however irritable it might have been before; and the eyes recovering their former lustre and sensibility. When at length salivation takes place, the patient is left free from disease, with a moderate warm moisture on his skin; and very soon after signs of returning health are indicated by calls for food, &c. The recovery of strength is proportionally rapid to that from disease; nor is it at all necessary to have recourse to bark, or any other medicine whatever; a circumstance truly gratifying both to the patient and the physician, in a disease wherein nature revolts at the very idea of it. There are circumstances, however," Dr. Chisholm candidly adds, "in which the utmost difficulty is experienced in obtaining this effect from calomel; and others in which the candid practitioner must acknowledge its insufficiency." (Loc. cit. vol. i. p. 253.) Dr. Chisholm declares, that the success attending this practice exceeded his most sanguine expectation; "so great, indeed, was it, that I did not lose a single patient in whose case it was pushed to the full extent;" (ibid. p. 352.)

In the subsequent occurrences of the epidemic in Philadelphia, *viz.* in 1794, 5, and 7, Dr. Rush employed the mercurial remedies, so as to produce *salivation*, with great advantage. He endeavoured to excite it early in all those cases which did not yield immediately to bleeding and purging. "I was delighted," he says, "with its effects in every case in which I used it. These effects were as follow: 1. It immediately attracted and concentrated in the mouth all the scattered pains of every part of the body. 2. It checked a nausea and vomiting. 3. It gradually, when it was copious, reduced the pulse, and thereby prevented the necessity of further bleeding or purging. I wish it were possible to render the use of this remedy universal in the treatment of malignant fevers. It is a rare occurrence for a patient, that has been sufficiently bled and purged, to die after a salivation takes place." "I lost but two patients in our late epidemic in whom the mercury excited a salivation. One of them died from the want of nursing; the other by the late application of the remedy." (See Rush's Medical Inquiries and Obs. vol. iv. p. 93, and vol. v. p. 117.)

The good effects of *purging* and of *salivation*, speedily excited in the *yellow fever*, appear, then, to rest upon strong evidence; for besides their personal experience, both Dr. Rush and Dr. Chisholm have adduced the testimony of several other practitioners, in whose hands the administration of these remedies was attended with a similar success.

The evidence, with respect to the advantages of *blood-letting*, is somewhat more contradictory: Dr. Rush, and several other physicians of Philadelphia, conjoined bleeding with the purging plan, and their success is stated to have been generally great. Dr. Rush affirms that "blood-letting, when used early on the first day, frequently fringed the disease in its birth, and generally rendered it more light, and the convalescence more speedy and perfect." But he admits that where it "had been omitted for three days, in acute cases, it was seldom useful," nay, he even says, "I am not sure that it ever shortened the duration of the

the fever, where it was not used within a few hours from the time of its attack." (Med. Inq. and Obs. vol. iii. p. 266 & 7.) Yet he mentions numerous instances in which the benefit was most decided, and has described at length the obvious advantages which generally resulted from it. He does not however recommend it indiscriminately; the repetition of the operation, and the quantity of the blood to be drawn, must be regulated by the observation of the physician. Dr. Chisholm considered the evacuation as invariably pernicious in the yellow fever of the West Indies in his first publication. In his second, he says, "with a trifling modification, it is the opinion I now hold, after again seeing the disease, and after becoming acquainted with the sentiments on it of the most judicious West India practitioners, I am satisfied, that when it is possible to see the sick in this disease at the period of its accession; that when these are young robust men, immediately from England, or any other country possessing a similar climate; that when the temperature of the weather is such as seems most to favour the propagation of the disease; and that, when the predisposing causes have been such as have a tendency to accelerate the motion of the fluids and to give rise to other unequivocal signs of an inflammatory disposition; then one plentiful bleeding may, undoubtedly, be of infinite service. But when most of these circumstances are absent; and when, consequently, no just indication for the employment of this remedy can be formed, I consider the use of it as a wanton abuse of confidence, and as inevitable destruction to the patient. This observation may be extended to the yellow remittent fever without limitation; for in it the means of unqualified depletion are fully as pernicious as those of repletion, or those which serve to maintain or augment the vigour and tone of the body." He attributes the freedom of Dr. Rush's practice to the difference of climate, the greater tendency to local inflammations, and the other circumstances above mentioned. But the testimony of Dr. Jackson, Dr. Moseley, Dr. Pinckard, and others, tends to prove the salutary effects of early bleeding, even in the yellow fever of the West Indies. (See Dr. Robert Jackson on the Fevers of Jamaica, Drs. Moseley and Pinckard, as before quoted.) It cannot be questioned, however, that, generally speaking, this remedy is principally beneficial at the very onset of the disease; and that when its vigour is abating the practice must be mischievous, and accelerate the malignant symptoms. Dr. Rush admits, that even an active purgative, given after the fifth day, has been hurtful.

On the whole, it seems to be demonstrable, that the treatment of the yellow fever has been most successfully conducted upon the principles which we have laid down for the cure of fever in general; namely, by a steady system of withdrawing all stimuli, internal and external, at the commencement, *i. e.* by the antiphlogistic plan, pursued with a vigour proportionate to the violence and fatality of the disease: and that stimulants and cordials are pernicious, if given early, and nearly unnecessary at the later periods, where the proper evacuations have been adopted in the beginning.

For the same reason which suggests the propriety of diminishing internal stimuli by evacuations, the diet must be light and liquid, and the drink cold and diluent. All solid animal food is to be forbidden for many days after the entire cure of the fever; as the indulgence of the appetite too suddenly in that way is the cause of numerous relapses. A weak vegetable diet, with fruits, should be strictly adhered to. The drink should be thin and diluent; such as cold water, toast and water, lemonade, tamarind or raw apple-water, or weak balm and camomile tea, where the stomach

is affected with sickness. The subacid drinks were preferred in most cases, Dr. Rush says, as being not only most agreeable to the taste, but because they tended to correct, by mixture, the acrid qualities of the bile. All these drinks may be taken in the early stage of the disorder. In the convalescent stage of the fever, and in such of its remissions, or intermissions, as are accompanied by great languor in the pulse, wine whey, porter and water, and brandy and water, may be taken with advantage.

Upon the same principle of withdrawing stimulus and irritation, cool fresh air, and cleanliness, are very beneficial. Cool air is equally proper, Dr. Rush observes, whether the arterial system is depressed, or whether it shewed in the pulse a high degree of morbid excitement; and is only improper where a chilliness attends the disease.

Cold bathing, or affusion of cold water upon the skin in the hot stage of the yellow fever, has been found extremely beneficial; Dr. Rush found its employment advantageous under the same circumstances as Dr. Currie recommended it. (See COLD, and FEVER above.) Dr. Chisholm and Dr. Jackson affirm that the cold affusion is most effectually used in a manner somewhat similar to the practice of the American Indians, and of the Russians, *viz.* by a succession of alternate warm and cold bathing. The patient being first immersed in a warm bath, and then removed, while the sensation of the heat is still upon him, a bucket of cold water is thrown over his naked body. Dr. Jackson recommends this practice after evacuation by blood-letting has been employed, and Dr. Chisholm affirms that evacuating medicines are advantageously used at the same time. The local applications of cold have been often very successful in removing local symptoms, such as head-ache, delirium, irritability of stomach, &c. Cold water, or a solution of salts, such as the muriate of ammonia, or of soda, applied by means of cloths repeatedly soaked in them to the head, and pit of the stomach, have often quieted excessive action in those parts, and thus afforded material relief. Cold water injected into the bowels by way of clyster has produced similar results; and bathing the feet in cold water has frequently had the agreeable effect of relieving the head, the oppression at the præcordia, and the general heat. Dr. Rush affirms that cold water thus applied to the feet very certainly diminishes the frequency of the pulse, and mentions an experiment, in which the pulse, in the course of a few minutes, was reduced 24 strokes, and became so weak as hardly to be perceptible. (Loc. cit. vol. iii. p. 288.—Chisholm, vol. i. p. 397.)

With regard to the employment of blisters in the yellow fever there is the same contradiction of sentiment, as to their use, among the physicians of our climate in fevers in general. Dr. Chisholm, both upon his own observation and the testimony of others, affirms that blisters were never of any use, at any period of the disease, or to whatever part of the body they were applied, not even in relieving head-ache, or other local symptoms; while Dr. Rush, like Dr. Lind, considers them of great service, when applied to any part of the body, but particularly to the crown of the head. In his subsequent publications, however, he expresses himself rather less favourably of their utility, and limits their good effects to a particular juncture, which he calls the *blistering point*, and which, in bilious fevers, he says, is generally circumscribed within eight and forty hours; for "when applied in a state of great arterial action, they do harm: when applied after that action has nearly ceased, they do little or no service." (See Med. Inq. and Obs. vol. iii. p. 291. iv. 97. and v. 122.) We are very sceptical as to the operation of blisters in fever, except in relieving local congestion.

After the reduction of the morbid action of the blood-

vessels, by means of the remedies which have been mentioned, no other tonic is necessary than a nourishing and gently stimulating diet, and change of air. The best authors coincide in stating that, contrary to what occurs in most febrile diseases, bark and wine were not only useless or absolutely hurtful, but were generally loathed and rejected by the convalescents. The diet which is generally most agreeable to the palate, as well as the lightest and most nourishing, consists of sago, panada, and arrow root, prepared with Madeira wine, and spice, with oysters, eggs, and malt liquors, which the patients relish greatly. The convalescence from the yellow fever is generally rapid, but in some cases it is very slow. As long as the patient remained in the infected room or house, Dr. Chisholm remarks, although all the symptoms of the disease had disappeared, the progress of his recovery was remarkably slow, and more especially when bark had been employed in the treatment, without the previous use of deobstruents, and the appropriate antiphlogistic. A change of air and situation became advisable from the moment that signs of convalescence appeared; and the purer the atmosphere, and the more elevated the situation to which the patient was removed, the more rapid was his acquisition of strength.

Prevention of Yellow Fever.—As those persons, who were in the highest strength and vigour of health, and who were not relaxed and enfeebled by long residence in hot climates, or by a low diet, were the most frequently attacked by the *yellow fever*, when it was epidemic, both in the West Indies and in America; so a system of diet and regimen, which was conducive to a diminution of plethora, was the most effectual means of preserving individuals from being attacked by the disease. Dr. Rush recommended his fellow citizens to reduce their diet during the prevalence of the epidemic. He lived sparingly himself upon tea, coffee, milk, and the common fruits, and garden vegetables of the season, with a small quantity of salted meat and smoked herring. His drinks were milk and water, weak claret and water, and weak porter and water. “I sheltered myself,” he says, “as much as possible from the rays of the sun, and from the action of the evening air, and accommodated my dress to the changes in the temperature of the atmosphere. By similar means, I have reason to believe many hundreds escaped the disease who were constantly exposed to it. There appears to be no combination of climate and miasmata that can resist the good effects of abstinence or depleting medicines, in preventing or moderating an attack of this fever.” (*Med. Inq. and Obs.* vol. v. p. 39.) He recommended also to the people, besides a diet of milk and vegetables, cooling purges to be taken once or twice a week, and moderate blood-letting to all such as were of a plethoric habit: and he advised them to avoid heat, cold, labour, and every thing else that could excite the contagion (which he knew to be present in all their bodies) into action. (*Ibid.* vol. iii. p. 295–297.) The advice of Celsus, during the prevalence of pestilence, is very comprehensive; “vitare fatigationem, eruditatem, frigus, calorem, libidinem, multoque magis se continere.” But it is a mortifying consideration, Dr. Chisholm remarks, that few of our countrymen can be prevailed upon to submit to the deprivation of any gratification; which, if within their ability to purchase, is very generally and very pertinaciously resorted to. The comparative security from, and less mortality of, the yellow fever in the French and Spanish than in the English islands in the West Indies, have been justly attributed to the more temperate habit of the people. When the pestilential fever raged at Grenada, Dr. Chisholm observes that the French inhabitants remained almost totally exempt from it. Among them, animal food

and strong liquors were very moderately used; their diet being chiefly composed of vegetables, and small acid red wine. The same author, indeed, remarks, “during the prevalence of pestilence, I am inclined to think, from a variety of facts, that abstinence from every species of strong liquor, wine itself not excepted, is more conducive to the maintenance of health, than any other dietetic regulation whatever. It is an established fact, that water-drinkers either escaped the malignant pestilential fever altogether, or had the disease in a remarkably mild degree. On the other hand, many instances occurred of free livers receiving the infection in the morning, and having the attack of the fever after a plentiful repast of animal food and wine in the following night.” (*Chisholm, loc. cit.* vol. ii. p. 49.) In short, the fact, that extreme temperance, and even evacuations in those that are plethoric, when in hot climates, is the most certain to escape the diseases peculiar to those countries, and especially the *feasoning*, or yellow fever, is now ascertained beyond all question. Dr. Moseley says, “the English drink more wine and spirits than the French: the French more than the Spaniards; and we calculate the mortality of each by this rule. The Spaniards live to great ages in the plains of St. Jacques, &c. in St. Domingo, partly from the salubrity of the air, but chiefly from their sobriety.” (*On Tropical Diseases*, p. 53.) And he affirms, that, while the inflammatory diathesis of the body remains, (as it will with some people, who migrate to hot climates, for many years,) “those who use water for their common drink, will never be subject to troublesome nor dangerous diseases.” (*Ibid.* p. 51.)

The question relative to the contagious or non-contagious nature of the *yellow fever*, above noticed, is not a matter of mere curiosity and speculation, but of the greatest practical importance, with a view both to individual and to public safety. The means to be adopted for the prevention of the spreading of the epidemic must necessarily be very different, if it arise from imported contagion, and if it be of domestic origin. Those means which afford security in either case must be useless, and therefore virtually detrimental in the other. Should the fever be the result of imported contagion in its origin, the usual methods of quarantine, and fumigation, &c. of goods, ships, and persons, must be resorted to. (See *CONTAGION, PLAGUE, and QUARANTINE.*) But the best writers attribute the *yellow fever* to the miasmata and putrid exhalations from various domestic sources; and we have understood that by diminishing these sources of the pestilence, Philadelphia has been much less subject to its occurrence in the usual season. In the memoir of the thirteen physicians above alluded to, the governor of Pennsylvania is informed, and the information is supported by accompanying documents, that the epidemic fever was derived from the following circumstances, which are stated more in detail by Dr. Caldwell. These are, 1. Putrid exhalations from the docks and wharfs, the streets, sewers, gutters, cellars, privies, dirty yards and alleys, ponds, and collections of filth in the neighbourhood of the city; and also 2. The foul and noxious air emitted from the holds of ships. Of the origin of these fevers from the putrid exhalations, arising within and around Philadelphia, Dr. Caldwell and others have stated much evidence; (see *Med. & Phys. Memoirs*, containing, among other subjects, a particular Inquiry into the Origin and Nature of the late Pestilential Epidemics of the United States. By C. Caldwell, M. D. Philadelphia, 1801.) and the correctness of attributing the origin of these fevers to such causes, is further strengthened by our knowledge of the connection of remittent and pestilential fevers in London,

don, and the other large cities of Europe, in similar seasons, with a filthy condition of the streets and houses, and a bad arrangement of the sewers, gutters, &c. See EPIDEMIC. (See also Dr. Heberden, jun. on the Increase and Decrease of Dif. Lond. 1801, and the Annual Med. Register, vol. i. for 1808.) With respect to the second source of fevers, viz. the foul air of ships, Dr. Rush has adduced some strong evidence of its occurrence in ships, containing especially vegetable matters in a state of putrefaction. In 1797 the yellow fever first appeared on board a vessel at one of the wharfs, and in the neighbourhood, affecting a great number of persons at the same time: this ship had in her hold a quantity of prunes, almonds, olives, capers, &c., in a putrid state, and emitted a most offensive smell, after she had discharged her cargo, which was perceived by persons several hundred yards from the wharf where she was moored. At Tortola, Dr. Rush states, a fever was produced, in June 1787, from noxious air generated from a few bushels of potatoes, which destroyed the captain, mate, and most of the crew in a few days. Some rotted bags of pepper on board a French Indiaman produced the yellow fever, in June 1793, at Bridgetown: "all the white men, and most of the negroes, employed in removing this pepper, perished with the yellow fever, and the foul atmosphere affected the town," where it proved fatal to many of the inhabitants. Several other facts, of a similar nature, are mentioned, and Dr. Rush adds, that this source of yellow fever in warm climates is so well known, and so generally admitted, that Dr. Shannon, a late writer, in enumerating its various causes, expressly mentions "the putrid effluvia of a ship's hold." These facts not only lead to the certain means of preventing one of the sources of the yellow fever, but serve to explain the reasons why sailors are so often its first victims, and why, from this circumstance, the origin of the disease has been so hastily ascribed solely to importation.

Under these impressions as to the origin of the yellow fever, Dr. Rush, Dr. Caldwell, and the others who addressed the governor of Pennsylvania, recommended the following means of prevention, 1. A continuance of the laws for preventing the importation of the disease from the West Indies, and other parts of the world where it usually prevails. 2. A removal of all those matters from the streets, gutters, cellars, garrets, yards, stores, vaults, ponds, &c. which, by putrefaction in warm weather, afford the most frequent remote cause of the disease in America. 3. "We most earnestly recommend the frequent washing of all impure parts of the city in warm and dry weather; a measure which we conceive promises to our citizens the most durable exemption from bilious fevers of all kinds, of domestic origin. 4. To guard against the frequent source of yellow fever from the noxious air of the holds of ships, we recommend the unlading all ships, with cargoes liable to putrefaction, at a distance from the city, during the months of June, July, August, September, and October. To prevent the generation of noxious air in the ships, we conceive every vessel should be obliged by law to carry and use a ventilator, &c." They add, "It has been by adopting measures, similar to those we have delivered for preventing pestilential diseases, that most of the cities in Europe, which are situated in warm latitudes, have become healthy in warm seasons, and amidst the closest commercial intercourse with nations and islands, constantly afflicted with those diseases. The extraordinary cleanliness of the Hollanders was originally imposed upon them, by the frequency of pestilential fevers in their cities. This habit of cleanliness has continued to characterize those people, after the causes

which produced it have probably ceased to be known." (Rush, Med. Inq. & Obs. vol. v. p. 54, *et seq.* Caldwell, loc. cit. Chisholm, vol. ii. chap. 1.)

Besides the denominations of fever above explained, several others are to be found, especially among the older medical writers, which, however, require no notice here, as they are improperly applied, and are not used at present. Such are *arthritic*, *asthmatic*, *hysteric*, *chlorotic*, *scorbutic*, *fever*, &c. See ARTHRITIS, ASTHMA, HYSTERIA, &c.

FEVER WARD, *Fever-house*, or *Fever-hospital*, wards or houses set apart for the reception of *typhus*, or contagious fever.

The country is indebted to Dr. Haygarth's, formerly of Chester, now of Bath, (1809,) for the suggestion of these admirable institutions. It had been observed by Dr. Lind of the Haslar hospital, that the infectious distance of common contagious fever was small; or, in other words, that the effluvia from the bodies of persons labouring under *typhus* were incapable of infecting those in health, at a greater distance than a few feet, and that in a pure atmosphere, or well ventilated room, the effluvia were so much diluted and weakened, as to be no longer capable of communicating the disease. Hence the inference, which Dr. Haygarth proved by the test of experiment, that by separating those persons, labouring under contagious fever, from others in the same hospital, or by appropriating wards to this disease, the contagion might be prevented from spreading in these crowded receptacles of the sick: and secondly, that by having such wards, or separate hospitals, for the reception of fever, constantly open for the admission of patients, especially in crowded towns, or in epidemic seasons, whole families might be at once preserved from the contagion by the removal of the first person infected into them; and that thus the contagion of *typhus* might be exterminated. Upon this principle, such fever-wards were opened in the hospital at Chester, and in that of Liverpool, and subsequently separate hospitals have been established in many of the large towns in England and Ireland; first at Manchester, then at Cork, Waterford, Dublin, Leeds, London, &c. These were happily named, we believe by Dr. Ferriar of Manchester, "Houses of Recovery;" a denomination conveying less alarm to the prejudiced and ignorant, than that of pest-house, or fever-house, and by which they are now generally designated. These institutions are not only calculated to preserve the crowded population of large towns from the fatal effects of epidemic fevers, but to diffuse the maxims of cleanliness and ventilation, which are inculcated in the habitations of the poor, whence patients are removed; and also to disprove those false and pernicious notions, respecting the general diffusion of contagion in the air, which are too widely prevalent even among the unlearned part, *i. e.* the majority of the profession. See *House of Recovery*; under which head we shall state more fully the principles upon which these institutions have been established, as well as the successful result of their practice, and the regulations under which they are conducted. (See also CONTAGION.) Haygarth on the small-pox, and his Letter to Dr. Percival respecting the suppression of contagion.—An excellent Collection of Papers on the subject of a similar establishment at Newcastle. Also Dr. Ferriar's Med. Histories and Reflections. The Reports of the House of Recovery at Dublin, Cork, London, &c.

FEVER, in the *Veterinary Science*, is a disorder to which horses are very subject from a variety of causes. The symptoms which denote the horse to be afflicted with a fever are great restlessness, by reason of which he ranges from one

end of the rack to another, beating of the flanks, redness and inflammation of the eyes, a parched and dry tongue; his breath is hot, and of a strong smell; he loses his appetite, and nibbles his hay without chewing it, and is frequently smelling to the ground; he dungs often, but little at a time; and his dung is usually hard, and in small pieces; he sometimes stales with difficulty, and his urine is highly coloured; he is always craving for water, and drinks often, but little at a time; and his pulse beats full and hard, fifty strokes and more in a minute. The first part of the cure is bleeding; and the quantity, if the horse is strong and in good condition, should be two or three quarts; then give him four times a day a pint of the following infusion; take baum, sage, and camomile flowers, each a handful; an ounce of liquorice root, sliced, and three ounces of nitre; and pour on these ingredients two quarts of boiling water; when cold, strain it off, and squeeze into it the juice of two or three lemons, and sweeten it with honey; or an ounce of nitre mixed into a ball with honey may be given thrice a day instead of the drink, and washed down with any small liquor. The horse's diet should be scalded bran in small quantities, or dry bran sprinkled with water, or a handful of picked hay may be put into his rack. His water should be a little warmed, and given to him often and in small quantities; his covering should be moderate. If the horse refuses to feed, in a day or two more blood should be taken away, and the drinks continued, to which may be added two or three drams of saffron. If his dung continues hard and knotty, a clyster may be given, prepared by boiling two handfuls of marshmallows, one of camomile flowers, and an ounce of fennel-seed, in three quarts of water, till it be reduced to two, and adding to the strained liquor four ounces of treacle and a pint of linseed oil or any common oil. This clyster should be repeated every other day; and on the intermediate day the following drink may be given: take of cream of tartar and Glauber's salts, of each four ounces; dissolve them in barley-water, and add an ounce or two of lenitive electuary, or a dram or two of powder of jalap. By pursuing this treatment the horse will begin to recover; and nothing more will be found necessary than to give him gentle exercise in the air, and plenty of clean litter in the stable.

There is another fever to which horses are subject, more dangerous than the former: this is a slow fever attended with great depression; the horse is sometimes inwardly hot and outwardly cold, and at other times hot all over; his eyes appear moist and languid; his mouth is continually moist, so that he has no inclination to drink, and he is satisfied with very little. He eats little, moves his jaws in a feeble loose manner, and grates his teeth; his body is commonly open, his dung soft and moist; his staling irregular, sometimes little, and at other times profuse, and his urine pale, with little or no sediment. These fevers are attended with a running at the nose, and the matter discharged is of a reddish or greenish dusky colour, and of a consistence like glue. About three pints of blood should be first taken away, and bleeding repeated according to the strength and fulness of the horse, the degree of his cough, or any tendency to inflammation. After this the nitre drink already prescribed may be given, with the addition of an ounce of snake-root, and three drams of saffron and camphor dissolved in a little spirit of wine.

The horse's diet should be scalded or sprinkled bran, and the best hay, with which he should be fed by hand, as he sometimes cannot lift up his head to the rack. Drinking plentifully will greatly contribute to dilute the blood; but if the fever should increase, balls of contrayerva root,

myrrh, and snake-root, powdered, of each two drams; saffron, one dram; mithridate or Venice treacle, half an ounce, mixed with honey, should be immediately given twice or thrice a day, with two or three horns of infusion of snake root sweetened with honey; to a pint and a half of which may be added half a pint of treacle water or vinegar; if these balls produce no sensible effect, let a dram of camphor or castor be added to each of them; or the following drink may be substituted in their stead for some days: take a dram of camphor dissolved in one ounce of rectified spirit of wine; then gradually pour on a pint of distilled vinegar warmed, and give it at two doses. If the horse should be colicive, recourse must be had to clysters or the opening drink; and if he purges to a considerable degree, diascordium may be added to his drinks instead of the mithridate. The operation of medicines in this disease is much promoted by plentiful drinking; the horse's staling should be restrained when it is considerable and weakening, by proper astringents, or by mixing lime-water with his drinks; and when he is remiss in this respect, and stales so little as to occasion a swelling of his body and legs, two or three of the following balls may be given at proper intervals, with a decoction of marshmallows sweetened with honey: take of sal prunella or nitre, one ounce; juniper-berries and Venice turpentine, of each half an ounce; and make these ingredients into a ball with oil of amber. If with this treatment the horse's skin feels kindly, his ears and feet are moderately warm, his eyes brisk and lively, his nose becomes clean and dry, his appetite increases, he lies down well, and stales and dungs regularly, there is a fair prospect of a speedy recovery; but he should be fed sparingly, and his diet should be light, and increased by degrees as he gains strength.

If the fever should intermit, give an ounce of Jesuit's bark in the interval of the fits, and repeat it every six hours till the horse has taken four or six ounces. (Bartlet's Farriery, and Farmer's Dictionary.)

Mr. White, in his "Compendium of the Veterinary Art," distinguishes only two kinds of fever, the one, an idiopathic or original disease, and termed *simple*; the other dependent upon external inflammation, and justly denominated *symptomatic* fever. The former does not occur so frequently as the latter, nor is it by any means so formidable in its appearance. The symptoms are shivering, succeeded by loss of appetite, dejected appearance, quick pulse, hot mouth, and some degree of debility; the horse is generally colicive, and voids his urine with difficulty. The disease is also often accompanied with quickness of breathing, and in a few cases with pain in the bowels, or symptoms of colic. As soon as a horse is attacked with this disease, Mr. White advises, that he should be lled freely; and in case of coliciveness, to give a pint of castor oil, or the oil of olives, and to inject a clyster of warm water-gruel. The following drink he has found to be a very useful laxative; take of Barbadoes aloes powdered, 3 drams, prepared kali 1½ dram, castor oil 4 oz. to 6 oz. simple mint-water and pure water, of each, 4 oz.; these ingredients should be mixed and will serve for one dose. After the operation of the laxative, the fever powder is to be given once in twelve hours, and continued until it has produced considerable diuretic effect. Mr. White has given several formulæ for preparing this powder, *e. g.* 1. Powdered nitre, 1 oz. and camphor, and tartarized antimony, of each, 2 drams; or, 2. Powdered nitre, 1 oz. and unwashed calx of antimony, 2 drams; or, 3. Antimonial powder, 3 drams, and camphor, 1 dram; either of these to be mixed for one dose. Warm water and maltes are to be administered frequently in small quantities,

warm

F E V E R.

warm cloathing, frequent hand-rubbing, and a liberal allowance of litter are also necessary. And when the fever runs high, it is advisable to insert rowels about the chest and belly, in order to prevent the recurrence of internal inflammation. When the disease appears to be going off, the horse looking more lively, and his appetite returning, let him be led out for a short time in some warm situation, and give now and then a malt mash for recovering his strength.

The *symptomatic* fever is generally occasioned by high feeding, close stables, and want of proper exercise; in some cases it is caused by a sudden transition from a cold to a hot temperature. This kind of fever is not preceded by shivering, like the simple fever; nor is it so sudden in its attacks, except when it is occasioned by great and long continued exertion. In this case the complaint assumes a very dangerous appearance in its earliest stage. The symptoms which this fever has in common with the simple fever, are loss of appetite, quick pulse, dejected appearance, hot mouth, and debility; and if to these be joined difficulty of breathing, and quick working of the flanks, with coldness of the legs and ears, the cause of it may be concluded to be an inflammation of the lungs. If the horse hang down his head in the manger, or lean back upon his collar with the appearance of drowlinefs, the eyes appearing watery and inflamed, it is probable that the fever depends upon an accumulation of blood in the vessels of the brain, and that the fladders are approaching; in this case, however, the pulse is not always quickened, but sometimes has been found unusually slow. When the symptoms of fever are joined with a yellowness of the eyes and mouth, an inflammation of the liver is indicated. If an inflammation of the bowels be the cause, the horse is violently griped. An inflammation of the kidneys will also produce fever, and is distinguished by a suppression of urine, and an inability to bear pressure upon the loins. When the fever arises from inflammation of the bladder, the horse is frequently staling, voiding only very small quantities of urine, with considerable pain. Extensive wounds, and particularly those of joints, will also produce symptomatic fever. In all cases of this kind, the essential remedies are copious and early bleeding, with rowels and blisters. (See INFLAMMATION.) In cases of symptomatic fever it will generally be necessary to take away four or five quarts of blood at the first bleeding; and even six quarts have been taken away with manifest advantage.

Some modern writers on farriery have described another kind of fever, termed putrid or typhus, in which bleeding is extremely injurious. On this subject Mr. White makes the following observations. The grand characteristic of fever he conceives to be an unusually quick pulse, *i. e.* from seventy to one hundred in a minute; a peculiar kind of sensation which it gives to the finger, as if it were struck sharply by the vibration of a cord; and at the same time a feebleness, or smallness, quite different from the gradual swell of the healthy pulse. When a horse labours under considerable debility, either from hard work, want of sufficient food, or other causes, except fever, the pulse is more or less languid or weak, sometimes slower, and sometimes a little quicker than usual; nevertheless, it swells gradually, and does not give that sensation which physicians term "hardness," and which has been already described. Simple debility, or weakness, is distinguished from fever by other circumstances: the mouth and tongue are in their natural state; the horse readily sweats; and when the weakness is considerable, the ears and hind legs will feel rather cold, and his flanks generally move quicker than usual. If blood be drawn, it will be found very different from that of a horse

labouring under fever or inflammation. Though bleeding in such cases is extremely injurious, a mild laxative is useful, unless the dung be softer, and is more copious than natural; and if there be a deficiency of urine, or any difficulty in voiding it, a diuretic, composed of camphor and nitre, should be given. After the laxative, tonics, with a nutritious diet, and good grooming or nursing, generally restore the animal in a short time to health. This disease is sometimes mistaken for fever, and treated improperly. Several cases have occurred where debility succeeded the inflammatory commencement, and rendered bleeding, and sometimes purging also, highly improper: and perhaps, says Mr. White, such cases have been mistaken by some writers for the *typhus*, or low putrid fever; or others may have copied their description of it from that given by authors on human diseases. In cases of simple debility, the following medicines have been found very beneficial, giving the laxative in the first place, if the horse be colicive, or even if the bowels be in a natural state; during its operation, however, it is advisable to give strong gruel instead of bran mashes. The *laxative* is prepared by mixing, for one draught, Barbadoes aloes, 3 dr.; powdered canella, 1½ dr.; prepared kali, 1 dr.; and mint-water, 8 oz. The *tonic* is composed of yellow Peruvian bark, 6 dr.; cascarella, 1 dr.; powdered opium, ½ dr.; prepared kali, 1 scr.; with syrup enough to form a ball for a dose. It is often found necessary to increase the proportion of bark, and sometimes of the other ingredients; but when the horse becomes colicive, the opium must be omitted, the most proper food on these occasions is good sweet oats, and the best hay, given frequently in small quantities. The horse should be allowed to drink frequently, and his exercise should be very moderate. If he become colicive, a clyster, or even a mild laxative, may be given.

FEVER, *Epidemic*, or *Distemper of Horses*, generally appears in the form of a violent *catarrh*, or cold; the first symptoms are cough, heaviness of the head, the eyes often watery, or a little inflamed; sometimes there is a quickness of breathing: and the inflammation of the membrane which lines the nose, throat, and windpipe, is often so considerable as to cause a difficulty in swallowing; and the pulse is generally quicker than usual. Without recurring to the proper remedies, weakness ensues, and considerable fever takes place; the appetite goes off; the cough and quickness of breathing increase, and debility is so great, that the animal staggers in his walk. The nose discharges offensive matter; and after lingering for some time, the horse dies from a consumption.

When an epidemic happens, horses should be carefully watched; and on the first appearance of any symptoms of the disease, the animal should be bled moderately, unless he is in low condition, or previously exhausted by hard work, old age, or unwholesome food. After bleeding, give the following laxative, *viz.* Barbadoes aloes, 2 dr.; tartarized antimony, 1 dr.; first mixed with about four oz. of warm water, and then add 4 oz. of castor oil: the whole to be given as a dose: let the horse's diet consist of bran mashes, sweet hay, and a very small quantity of oats. A relapse should be prevented by good nursing, and giving every day a dose of some antimonial preparation, of which, that which resembles Dr. James's fever powder is the best. But when the inflammatory symptoms are at first violent, when there is a quickness of breathing, soreness of the throat, and distressing cough, a blister to the throat is necessary; and unless weakness forbids, bleeding even to three quarts is proper. A laxative is always beneficial at first, if the bowels be not too open; after which, the antimonial with nitre is to be given daily. Warm cloathing, and frequent

quent hand-rubbing to the legs, are useful; but a close stable is injurious. The horse should be turned loose into a large stall; and if a discharge from the nose appear, let it be encouraged by causing the vapour of warm water to pass through the nostrils, and cloathing the head and ears. When the disease, from being neglected, or improperly treated at first, becomes alarming, and the weakness is considerable, nothing but tonic medicines and a nutritious diet can do any good.

FEVER, in *Mythology*, one of the Roman divinities, who had a temple on Mount Palatine, mentioned by Cicero. Valerius Maximus says that he had others, into which they carried the remedies used in diseases. On one monument she is called the "Holy Fever."

FEVER-Root, in *Botany*. See TRIOSTEUM.

FEVER-Weed. See ERYNGIUM.

FEVERFEW. See MATRICARIA.

FEVERFEW, *Bylandt*. See PARTHENIUM.

FEVERFEW, in the *Materia Medica*, the parthenium of Dioscorides, has been very generally employed since his time for medical purposes. In natural affinity it ranks with camomile and tanfy, and its sensible qualities shew it to be nearly allied to them in its medicinal character. According to Bergius its virtues are tonic, stomachic, resolvent, and emmenagogue. It has been given successfully as a vermifuge, and for the cure of intermittents; but its use is most celebrated in female disorders, especially in hysteria: whence it is supposed to have derived the name "Matricaria." Its smell, taste, and analysis prove it to be a medicine of considerable activity: so that we may say with Murray, "Rarius hodie prescribitur quam debetur."

The leaves and flowers communicate by infusion their strong smell and bitter taste to water and rectified spirit. The watery infusions, inspissated, leave an extract of considerable bitterness, and which also discovers a saline matter both to the taste and by throwing up to the surface small crystalline efflorescences in keeping: the peculiar flavour of the matricaria exhales in the evaporation, and impregnates the distilled water, on which also a quantity of essential oil is found floating. The quantity of spirituous extract, according to Cautheuser's experiments, is only about $\frac{1}{4}$ th the weight of the dry leaves, whereas the watery extract amounts to near one-half. Lewis. Woodville.

FEVERSHAM, in *Geography*. See FAVERSHAM.

FEUGEROLLES, a town of France, in the department of the Rhone and Loire; 5 miles S. of St. Etienne.

FEUILLANS, in *Ecclesiastical History*, an order of religious clothed in white, and going bare-foot, who live under the strict observance of the rule of St. Bernard.

The name was occasioned by a reform of the order of Bernardus, first made in the abbey of Feuillans, a village in France, five leagues distant from Thoulouse, by the sieur Barriere, who established it about the year 1580.

It was approved of by pope Sixtus V. and the popes Clement VIII. and Paul V. granted it its particular superiors. King Henry II. founded a convent of Feuillans in the Fauxbourgh St. Honoré at Paris in 1587.

There are also convents of nuns who follow the same reform, called Feuillantes; the first of which was established near Thoulouse in 1590.

FEUILLE *de Sci.*, in *Heraldry*, expresses that an ordinary, as a fesse, pale, or the like, is indented only on one side; because it then looks like the leaf of a saw, as the French phrase imports.

FEUILLEA, in *Botany*, named by Linnæus in honour of Father Louis Feuillée; see FEUILLÉE. Linn. Gen. 523. Schreb. 690. Juss. 397. (Nhandiroba; Plum. Gen. t. 27.)

Class and order, *Diocia Pentandria*. Nat. Ord. *Cucurbitaceæ*? Juss.

Gen. Ch. Male, Cal. Perianth of one leaf, bell-shaped, rounded at the base, spreading in the upper part, cut half way down into five segments. Cor. of one petal, wheel-shaped; limb cut half way down into five convex, rounded segments; the centre closed with a double star, whose rays are alternately longer and shorter, regarding the course of the sun. Stam. Filaments five, awl-shaped; anthers two-lobed, roundish. There are five compressed incurved filaments, ranged alternately with the stamens.

Female, Cal. Perianth as in the male, but with the germen at its base. Cor. as in the male; the central star furnished with five heart-shaped plates. Pyl. Germen inferior; styles five, thread-shaped; stigmas heart-shaped. Peric. Berry very large, ovate, obtuse, fleshy, three-celled, with a woody coat, encompassed by the calyx. Seeds several, orbicular, compressed, oblique.

Eff. Ch. Male, Calyx five-cleft. Corolla five-cleft. Stamens five, with five alternate barren filaments.

Female, Cal. and Cor. as in the male. Styles three. Berry hard, three-celled. Seeds orbicular.

Obs. The above characters, copied from Linnæus, appear to have been taken by him entirely from Plumier's figure, except that the description of the fruit was partly borrowed from Maregrave. We have seen the seeds, sent from Jamaica by the name of Antidote Cocoon, which appellation is mentioned in Browne's Jamaica, p. 374; and as they agree with Plumier's figure above quoted, we are so far right as to the genus.

With regard to the species, whether one or two, they are to be known from Plumier and Maregrave only.

1. *F. cordifolia*. Linn. Sp. Pl. ed. 1. 1013. Plum. Ic. t. 209. "Leaves heart-shaped, angular." (Nhandiroba scandens, foliis hederaceis angulosis; Plum. Gen. 20.) Native of the West Indies, or South America. Stem climbing, furrowed. Leaves alternate, stalked, heart-shaped, acute, with three or five slight angles, entire, smooth on both sides, reticulated with numerous veins, dark green above, rather paler beneath. Stipules none. Tendrils axillary, solitary, simple, about as long as the leaves. Flower-stalks axillary, either with respect to the leaves or the tendrils, compound, alternately branched, many-flowered. Our description is taken from Plumier's figure, assisted by a leaf gathered by himself.

2. *F. trilobata*. Linn. Sp. Pl. ed. 1. 1014. Plum. Ic. t. 210. "Leaves with three (or five) lobes." (Ghandiroba, vel Nhandiroba Brasiliensibus; Maregr. Brasil. 46, cum ic. Sloane Jam. v. 1. 200.) Native of Brazil and Jamaica, in woods and hedges. This appears to differ from the former chiefly in the form of its leaves, which are deeply three-lobed, the lateral lobes being moreover generally elongated at the base into two other shorter more obtuse lobes. In colour, texture, and habit, they appear, by an original specimen, to agree precisely with the former. The inflorescence is so different in Plumier's, t. 210, that we apprehend some mistake. It there consists of a few solitary flowers, from the bosoms of small leaves on a lateral branch. Yet this is not altogether dissimilar to Maregrave's figure.

Linnæus seems to have been led by Browne to unite the two in Sp. Pl. ed. 2, by the name of *F. scandens*; but he again separated them in his Syst. Veg. He very erroneously confounded with the latter his own *Tribofantbes punctata*, Sp. Pl. 1432, as well as the *Tribofantbes* of Browne's Jamaica, 354, two plants as unlike each other as they are to either of the *Feuilleæ*. As great a mistake exists in his son's herbarium, where, under the name of *F. triloba*,

is found the *Modékka* of Rheede Hort. Malab. v. 8. 39. t. 20. This belongs to a genus hitherto not defined by systematic botanists, though mentioned by Jussieu, for future consideration, under *Paffiflora*. Linnæus in his second Mantilla, 336, strangely confounds it with *Convolvulus paniculatus*. We have a species or variety of *Modékka* from Sierra Leone, gathered and ascertained by Dr. Atzelius, which flowered in September 1793, in the stove of the late Lady Amelia Hume, where we gathered and fully described it. This very plant, which was a male, bore some simple heart-shaped leaves, like those of *Orelamodékka*, Hort. Malab. t. 23, with others that were variously lobed, mostly three-lobed, like t. 20. See also t. 21. Such a variation, in a plant so much allied in natural affinity to *Feuillea*, may justify the union of its two supposed species into one. S.

FEUILLE'E, Louis, in *Biography*, a Franciscan friar, of the order of minims, celebrated as a botanist and natural philosopher, was born at Mane in Provence, in 1660. He travelled to the western coast of South America, investigating the natural productions of New Spain and the neighbouring islands, from the year 1707 to 1712. He had previously visited Carthageua, and the island of Martinico, in 1703 and 1704. These, with several other voyages, the number and course of which are not exactly recorded, he accomplished under the patronage of Louis XIV. by whom he was pensioned and greatly encouraged. The king caused an observatory to be built for him at Marseilles, in which town Feuillée, worn out with his labours, died in 1732, aged 72. He is said to have been of that modest simple character, which best becomes an ecclesiastic and a true philosopher. Nevertheless, he was excited to a considerable degree of resentment against Monsieur Frezier, a rival philosopher and naturalist, sent out likewise by Louis XIV., whom he criticises at some length, in a rather contemptuous style, in the preface to the *Journal* of one of his voyages.

Feuillée published "Journal des Observations physiques, mathématiques, & botaniques, faites par l'ordre du Roi, sur les côtes orientales (occidentales) de l'Amérique meridionale, & dans les Indes occidentales, depuis l'année 1707 jusques en 1712," Paris 1714, in two vols 4to. with numerous plates. This is a circumstantial and exact work, written with no elegance of style, but valuable for solid information upon all the subjects announced in its title, with various incidental matter besides. What relates to Peru makes a principal part of these volumes. The descriptions of plants occupy 62 pages at the end of the second, accompanied by 50 very tolerable plates, in which Linnæus confined for his definitions of several species, without seeing specimens, a measure he rarely adopted. But it does not appear that Feuillée was one of those writers who, having been found to have missed him, caused him, in the preface to his *Species Plantarum*, to declare against that practice in future, "non visas plantas heic omisi, toties elusus ab auctoribus." The reputed medical virtues of the plants met with laudable attention from Feuillée, and are always added to his botanical descriptions. Haller remarks that he first established the genus *Epipactis* in this work, and he certainly describes some species still unknown to us, not only of that genus, but several others. (See *EPIPACTIS*.) The magnificent *Flori-pandio* (*Datura arborea*) was here first made known to botanists.

He published another quarto volume, with a similar title, in 1725, in the preface to which he censures Frezier, as above-mentioned. The appendix, of 71 pages, with 50 plates, describes many extremely interesting plants of Chili,

among which are the first described *Calceolaria*, the Sweet Potatoe, *Convolvulus Batatas*, whose flower is scarcely known but from this figure, the *Buddlea globosa*, now so common, as well as the equally common, but transcendently elegant, *Fuchsia coccinea*.

These 100 botanical plates were, according to Haller, republished at Nuremberg in 1756 and 1757, in two vols 4to., with a German translation of their descriptions.

The original drawings of Feuillée, many of which were never published, remain in the *Bibliothèque Nationale* at Paris. They are very rudely coloured, and without any pretensions to the skill of a painter. Whatever merit of that kind, slight as it is, can be discerned in his plates, is entirely owing to the engraver. S.

FEUILLE'E, La, in *Geography*, a town of France, in the department of the Lower Seine; eight miles W. of Gournay.

FEULEN, a town of Germany, in the principality of Culmbach; six miles S.E. of Culmbach.

FEUQUIERES, ANTHONY DE PAS, *Marquis* of, in *Biography*, was descended from a family distinguished in arms, and born in 1648. He, following the steps of his ancestors, became noted for acts of heroism and military prowess. His conduct in the campaign in Germany, in 1688, obtained for him the rank of *maréchal-de-camp*. For the part which he took in several actions in Piedmont, he rose, in 1693, to the rank of lieutenant-general. This was the highest promotion he obtained; and he felt most severely the slight put on him, as he thought, in passing him over when others were appointed marshals of France. He became the enemy of all contemporary commanders, whose conduct was rigidly scrutinized by Feuquieres. He discovered, and enumerated, twelve capital blunders which the French generals had committed at Blenheim. He published the result of his enquiries and criticisms on the generals employed by Lewis XIV., in a work entitled "Memoirs." This volume has a good reputation for clearness of style; for the freedom of its representations, and for the depth and sagacity of its remarks. He died in 1711, having a few hours before his death written a letter to the king, in which, with great feeling, he recommended to his majesty's favour his only son, as innocent of what had made him unfortunate, and born of a race which had always faithfully served their king. Gen. Biog.

FEUQUIERES, in *Geography*, a town of France, in the department of the Oise; eight miles W. of Granvilliers.

FEURDON, JUSTUS, in *Biography*, who flourished in the 17th century, was brought up to the profession of the law, which he soon relinquished for the study of theology and the belles lettres. He obtained several respectable appointments, till at length, on the death of Helvicus, in 1617, he was made professor of divinity at Gießen, of which town he was already the pastor of the church. In 1629 he was nominated preacher to the court by the Landgrave George; and in the following year he received still higher preferment at Gießen. After this, his high reputation obtained for him invitations from other places, but he preferred spending the remainder of his days at Gießen, where he died in the year 1656. He was author of many theological works which are enumerated by Moreni and others.

FEVRE, GUY LE, was born, in 1541, at the family seat of La Boderie, in Lower Normandy, whence he obtained the title of "Sieur de la Boderie." It has been supposed, from the bent of his studies, that he was intended for the ecclesiastical profession. He was a diligent student in the oriental languages, and had, in after life, a large share in the compo-

fiction of the Polyglott of Antwerp, of which Arias Montanus was the chief director. He complains that neither himself, nor his brother Nicholas, who had likewise a share in the same work, was properly remunerated for their labour. On his return to France he was made secretary and linguist to the duke of Alençon, who was likewise deficient in the principle of gratitude. He died on his estate at La Boderie in 1598, leaving behind him various works relative to the Syriac, Chaldaic, and other oriental languages. He translated a treatise on baptism, written by Severus, patriarch of Alexandria; and wrote some poetical pieces, by which he acquired considerable reputation among his contemporaries. His brother Anthony, born about 1555, was some time Charge des affaires for Henry IV. at the court of Rome, and afterwards ambassador extraordinary in England; and when he left this country he received singular marks of friendship from king James and several of the nobility. An account of his negotiations, in letters written by him to the ministers, and their replies, were published in 5 vols. 12mo. under the title of "Ambassades de M. de la Boderie en Angleterre sous le Regne de Henry IV. et la minorité de Louis XIII." Moreau.

FEVRE, OF FABRI, JAMES DE, who flourished in the 16th and 17th centuries, was born at Etaples. He was of low extraction, but possessed vigorous mental powers, which he improved by a diligent application to the different branches of useful and ornamental learning. He pursued his studies in the university of Paris, where he afterwards took the degree of doctor, and delivered lectures to numerous pupils in the belles lettres and philosophy. The system which he taught, or rather his opposition to old and long established theories, exposed him to the jealousy of ignorant zealots, by whom he was accused of being friendly to Lutheranism. He was obliged to leave Paris, and, on the invitation of William Briçonnet, bishop of Meaux, he took refuge in the family of that worthy ecclesiastic, who was obliged, in a short time, for the sake of his own peace, and that of his family, to withdraw the protection of which Fevre so much stood in need. He was now abandoned to the wide world, and first went to Blois, thence to Guicame, about which time he was degraded from the doctor's degree, by the faculty of the Sorbonne. Not content with this, his enemies induced the parliament of Paris to order a process to be carried on against him; from the effects of which he was timely delivered by an order from the sovereign Francis I., who forbade them to come to any resolution against Le Fevre without his injunction. Margaret, sister to the king, and herself queen of Navarre, took the persecuted man under her protection, and honoured him with her confidence and esteem during the remainder of his life. By her authority he went to Stralburg to confer with Bucer and Capito, respecting a reformation in the church; it does not, however, appear that he was prepared to go far into the business of reform. He continued, by profession at least, attached to the church of Rome till his death in 1537. But towards the close of life he felt uneasiness at not having been more bold in the cause of truth. While at dinner with his patroness, the queen of Navarre, and in a company of learned men, he was observed, in the midst of the entertainment, to burst into tears, and, in explanation, he declared that his conscience accused him of being highly criminal, in having known the truth, and taught it to others, who had sealed it with their blood, and yet shrunk from his duty in avowing it, and timidly taken refuge in a place of security, far from the scenes where the crowns of martyrdom were distributed. The queen endeavoured to console him, but probably without much effect; he felt that he had not

done all that he might and ought to have done, and was come to that point of time in which self-deception could no longer avail. This declaration seemed to give ease to his labouring mind; he made some arrangements with regard to his property, and almost immediately expired. Le Fevre published various works that display much solid erudition, and great critical skill; and if the opinion of Simon be of weight, he is to be ranked with the best commentators of his age. His translation of the New Testament into French is highly esteemed, and is now very scarce. Le Fevre once involved himself in a contest with Erasmus, by treating his notes on the New Testament with undue severity, and even charging the author with intentionally corrupting the scriptures, and advancing impieties. Erasmus vindicated his conduct in the most satisfactory manner, and freely forgave his antagonist, assuring him that he should, notwithstanding what had happened, continue to respect him. Such liberal conduct on the part of Erasmus produced the happiest effect on Le Fevre, who sincerely repented of his having attacked Erasmus; and "they continued," says the learned and candid Jortin, "to speak of each other with great respect and esteem;" hence, he infers, that "it would be happy if wrangling geniuses would copy from their example, and consider a little how all men of sense and manners applaud such moderation, and how they abhor and despise those, who having begun to quarrel, perhaps upon mere baubles, never end their contests and animosities, till death comes and puts them to silence." Bayle. Morcri. Jortin.

FEVRE, TANNEGUI LE, was born at Caen in the year 165. He received a private education, and then finished his studies at the college of La Fleche, where he distinguished himself. At Paris he obtained the patronage of cardinal Richlieu, who procured him a pension of 2000 livres, as inspector of the works printed at the Louvre. At the death of Richlieu he went to Langres, where he avowed himself a Protestant, and was invited to Saumur to the professorship of classical literature. His mode of instruction was so excellent that he had pupils from all parts. Voltaire, in speaking of him, asserts, that he despised those of his sect, and lived among them more as a philosopher than a huguenot. He died in 1672, as he was preparing to quit Saumur for Heidelberg, whither he had been invited by the prince palatine. His works were translations of, and comments on, Greek and Latin authors; he published two volumes of "Letters," and Greek and Latin poems. He wrote Latin elegantly, though not without some Gallicisms. He was a man of strict probity and integrity, of which he gave proof by dedicating a work to Pelisson while a state prisoner. Moreri.

FEVRE, CLAUDE LE, a painter, a native of France, born in 1633. He principally painted portraits, but he likewise attempted flowers, and even historical subjects, but not with so great success. He came to London, where he met with much encouragement for several years, and there he died in 1675.

FEURS, FORUM SEGUSIANORUM, in *Geography*, a town of France, in the department of the Loire, and chief place of a canton in the district of Montbrison; 25 miles W. of Lyons. The place contains 1,796, and the canton 14,016 inhabitants, on a territory of 250 kilometres, in 18 communes. About a league from this town, at the foot of a rock, called Dinzy, is a mineral spring, of a sulphureous quality.

FEUTSKING, JOHN HENRY, in *Biography*, was born in the duchy of Holstein in the year 1672. Having acquired a good stock of elementary knowledge, he went to
Rostock

Rostock to study philosophy and theology, and from thence he removed to Wittenberg, where he was created doctor in philosophy, in the year 1692. Here he acquired much reputation, and was appointed pastor and superintendent of the diocese of Jessen in the year 1697. In the following year he was admitted to the degree of doctor in divinity. He obtained several offices, and at length became pastor of the church of St. Bartholomew at Zerbst, preacher to the court, confessor and ecclesiastical counsellor, and superintendent of the diocese of Zerbst, in Anhalt, by the prince of that name. In the year 1709 he undertook the offices of professor of divinity, and assessor of the ecclesiastical consistory of that city. At the same time he preached once a week before the electors of Saxony, and was honoured with the post of ecclesiastical counsellor to the duke of Saxe-Gotha. His last appointment was that of confessor to the electors of Saxony, in 1712, an office that he enjoyed but a few months, as he died in 1713, when only 41 years of age. His works, which are very numerous, are chiefly on theological subjects. They are enumerated by Moreri, who may be referred to by the curious.

FEWEL. See FUEL.

FEWMET. See FUMET.

FEWS, in *Geography*, a barony of the county of Armagh, Ireland, with a village of the same name. The south and west parts of this barony are full of mountains. The soil of these mountains is much inclined to grass, which is less coarse than that usually met with on mountain ground, so that the cattle have always full pasture, except in time of continued snow. The grass-farms are large and extensive; and there is also much tillage in this district. The Fews abound with whins or gorse (*ulex Europæus*), ferns, and those plants which flourish in a warm soil. There is no limestone in the district, but either a brittle and decayed free-stone with a ferruginous tinge, or a hard stone found in large blocks, which is called whinstone, but which differs from other stones called by that name. Coote's Armagh.

FEY, in *Rural Economy*, is a term which signifies the winnowing or cleaning of grain by means of the natural wind. It likewise signifies the bed or stratum of earthy materials by which chalk, marl, and other similar substances are covered, and which must be removed before the workmen can come at them. This sort of labour is consequently termed *feying*, and is usually paid for by measure, according to the difference in depth. In both chalk and marl pits they are considered the more valuable the less the *fey*.

Fey is also in some districts applied to the cleaning and digging out of ponds and wells.

FEYDANY, in *Geography*, a town of Samogitia; 16 miles S.S.W. of Miedniki.

FEYDEAU, MATTHEW, in *Biography*, was born at Paris in the year 1616. He pursued his studies in the college of the Sorbonne, and so conducted himself in that place as to obtain the esteem of persons of all ranks. In the year 1645, he was engaged by M. de Bellegarde, archbishop of Sens, to deliver a course of instructions to the candidates for holy orders in his diocese. He obtained some preferment in the church, and composed several useful books, among which was one entitled "A Catechism on Grace," which was afterwards reprinted with the title of "Illustrations of certain Difficulties respecting Grace." This work was condemned by a decree of the inquisition at Rome, which M. Fouquet, attorney-general of the parliament at Paris, would not permit to be promulgated in that city. In 1656, M. Feydeau was one of the seventy-two doctors who were expelled by the faculty of the Sorbonne, for refusing to subscribe to the condemnation of M. Arnauld, and on this account he was

obliged to relinquish his church preferment. After this, for several years, he lived chiefly in retirement, and produced his "Reflections on the History and Harmony of the Gospels," in 2 vols. 12mo.; a work which has gone through several editions. In 1665, he was presented by the bishop of Aleth with a prebend in his diocese; this he resigned in 1668, in order to undertake the cure of Vitri le François, in Champagne. Here he officiated seven years, and was then obliged to give up his charge in consequence of the persecutions with which his party was harassed. He was banished by a lettre de cachet to Bourges in 1677; and by another process he was sent to Annonai in the Vivarès, where he died in July 1694, in the 79th year of his age. He published many works, and left behind him many others that have not yet appeared. A long Latin epitaph was engraved on his tomb, which is preserved by Moreri.

FEY-HIANG, in *Geography*, a town of China, of the third rank, in Pe-tchéli; 12 miles S.E. of Quang-ping.

FEYJOO, BENEDICT JEROM, in *Biography*, a learned physician of the order of St. Benedict, born in Spain, who died in the year 1765. By his writings many have thought that he contributed as much towards curing the mental diseases of his compatriots, and reforming the vitiated taste of his countrymen, by introducing liberal notions in medicine and philosophy; as the great Michel Cervantes had done those of a preceding age, by writing his immortal work, the incomparable history of Don Quixotte. In the Teatro Critico, published in fourteen volumes, are many severe and cutting reflections against the ignorance of the monks, the licentiousness of the clergy, ridiculous privileges, abuse of pilgrimages, exorcisms, pretended miracles, &c. &c.; by which he made a formidable host of enemies. The confessor of truth, he would certainly have been also a martyr, had the numerous calls of vengeance been listened to by those in power. In a superstitious country like Spain, it was sufficient only to have praised such men as a Bacon, a Descartes, a Newton, &c. to incur the charge of heresy. The learned part of the nation, however, undertook his defence, and he escaped the grasp of the inquisition. And although in his writings he has demonstrated the uncertainty of the healing art, and the charlatancy of many among its practitioners; yet the medical college at Seville conferred on him the degree of doctor, and honoured him with a seat at their board. Mr. Bourgoing observes, that Dr. Feyjoo, or Feijoo, was one of those writers who treated this conjectural art in the most rational manner. Tableau de l'Espagne.

FEYOE', in *Geography*, a small island of Denmark, a little to the north of Laaland. N. lat. 54° 57'. E. long. 11° 25'.

FEYREGG, a town of Austria; 8 miles W.S.W. of Steyr.

FEYSTRIZ, a town of Austria; 15 miles S.S.W. of Ebnfurth.

FEZ, a province of the empire of Morocco, in Africa, situated to the north of Tedla and Shavaya, and having to the west the provinces of Benihasen and Garb, and mount Atlas to the east, and stretching to the north as far as the provinces of Shans, Rif, and Garet. This was formerly a kingdom of very great extent, and still its dependencies are numerous and extensive, including several mountains, abounding in inhabitants, and well cultivated. According to Jackson, the district of Fez, exclusive of the cities or towns, contains 1,280,000 inhabitants. The kingdom of Fez has been united to Morocco, since it first became an independent sovereignty in the 13th century. Although a considerable part of this country lies waste, and a tract to the west of Old Fez abounds with marshes, which render the

air unwholesome, and the people unhealthy; the soil is elsewhere fertile, and produces, in the greatest abundance, corn, fruit, flax, salt, gum, wax, &c. and also oranges, lemons, figs, and olives. The mountains abound with game, and the forests with wild beasts. The lions of Fez are the most daring and savage of any in Africa; horses, camels, kine, sheep, goats, and hares, are very numerous. The principal exports from this province are hides and leather of all sorts, particularly that denominated Morocco, skins, furs, wool, dates, almonds, figs, raisins, olives, honey, wax, silk, cotton, flax, horses, ostrich-feathers, gold-dust, &c. The imports chiefly consist in spicery, cochineal, vermilion, iron, brass, steel, wire, arms, ammunition, drugs, watches, small looking-glasses, quicksilver, tartar, opium, alum, aloes, English and other linen and woollen cloths, muslins, calicoes, fustians, gold wire, silk of all kinds, brocades, damasks, velvets, and woollen caps, toys and trinkets of all sorts, Guinea cowries, combs, paper, and a great variety of earthen ware.

Fez, a city of Africa, and capital of the province of that name, was built, about the end of the eighth century, by Edris, the descendant of Mahomet and Ali, whose father, flying from Medina to avoid the proscriptions of the caliph Abdallah, retired to the extremity of Africa, and was proclaimed sovereign of the Moors. Sidy Edris, succeeding to the crown of his father, founded the city of Fez, in 793, and built the mosque in which he is buried. From that time the city of Fez has been considered by the Moors as a sacred asylum, and an object of devotion. In the first moments of that zeal which every religious novelty inspires, a still larger mosque was built at Fez, and called "Caroubin," because it was founded by the Arabs of Carroan. This is one of the finest edifices in the whole empire. Many other mosques were successively built at Fez, to which were annexed, according to the custom of the Mahometans, colleges and hospitals; and this city was held in so high a degree of veneration, that when the pilgrimage to Mecca was interrupted, in the fourth century of the Hegira, the western Mahometans, as a substitute, repaired to Fez, while the eastern journeyed to Jerusalem. When the Arabs had extended themselves in Asia, Africa, and Europe, they brought to Fez the knowledge they had acquired in the arts and sciences; and, to its religious schools, this capital added academies for philosophy, physic, and astronomy. Fez, resorted to from almost all Africa, and the object of the devout pilgrimages of the Mahometans, soon became the rendezvous of the neighbouring provinces. The increase of wealth produced the love of pleasure, and every species of luxury; licentiousness quickly followed; and as its progress in hot countries is always most rapid, Fez, the school of sciences and manners, soon became the sink of every vice. The public baths, which health, cleanliness, and custom rendered necessary, became the receptacles of the most infamous debauchery. The Mahometans of Andalusia, Grenada, and Cordova, during the revolutions of Spain, passed over to Fez, whither they brought new manners, knowledge, and, perhaps, some degrees of civilization. They taught the Spanish method of dressing and dyeing red and yellow goat and sheep skins, then called Cordova leather, now Morocco, from the city of that name, where, however, the dye is least in perfection. At Fez, likewise, they established the manufacture of milled woollen caps, worn by the Moors and eastern nations. Gauzes, silks, stuffs, and beautiful shawls, wrought in gold and silver, are manufactured at Fez; and the little they do proves how much might be done, if nodally were encouraged. Some love of learning is still preserved at

Fez, where Arabic is better spoken than in the other parts of the empire. The rich Moors send their children to the schools at Fez, where they gain more instruction than they could do elsewhere.

The city of Fez contains some tolerably convenient inns; the streets are ill-paved, and so narrow that in many places two horsemen cannot ride abreast. Fez, though in times past it attracted the attention of travellers, is in no respect preferable to the other cities of the empire, except by its situation, schools, industry, and somewhat greater urbanity; yet, though more polished than their countrymen, the Moors of Fez are vain, superstitious, and intolerant. The saints, whom they pretend to have buried in that city, furnish a pretext for prohibiting Jews and Christians to enter it; and an order from the emperor is necessary to gain admission. The local situation of Fez is somewhat singular. It is seated at the bottom of a valley, and surrounded by hills in the form of a funnel, flattened at the narrow end. The upper part of the valley is divided into gardens, planted with high trees, orange groves, and orchards. A river, called Rasfalet, winds along the valley, watering it in various directions, turning by its streams a number of mills, and supplying water in abundance to all the gardens and most of the houses. On the height of Old Fez is a plain capable of great cultivation. Jacob-Ben-Abdallah, of the race of Beni-Merian, built, in the 13th century, New Fez, contiguous to the Old, and, by its situation, keeping the latter in awe. The high town, which is salubriously situated, contains some old palaces, in which the sons of the emperor live. The new town is inhabited by some Moorish families, but by a greater number of Jews, who trade with Old Fez, notwithstanding the contempt with which they are treated by the inhabitants; their gains, however, reconcile them to this contempt. Fez is about 200 miles N.N.E. of Morocco. Fez is said to have about 3000 inhabitants. N. lat. 33° 50'. W. long. 5° 20'. Chénier's Morocco, vol. i.

FEZZAN, a country of Africa, situated to the south of Tripoli, and 60 journies west of Cairo. Mr. Horneman, a late traveller, sent out at the expense of the African association, informs us, that the greatest length of the cultivated part of this country is about 300 English miles from north to south, and the greatest width 200 miles from east to west; but the mountainous region of Harutfeh to the east and other deserts to the south and west are reckoned within its territory. The borderers to the north are Arabs, nominally dependent on Tripoli. Fezzan, to the east, is bounded by the Harutfeh and line of deserts; to the south and south-east is the country of the Tibboos, to the south-west that of the nomadic Guaricks; on the west are Arabs. The kingdom contains 101 towns and villages, of which Mourzouk is the capital. The principal towns next in order to the imperial residence are Soekna, S-bba, Hun, Wadon to the north, Gatron (or Kattrou) to the south, Yerina (or Jerma) to the west, and Zucia to the east. The climate is at no season temperate or agreeable. During the summer the heat is intense, and when the wind blows from the south is scarcely supportable, even by the natives. The winter might be moderate, were it not for the prevalence of a bleak and penetrating north wind during that season of the year, and which chilled and drove to the sick not only the people of the place, but even myself, the native of a northern country. It rains at Fezzan seldom, and then but little in quantity. In January 1799, there were some faint lightnings without thunder. Tempests of wind are frequent both from the north and south. There is no river or even rivulet deserving notice throughout the whole country. The soil is a deep sand covering calcareous rock

or earth, sometimes a stratum of argillaceous substance. Dates may be termed the natural and staple produce of Fezzan. In the western parts some senna is grown, of a quality superior to that imported from the country of the Tibboos. Pot-herbs and garden vegetables are plentiful. Wheat and barley are sown to the soil and climate; but, from inexperience, or want of skill, and from the indolence of the people and oppressions of government, corn is not raised sufficient for the inhabitants, and they rely for subsistence on importation from countries bordering on the north. Very little attention is bestowed in rearing beasts: horned cattle are to be found only in the most fertile districts, and even there few in number; they are employed in drawing water from the wells, and slaughtered only in cases of extreme necessity. The ordinary domestic animal is the goat. Sheep are bred in the southern parts of the kingdom, but the general supply is furnished by the bordering Arabs. The wool is manufactured into abbes, or coarse woollen cloths, the general clothing throughout the country; with the meat the skins are roasted while fresh, and eaten. The horses are few: asses are the beasts of general use, whether for burthen, draught, or carriage. Camels are exceedingly dear, and kept only by the chief people, or richer merchants. All these animals are fed with dates, or date kernels. The commerce of Fezzan is considerable, but consists merely of foreign merchandize. From October to February Mourzouk is the great market and place of resort for various caravans from Cairo, Bengail, Gudan, Twat, and Soudan; and for other smaller groups of traders, Tibboos, Tuaricks, and Arabs. The caravans from the south bring slaves of both sexes, ostrich feathers, zibette, tiger skins, and gold. From Bonon copper is imported in great quantities. Cairo sends silks, melayes, (striped blue and white calicoes,) woollen cloths, glass, imitations of coral, beads for bracelets, and East-India goods. The merchants of Bengail, who usually join the caravan from Cairo at Augela, import tobacco, snuff, and sundry wares fabricated in Turkey. The caravan from Tripoli chiefly deals in paper, false corals, fire-arms, sabres, knives, cloths called abbes, and red worsted caps. Those trading from Gadamus bring nearly the same articles. The smaller caravans of Tuaricks and Arabs import butter, oil, salt, and corn; and those coming from the more southern districts bring senna, ostrich feathers, and camels for the slaughter house. Fezzan is governed by a sultan, descended from the family of the Shereefs. The tradition is, that the ancestors of the reigning prince coming from western Africa, invaded and conquered Fezzan about 500 years past. The sultan reigns over his dominions with unlimited power; but he holds them tributary to the bashaw of Tripoli. The amount of the tribute was formerly 6000 dollars; it is now reduced to 4000, and an officer of the bashaw comes annually to Mourzouk to receive this sum, or its value, in gold, senna, or slaves. On his journey he takes travelling merchants under his protection. The throne is hereditary in the eldest prince of the royal family, whether nephew or son. The revenues are produced from a tax on gardens and cultivated lands, fines and requisitions, with a further income from duties on foreign trade; from domains of the crown, salt pools, natron lakes, &c. The public expenditure consists in the maintenance of the sultan, his court, and palace. The cad and department of justice, the religious, and the great officers of government, are supported from the produce of date tree woods, and gardens set apart for that purpose. The dignity of cad or judge, who is also chief of the clergy, is hereditary in a certain family. The population of Fezzan is loosely estimated at 70,000 or 75,000,

all of whom, without exception, profess the Mahometan religion. The colour or complexion of the people varies; those of the northern parts have a complexion and features similar to those of the Arabs. In the southern districts they have mixed with the natives of the great nations bordering on that quarter, and bear a resemblance to the Tibboos and the Tuaricks. The genuine and indigenous race of Fezzaners may be described as a people of but ordinary stature, and their limbs by no means muscular or strong; their colour a deep brown, their hair black and short, their form of face such as in Europe we should term regular, and their nose less flattened than that of the negro. Their men, walk, and every gesture, denote a want of energy either of mind or body. The tyrannic government, the general poverty of the country, and their only food consisting of dates, or a kind of farinaceous pap, with no meat, and rarely with a little rancid oil or fat, sufficiently account for the abject state of the inhabitants. Throughout Mourzouk Mr. H. could not find one artificer skilful in any trade or work: indeed there are no other tradesmen but shoemakers and smiths. The latter work every metal without distinction; and the same man who forges shoes for the sultan's horse, makes rings for his princesses. The women fabricate woollen cloths solely by hand, as the weaver's shuttle is unknown. The dress consists of a shirt or frock, made of coarse linen or cotton cloth, brought from Cairo, and the abbe. The middling classes wear frocks made in Soudan of dyed blue cloth. The richer people, and the Mamelukes of the sultan, are clothed in the Tripolitan habit, over which they wear a Soudan shirt of variegated pattern and colours, and likewise the abbe. The ornaments are chiefly confined to the head dress, and rings on the arms and legs. The women are fond of dancing, and are wanton in their manners. The men are much addicted to drunkenness. Their beverage is the fresh juice of the date tree, called lugibi, or a drink called busa, prepared likewise from dates. The houses are miserably constructed with stones or bricks of a calcareous earth mixed with clay, and dried in the sun. They are low, and the light enters by the door only. As to diet, says Mr. Horneman, I never knew a more abstemious people than those of Fezzan. Meat indeed is a food they can at no time abstain from, when set before them; but meat is not an article of food with the people in general. To indicate a rich man at Mourzouk, the usual expression is, "that he eats bread and meat every day."

FEZZARA, a town of Egypt, on the W. branch of the Nile; 13 miles S. S. E. of Rosetta.

FI, a syllable in French Classification, with which some musicians express *f*, *ma*, *b* b. See SOLMISATION.

FIACONE, in Geography, a town of Genoa, on the confines of the Milaneze, between Genoa and Tortona.

FIALLSIO, a town of Sweden, in the province of Angermanland; 83 miles N. N. W. of Hernoland.

FINO, a town of Naples, in Abruzzo Ultra; nine miles S. of Teramo.—Also, a town of Italy, on the Tiber; 15 miles N. of Rome.

FIANONA, a sea-port town of Fria, with a good harbour; 36 miles S. E. of Trieste. N. lat. 45° 49'. E. long. 14° 18'.

FIANTS, or FVANTS, the dung of a badger, fox, and other vermin.

PIOR, in *Rural Economy*, a term applied, in the northern parts of the kingdom, to certain averaged returns of the prices of different sorts of grain, &c. In East Lothian, according to the agricultural survey of that district, from time immemorial, it has been the practice of it and

some others to fix, by public authority, fiar or average prices of each kind of grain fold within the county for ready money. In it the average is taken only of wheat, barley, oats, and peas, as these were formerly the staple produce of the country; but though at present a large quantity of beans are grown, no fiar prices of them have ever been struck. In performing the business, the sheriff of the county, who strikes the fiars, calls before him, some time in the last week in February, or first week in March, a number of respectable tenants, and other persons who deal in corn; when he requires of them an account of the quantity and price of the grain bought or sold within the county, for ready money, from the time that the preceding crop came first into the market, until the day of the proof. Having procured an account of this, he strikes a general average for each of the four species of corn; he then finds the number of bolls that have brought a price above that average, of these he likewise takes an average; and he proceeds in the same manner with what has been sold below the general average. To each of these rates he adds two and a half per cent., and they then form what are called the first, second, and third fiars. The addition of two and a half per cent. to the real prices must appear a singularity to strangers, who may not easily perceive either the object or propriety of it. It is explained in the following ingenious and seemingly just manner. Upon looking into the extract from the second of the fiars it will be found, that from the year 1627 down to 1647, the fiars were struck only once in the year, and as the record is silent as to the date for the first thirteen years, it is impossible now to say at what period of the year these fiars were struck; but in the year 1648 the record shews that fiars were struck twice for that year, namely, at Candlemas and Lammas. In the following year, 1649, the fiars were struck only once; but in the year 1650, and for every year down to 1675 inclusive, with the exception of the year 1665, the fiars were struck twice, namely, at Candlemas and Lammas; but in the year 1676 they were again struck only once, namely, at Candlemas; and this practice has continued uniformly down to the present time.

It is consequently extremely probable, that the two and a half per cent. was first established by being added to the Candlemas fiars for the year 1676, and was continued to be added to them for every year from that period downwards.

Upon examining the fiars for the twenty-six years, during which they were struck at Candlemas and Lammas, and taking the average of both, which seems to be the fair medium price, it will be found that, in point of fact, the Candlemas, with the addition of two and a half per cent., is somewhat below the above medium of the double fiars. This appears to account in a satisfactory manner for the origin of the two and a half per cent.; and shews, that they who first introduced it had paid considerable attention to the subject. It is evident, indeed, that fiars taken at Candlemas cannot shew the average price of grain through the year, because, in the early part of the season it has not reached its full value. Whitsuntide would, perhaps, be the most proper time for finding a just average, and the addition made to the fiars taken at Candlemas may amount nearly to the same thing.

It may, however, be observed, that there is one objection to the manner of striking the fiars in this county, which is deserving of attention. The first price taken is the true average, the highest and lowest are only the averages of the highest and lowest market days, whereas they should express the average of the best and worst grain. A person who makes a payment according to the highest fiars, may

in fact pay considerably more than the average price of the best grain fold throughout the season. The sales of a few high market days, in which prices rise much above the level of the season, thrown into the general mass, may cause the highest fiars to be much above the current value of the best grain. It would seem to be a fairer mode to strike the fiars from the weekly prices in the Haddington market; the averages of all the market days would give the general average, while the highest prices on each market day, thrown into one mass, and the lowest into another, would furnish the true average of the best and of the worst grain. The fiars in this county are, however, said to be taken with greater correctness than in most other parts of Scotland.

In the more northern parts of Scotland, as in Perthshire, they are annually settled, in the same manner as in other counties, by a jury of traders in grain; a method which would seem to be improper, as the persons examined in respect to the prices of the grain may all have an interest preponderating in the same way, being themselves dealers in the article of which they fix the price; whereas, were only one-third of that jury corn merchants, another third actually farming gentlemen, and the other third farmers, who pay one hundred pounds or upwards of yearly rent, every class of the community would be represented in those meetings, every interest would be attended to, and every objection stated and considered; so that there would be every chance, that the judgment given would rest on the broad basis of the general good of the whole county. The sheriff should continue, as at present, to be the chairman of the jury, the umpire in case of an equality of votes, and have the power of judging of any objection that may be brought forward against any of the members, as a dealer in grain, which might disqualify him for holding a seat at the meeting. The time of settling these average prices is seemingly capable of being changed for the better, as Candlemas is too early a period; as but a small proportion of the corn is by that time brought forward to be sold, and even that small portion of the crop which is threshed out, and so brought, is in a green state, and consequently disposed of at an undervalue. A fair estimate can, perhaps, hardly be made of any crop before the end of March, or perhaps a later period. As frequent decisions in courts of law are given in respect to the prices of grain, many contracts entered into, and much corn and meal sold with a reference to the fiars, as well as the rents of land, and the stipends of the clergy in various cases, received according to them; there can hardly be a retrospective rule or regulation of equal publicity, or of equal authority devised, or more properly calculated for directing such transactions; consequently, too much care and circumspection cannot be employed in the mode of establishing them, as the medium prices of all sorts of grain, for the respective years to which they may have a reference.

However, in order to afford a better idea of what has been the average prices of grain in the first of the districts noticed above, for several years past, according to the method of forming them just described, it may not be improper to introduce a list of fiars, from 1794 to 1804 inclusive.

	Fiars of Grain.									
	First.			Second.			Third.			
	£.	s.	d.	£.	s.	d.	£.	s.	d.	
Wheat	-	1	5	6 $\frac{3}{4}$	1	3	11 $\frac{3}{4}$	1	2	3 $\frac{3}{4}$
Barley	-	1	2	1 $\frac{3}{4}$	1	1	2	0	19	8 $\frac{1}{2}$
Oats	-	0	15	2 $\frac{3}{4}$	0	14	10	0	14	1 $\frac{1}{2}$
Peas	-	0	16	4 $\frac{1}{2}$	0	15	6	0	14	9 $\frac{1}{2}$

F I A

F I B

Crop of 1795.

	First.			Second.			Third.			
	£.	s.	d.	£.	s.	d.	£.	s.	d.	
Wheat	-	2	6	9	2	4	4	2	0	4
Barley	-	1	5	2	1	3	10	1	1	11
Oats	-	1	1	3	0	19	5	0	18	2
Peas	-	1	0	4	0	18	9	0	17	9

Crop of 1796.

Wheat	-	1	7	2	1	5	10	1	4	5
Barley	-	1	5	0	1	2	8	1	0	6
Oats	-	0	16	1	0	14	11	0	14	0
Peas	-	0	14	3	0	13	5	0	12	8

Crop of 1797.

Wheat	-	1	4	9	1	3	0	1	1	7
Barley	-	0	19	4	0	17	9	0	15	5
Oats	-	0	14	2	0	13	0	0	12	6
Peas	-	0	13	1	0	12	4	0	11	8

Crop of 1798.

Wheat	-	1	3	8	1	2	8	1	2	0
Barley	-	0	19	5	0	18	6	0	17	9
Oats	-	0	15	0	0	14	8	0	14	0
Peas	-	0	12	10	0	12	5	0	11	11

Crop of 1799.

Wheat	-	2	3	9	2	0	9	1	14	8
Barley	-	1	14	8	1	11	11	1	9	2
Oats	-	1	1	4	1	8	7	1	5	6
Peas	-	1	18	1	1	13	1	1	8	6

Crop of 1800.

Wheat	-	3	7	3	3	3	1	2	15	3
Barley	-	2	12	6	2	6	11	2	2	4
Oats	-	1	18	11	1	15	8	1	10	9
Peas	-	2	6	2	1	6	1	1	16	8

Crop of 1801.

Wheat	-	1	17	5	1	15	1	1	12	4
Barley	-	1	8	5	1	6	1	1	4	4
Oats	-	0	18	7	0	17	4	0	15	11
Peas	-	0	17	10	0	16	10	0	16	0

Crop of 1802.

Wheat	-	1	12	1	1	8	8	1	6	11
Barley	-	1	0	8	0	19	2	0	17	1
Oats	-	0	16	6	0	15	4	0	16	4
Peas	-	0	16	1	0	15	6	0	15	0

Crop of 1803.

Wheat	-	1	7	5	1	5	11	1	4	7
Barley	-	0	19	2	0	17	10	0	16	6
Oats	-	0	18	6	0	16	11	0	15	7
Peas	-	0	17	10	0	16	10	0	15	10

Crop of 1804.

Wheat	-	2	6	1	2	2	4	1	15	7
Barley	-	1	13	3	1	11	6	1	9	5
Oats	-	1	1	2	0	19	8	0	18	5
Peas	-	0	19	2	0	17	11	0	16	11

These records of the returns of grain are highly useful and interesting, in shewing the different prices of corn in different years, for a considerable period, in the northern parts of the kingdom, and afford perhaps the best views of the subject that can be given.

FIARRA, in *Geography*, one of the smaller western islands of Scotland. N. lat. 57° 4'. W. long. 7° 27'.

FIARSING, in *Ichthyology*, a name given by the Swedes and Danes to the fish generally called the *draco marinus* and *araneus marinus*, the sea-dragon, and the sea-spider. See *TRACHINUS Draco*.

FIAT, in *Law*, is used for a short order or warrant of some judge, for making out and allowing certain processes, &c. Thus, if a certiorari be taken out in vacation, and tested of the precedent term, the fiat for it must be signed by a judge of the court, some time before the esoin day of the subsequent term, otherwise it will be irregular. There is no need for the judge to sign the writ of certiorari itself, but only where it is required by statute. 1 Salk. 150.

FIAT *justitia*, is an order granted on a petition to the king, for his warrant to bring a writ of error in parliament, in which case he writes on the top of the petition *fiat justitia*, and then the writ of error is made out, &c.

FIATO, *Ital.* a term, in *Music*, equivalent with *volta*. Time, not measure, put at the end of a strain when there are different leading notes to the first and second part of an air. *Primo fiato*, or *prima volta*, the first time, *secondo fiato*, the second time; but the words *fiato* and *volta* are more frequently understood than expressed, as 1^{ma} 2^{da} mean the same thing.

FIATOLA, in *Zoology*, a name given by the Italian fishermen to the *stromateus*.

FIBER, or *fiber castor* of Linnæus, the *beaver*. See *CASTOR Fiber*.

FIBER, in *Ornithology*, a species of *Pelecanus*, which see.

FIBRARIÆ, in *Natural History*, the name of a class of fossile bodies, the greatest part of which have been very improperly called by the writers on fossils, fibrose tales, they being of a very different substance and structure of parts from the tales, and having none of their distinguishing characters.

The word is derived from the Latin *fibra*, a *fibre* or *filament*, these bodies being all composed of arrangements of parallel filaments or fibres. The fibrariæ in general are fossils composed of parallel filaments, usually remaining so distinct as to preserve in the whole masses a thread-like texture, but sometimes uniting so as to form plates or flakes resembling those of the tales in external figure. They are bright, and in some degree transparent, not giving fire with steel, nor fermenting with, or soluble in, acid menstrua. Hill's *Hist. of Foss.* p. 88.

Of this class of bodies there are two distinct orders, and under these four genera. To this class belong the amianthus, asbestos, lachnides, and tricheriæ.

FIBRAUREA, in *Botany*, from the golden hue of the congeries of woody fibres which compose the stem. Loureir. *Cochinch.* 626. Class and order, *Diacia Hexandria*. Nat. Ord. *Menispermata*, Juss.

Gen. Ch. Male, *Cal.* none. *Cor.* Petals six, very small, roundish, spreading. *Stam.* Filaments scarcely any; anthers six, oblong, two-celled.

Female, in a separate plant, *Cal.* none. *Cor.* Petals six, roundish, concave, spreading. *Pist.* Germens three, superior, ovate, connected together, and angular, at the base; style none; stigmas three, cloven. *Peric.* Berries three, ovate, somewhat compressed, smooth, each of one cell. *Seed* solitary, ovate, rugged.

Ess. Ch. Male, Calyx none. Petals six. Female, Calyx none. Petals six. Stigmas three. Berries three, single-seeded.

1. *F. tinctoria*. Cây Vàng dăng of the Cochinchinese; Tien sien tan of the Chinese. Found in the woods of China

China and Cochinchina. *Stem* shrubby, climbing, without tendrils, long, woody, branched, as thick as the arm, composed of large pliant fibres, of a golden yellow, ranged in concentric circles, with perforations between. *Leaves* alternate, ovate, acute, entire, smooth, unequally ribbed, veiny. *Footstalks* long, round, swelling at the base. *Flowers* white, minute, in long lateral clusters. *Berry* small, yellow, not eatable. The flavour of the whole plant is bitter.

The roots and lower part of the stem are esteemed resolvent, deobstruent, and diuretic. The bruised stems afford, by boiling, a yellow dye, which is not very vivid, but lasting, and serves as a basis for Turmeric and Safflower, which, though more beautiful, are not so durable.

Loureiro, from whom the above account is taken, supposes the *Tuba flavo*, Rumph. Amboin. book 7. chap. 20. t. 24. to be nearly allied to this plant, as well as the *Abuta* of Aublet. t. 250, 251. Juss. 284. In the latter he seems to be right, as far as the natural order is concerned, and in the former at least equally so. That they are all one species, as he suspects, is manifestly not the case. Aublet gives his *Abuta*, which have downy leaves, as the *Pareira Brava* of the Portuguese.

FIBRE, in *Anatomy* and *Physiology*, is generally understood to denote the elementary component parts of the animal body: the most simple form of organized matter, to which the more complicated organs of the frame can be reduced by the various methods of examination employed by the anatomist. In this sense, it is to the physiologist what the *line* is to the geometrician, that from which all other figures are produced. Haller has devoted the first section of his great physiological work to the consideration of this subject. He observes that all the solid parts of the frame are composed of fibres, and that these are resolvable into earth, water, oil, iron, and air. The simple fibre is invisible, and cannot even be brought under observation by the assistance of microscopes: since the smallest animals, which are only discernible by very great magnifying powers, are themselves composed of such elementary parts. He proceeds to explain that these primary and invisible fibres unite together to constitute visible fibres and plates of animal substance, from the assemblage and connection of which our organs are composed. Our respect for so great an authority must not induce us to repose any great confidence in such statements as the foregoing: they appear, on the very first examination, to be in great measure hypothetical. The confession that these supposed elementary fibres are invisible, must lead us to receive with great caution accounts of their physical and vital properties. And the obvious differences in the composition and texture of our organs will naturally give rise to an inference, that the elementary constituents of these are probably dissimilar. We do not speak here of the chemical elements into which parts may be resolved; but of the primary animal fibre resulting from them. Without troubling ourselves with descriptions of an object, the very existence of which is not yet proved, we shall proceed to explain shortly the composition of the body, as far as it can be ascertained by our senses. In this investigation we shall find structures of very different appearance exhibited in the different organs of our frame; so that the imaginary fibre will not be found to assist the physiologist much, whatever benefit the *line* may afford to the researches of the geometrician. The following account is derived from the ingenious work of Bichat, entitled "Anatomie Generale."

An animal body is an assemblage of various organs, each of which, exercising some function, concurs in its own manner in the preservation of the whole. These organs may be regarded as so many particular machines contained in the

general machine of the individual. But the latter are made up of several structures or tissues of very different natures, which form the true elements of the organs. Chemistry has its simple bodies, which form compounds by the various combinations of which they are susceptible. In the same way, anatomy has its simple tissues, which, when combined in numbers of four or more, make up the animal organs. They are, 1. the cellular; 2. nervous of the animal life; 3. nervous of the organic life; 4. the arterial; 5. the venous; 6. that of the exhalants; 7. that of the absorbents and their glands; 8. the osseous; 9. the medullary; 10. the cartilaginous; 11. the fibrous; 12. fibro-cartilaginous; 13. muscular of the animal life; 14. muscular of the organic life; 15. the mucous; 16. the serous; 17. the synovial; 18. the glandular; 19. the dermoid; 20. the epidermoid; 21. the hairy. Such are the organized elements of our parts: they possess the same nature in all situations; as the simple bodies in chemistry are the same, whatever combinations they may enter into. The advantage of considering the structure of the body under this point of view is, that it is not imaginary, but rests on the real foundation of observation. The lines of demarcation between the various tissues are drawn by nature, and not produced by metaphysical abstractions.

The forms are every where different; here flattened, there rounded. The simple tissues may be arranged in membranes, tubes, or fibrous bundles. But these differences of form are merely accessory. The nervous tissue forms a pulp in the retina, and cords or threads in the nerves. The fibrous constitutes fasciculi or bundles in the ligaments, and membranes in the aponeuroses. The organization and properties are the sources of the essential distinctions.

None of the simple tissues are analogous in their organization, that is, made up of common and of proper parts; and the former are very differently arranged in each case. In one instance cellular tissue, blood-vessels, and nerves, may exist in abundance; while in another one or two of these may be found very sparingly, or may be entirely deficient. Here we have an abundance of capillary vessels; there this system can hardly be demonstrated. The proper or characteristic parts are decidedly different. Their colour, thickness, hardness, density, &c. are all various. Simple observation is sufficient to shew numerous characteristic attributes: but further properties are discoverable by the application of heat, air, water, acids, &c.

At the same time that nature bestowed on each system a different organic arrangement, she endowed it also with different properties. (See LIFE, and the account of the particular systems.) The consideration of these systems, as entering into the composition of organs, where they may be diseased independently of each other, is of the highest importance in physiology; and the separate affections of particular tissues in a compound organ will come more particularly under notice in chronic diseases.

The organic systems of the living economy may be divided into two grand classes. Those of one kind, distributed over the whole body, and present everywhere, concur not only in the formation of all the organs, but also in that of the other systems, and constitute a common and uniform basis to every organized part: these are the cellular, arterial, venous, exhalant, absorbent, and nervous systems. The others, placed in certain determined apparatuses, and foreign to the rest of the economy, have a less general existence, and are often almost isolated. Such are the osseous, cartilaginous, fibrous, muscular systems, &c. &c. Bichat calls the former the generating systems. All organized parts are not necessarily provided with all the six. Some have no
arteries

arteries nor veins; some no nerves, &c., but they meet together in most of the organs, and there are always some present, although others may be wanting. Thus tendons and cartilages, which have no blood, possess exhalants, absorbents, &c. The two last-mentioned systems are the most univervally found. Nutrition supposes their existence: that function, in fact, results from a double motion, of composition which brings nutritive matter to the organs, and of decomposition which removes it. The exhalants are the agents in the first of these motions; the absorbents in the second. Since every organ is nourished, and the mechanism of nutrition is uniform, it follows that these two systems must belong to all organs. The cellular exists the most generally after these. It is sometimes found where there are no blood-vessels, and it always exists where these are found. The arteries and veins come the next in order: often there are no nerves where these penetrate, as in the aponeuroses, the fibrous membranes, &c. The nervous is that of all the generating systems, which can be traced into the fewest organs. The serous membranes, the fibrous, fibro-cartilaginous, and bony systems, &c. appear to want it.

The generating systems, besides entering into the structure of other organs, also belong reciprocally to each other. Thus, cellular substance is found in the nerves, arteries, and veins; the latter ramify in the cellular substance, &c.

It will be expected, from the preceding observations, that the generating systems, considered as the common basis of all the organs, ought to be developed more early than the others; and we find this in the fetus. The nerves, with their centre, the brain; and the arteries and veins, with their central organ, the heart; the cellular tissue, the exhalants and absorbents all present this phenomenon. With respect to the two latter, it is sufficiently clear from the great activity of absorption and exhalation at this period.

These general systems must perform the most important part in the office of nutrition. They constitute the nutritive parenchyma of every organ: this is the cellular, vascular, and nervous matter, into which the nutritive substance of the organ is deposited. The latter, different in every instance, constitutes the difference of the various organs. It is phosphate of lime and gelatine in the bones; gelatine only in the cartilages, tendons, &c.; fibrine in the muscles; albumen in other organs. If, therefore, the nutritive parenchyma of a bone was filled with fibrine, it would constitute a muscle in the form of a bone, and under the opposite circumstances, we should have a bone in the form of a muscle. The nutritive substances are hitherto for the most part unknown to us: but as the parenchyma is greatly analogous in all cases, if the former were removed, the only differences would be in form, volume, arrangement of cellular lamina, and of vessels and nerves; without any essential variation in nature and composition.

The mucous mass of the fetus, in the early periods of conception, seems to be merely an assemblage of general systems. The organs exist only in their nutritive parenchymas. As these grow, and become developed, the nutritive matters penetrate them; and then each organ, hitherto similar in its nature to others, begins to be distinguished, and to possess an isolated existence; each derives its appropriate substance from the blood.

The systems of the second kind belong only to some particular apparatuses of the animal economy: thus, the osseous, muscular of animal life, cartilaginous and fibrous are peculiarly set apart for the locomotive organs: the serous, mucous, muscular of organic life, &c. belong to the digestive, respiratory, and circulating apparatuses, &c. All these, therefore, are much more isolated, and perform a less exten-

sive part in the animal fabric. Concentrated in peculiar organs, they are foreign to others, and have an independent life; while the vitality of the primitive systems is blended with that of the organs, into the composition of which they enter. The different parts of these systems are not connected together; and this is exemplified in the bones, muscles, cartilages, glands, &c.: various organs of different natures, and belonging therefore to other systems, are interposed between them. The primitive systems, on the contrary, are every where continuous, and uninterrupted. The cellular, arterial, venous, absorbing, and nervous systems, are so disposed, that, if it were possible to remove all the organs, which they penetrate, and leave them only, there would still be a whole continuous fabric left behind. If, on the contrary, the organs, intermediate to the bones, cartilages, fibro-cartilages, &c. were removed, the various pieces of these systems would be immediately isolated. The particular account of the different systems will be found under their respective articles in the Cyclopædia.

FIBRE, Animal, fibrin, muscular fibre, in Chemistry. The muscle or flesh of animals is composed of an infinite number of cylindrical, soft, nearly inelastic, semi-transparent fibres; these, when examined by the microscope, are seen to be still further subdivided into bundles of parallel fibrils, bound together by very fine cellular membrane. The living muscle is moreover penetrated by arteries, veins, nervous fibres, and lymphatics with their contents; and thus a considerable quantity of extraneous matter is mingled with the pure fibre of the muscle, so as to throw a certain degree of ambiguity on the chemical analysis of this latter substance. By means, however, of maceration with cold and hot water, and mechanical pressure, much of the foreign matter may be got rid of, after which the fibre exhibits the following properties.

Its colour is greyish-white, to the taste it is insipid, its texture is stringy; it hardens rather than softens by the long-continued action of hot water. When dried slowly in a warm air it becomes semi-transparent like horn, and very brittle.

Fibre, prepared as mentioned above, is entirely insoluble in water, in most of the acids it dissolves readily; with the dilute nitric acid it gives out a large portion of azotic gas of great purity, but if stronger nitric acid is made use of, a more complicated action takes place, by which, according to Berthollet, one portion of the fibre is changed into a kind of suetty fat, which floats on the surface of the liquor, while the rest is converted into oxalic acid.

Mr. Hatchett's valuable experiments on this substance throw great light on the composition of muscular fibre, and point out a variety of before unnoticed points of resemblance between fibre and condensed albumen. Of these, the principal are the following: muscular fibre (previously exhausted by long maceration in cold and hot water of every thing soluble in this fluid) was steeped for a fortnight in nitric acid, diluted with three parts of water; at the end of that period the acid was become yellow, and had acquired all the properties of a nitric solution of lichen. The undissolved residue, which consisted of by far the greater portion of the fibre, being thoroughly treated by the acid, as directed in boiling water, in which it dissolved, and by evaporation afforded a gelatinous mass, which, after being dissolved in water, was precipitated by infusion of tart, and not a moment of tin, precisely with the first phenomena observed in the case of solutions of albumen. Fibre, penetrated as above-mentioned by nitric acid, is for the most part soluble in ammonia, forming a liquor of a brownish orange colour. By digestion with potash the ammonia is given out, and a saponaceous mass is produced,

produced, resembling the other albuminous soaps. The residue left undissolved after the action of ammonia consists chiefly of fat.

If washed fibre, however, is treated with *boiling* nitric acid, the solution still more resembles that of albumen in the same menstruum, but with this additional circumstance, that, on super-saturation with ammonia, a copious white precipitate falls down, consisting of the phosphat and oxalat of lime, the former of which pre-exists in the fibre, while the acid of the latter was produced by the action of the nitric acid on some portion of the fibre, and then united with the lime which naturally exists in fibre, in the state of carbonat. Lime, therefore, is found in muscular fibre in two states; as a phosphat, which is chiefly separable by long boiling, and in some other state in which it is not soluble in water, but remains ready to combine with the oxalic acid as soon as formed; this state is probably the carbonat, and the quantity of lime thus combined is such as to afford 17 grains of dry oxalat from 200 grains of dry fibre.

The proportion, however, of earthy salts contained in fibre varies greatly, according to the age of the animal; for it appears from Mr. Hatchett's experiments, that though beef contains both phosphat and carbonat of lime, veal gives hardly any indication of the latter, and a much smaller proportion of the former.

The analysis by fire shews the following very notable difference between gelatine, fibre, and albumen, (the three great constituents of the soft parts of animals,) in their proportions both of carbon and earthy residue.

500 grains of isinglass, being gelatine in its purest form, distilled with a strong heat in close vessels, left 56 grains of residue, of which 54.5 disappeared by subsequent calcination in the open air, and therefore were carbon, the remainder, amounting to 1.5 gr. appeared to be phosphat of soda, with a trace of phosphat of lime.

500 grains of dry albumen, treated in the same manner, gave 63.25 grs. of carbon, and 11.25 grs. of residuum, consisting of soda in a semi-caustic state, together with phosphat of soda, and a very small portion of phosphat of lime.

500 grains of muscle of beef, well washed and dried, gave 82.4 grs. of carbon, and 25.6 of residue, the greatest part of which was carbonat of lime, mixed with some caustic lime and a little phosphat: it is to be observed, however, that this is by no means the whole earthy contents of the muscle, as by its previous digestion in boiling water nearly the whole of the phosphat of lime would be dissolved out.

The general inference from these experiments, and from others that have been mentioned under the article ALBUMEN is, that the principal constituent of muscular fibre is a substance which, from its habitudes with the principal chemical reagents, may be considered as nearly identical with inspissated albumen.

A few miscellaneous circumstances concerning muscular fibre may be added. When thoroughly washed and freed from all that can be extracted from it by cold water, it does not readily putrefy; but in its natural state it soon undergoes this change, the texture becoming slabby and loose, the colour pale, and the odour excessively fetid. The flesh of young animals putrefies sooner than that of old ones in similar circumstances. When immersed in running water, or buried under ground in large masses, it changes to that singular spermaceti-like matter already described in the article ADIPOCIRE. When slowly and thoroughly dried, and kept in a dry air, it will remain long without undergoing any change. Alcohol deprives it of colour, hardens its texture, and effectually prevents the access of putrefaction; and it may be observed that antiseptics in general are more efficacious

in preserving muscular fibre than any other of the soft parts of the body.

The most important of the volatile products of the dry distillation of fibre is ammonia, which also indicates the presence of much azot in the fibre itself. An acid also is given out at the same time, which is acrid, uncrystallizable, and has the peculiar odour of roasted meat. It was first described by Berthollet as a peculiar acid, and was named by him the *zoonic*; the general opinion of chemists however at present concerning this substance is, that it consists of acetic acid, fouled and rendered empyreumatic by the action of heat on the substances from which it is procured.

FIBRE, *Vegetable*. Almost all plants contain a fibrous matter, which is distinguished from the other vegetable principles by its comparative insolubility in chemical menstrua, its indestructibility by spontaneous decomposition, and a certain toughness and elasticity occasioned by its minutely fibrous texture. In some plants these fibres are remarkably flexible and tough, as in the flax, the hemp, the alve, and the inner bark of the lime, the birch, and other trees that furnish the materials of Russia matting; in the cane and bamboo these fibres, though still considerably flexible and elastic, are inferior to those produced by the preceding plants; and in the lignous fibre or wood of the larger trees they exhibit still greater density and diminished flexibility. The chemical characteristic of vegetable fibre is, that it presents on analysis a greater proportion of carbon and earthy matter than any other vegetable substance; as will be detailed at length under the article WOOD.

FIBRILLA, a little fibre, or capillament.

FIBRO-CARTILAGE, in *Anatomy*, a tissue of the animal body, partaking of the characters both of ligament and cartilage. An ingenious French anatomist distinguished it by this name; and he has included, under the expression *fibro-cartilaginous system*, all those parts of the body which exhibit this kind of structure. From the mixed nature of their properties, the fibro-cartilaginous organs have been partly arranged among the ligaments, and partly among the cartilages. They may be conveniently arranged under three divisions. 1. The membranous fibro-cartilages; as those of the ear, nose, trachea, eye-lids, &c. These are very thin, disposed in an uniform plane, or convoluted in various directions. 2. Articular fibro-cartilages; of very variable forms, but in general thick; interposed between the opposite ends of bones, in some instances unconnected by their surfaces, and moveable, in others closely attached, as in the vertebrae. 3. Fibro-cartilages of tendinous sheaths; consisting of a thick layer covering the bone in some instances, where the tendon passes over it. The structure and vital properties are not exactly the same in all these organs.

The peculiar tissue of this system is composed, as the name indicates, of a fibrous substance, with the addition of a true cartilage. The former seems to be the basis of the organ. It is very distinct in the masses which connect the bodies of the vertebrae, but much less so in the membranous fibro-cartilages. The fibres are sometimes parallel, and sometimes interwoven. This fibre is exactly of the same nature as in the fibrous system, compact, hard and strong; and hence arises the strength of the different organs belonging to this system. The solidity of the union which connects together the bodies of the vertebrae, and the difficulty of rupturing the fibro-cartilages of the knee, jaw, or clavicle, sufficiently exemplify this. These organs bend in every direction, whereas the true cartilages, if powerfully bent, would break. The cartilaginous substance is interposed between the fibres, and is particularly discernible in the articular fibro-cartilages; which owe to it their elasticity, white colour, and the

the inorganic appearance exhibited by a section. These are rendered yellow and transparent by boiling, and are converted into jelly, although not quite so readily as the true cartilages. The fibro-cartilages of the organs of sense, which we have already adverted to in the article **CARTILAGE**, are not resolved into gelatine by boiling; they are softened, but remain whitish. After some time their surrounding membrane is detached, and the substance itself breaks in several places. After macerating for some days they become red. Diccation renders them hard and brittle, without imparting the yellow colour which tendons or aponeuroses receive on such treatment. The inter-vertebral substances have, when dyed, a remarkable transparency, without any yellow tint. They swell when detached, and placed in water.

The fibro-cartilages in general have no perichondrium. Those of the tendinous sheaths are in contact on one side with the bone, and by the other with the synovial membrane. The articular ones are covered by the synovial membranes of the joints, and those of the vertebræ are covered only by the anterior and posterior vertebral ligaments. A very distinct and closely adhering fibrous tissue covers those of the organs of sense; and is rendered white by maceration.

The cellular texture is difficultly seen in these organs; but maceration brings it into view. Very little blood circulates through them in the ordinary state; but they become vascular when inflamed. No nerves can be traced into them.

This system is distinguished most particularly by its elasticity. The fibro-cartilages of the organs of sense and of the trachea, when bent, immediately restore themselves; and those between the vertebræ, being compressed by the motions of the bones, resume their former state, as soon as the compressing force ceases to act. (See **CARTILAGE**.) They have the power also of bending in every direction, without any risk of being broken. They possess extensibility, and contractility.

Their vital properties are very obscurely marked. They have no animal sensibility or contractility in the natural state; but the former appears under inflammation. Organic sensibility, and insensible contractility, exist in these organs as far as they are necessary for the purposes of nutrition. This obscurity of the vital properties renders all the vital phenomena very slow. If the ear of a dog be cut, and the sides of the incision brought together, the skin quickly unites; but the cartilage is not agglutinated until long after. From the same cause we must explain the rare occurrence of disease in these organs. No parts in the body are so seldom diseased as the fibro-cartilages of the nose, ear, trachea, &c. Gangrene produces hardly any alteration in them, and it is almost doubtful whether they ever suppurate.

This system is developed at an early period; the ends of the bones are large in the fœtus, and the articular fibro-cartilages are consequently considerable. Those of the tendinous sheaths are not to be distinguished from the cartilaginous epiphyses which in the fœtus form the ends of the bones. The gelatinous portion exceeds the fibrous part in the fœtus; particularly in the inter-vertebral masses; and its proportion is here always in an inverse ratio to the age of the subject. The membranous fibro-cartilages are developed very early in the fœtus.

The parts become stronger and more dense as the age advances; and in the old subject they take a hard form. Hence the stiffness and inflexibility of the vertebral column.

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The fibro-cartilages are much less prone to ossification than the cartilages. This change has never been observed in the membranous ones. Those of the vertebræ are almost the only ones in which ossific matter is sometimes deposited, and this is very rare. Bichat, *Anatomic Generale*; tom. iii.

FIBROLITE, in *Mineralogy*, a substance first noticed by the count De Bournon, and found by him amongst the matrix of Corundum, from India and China. It is of a whitish, or dirty whitish grey colour; it occurs in masses of an indeterminate form and fibrous texture. The count De Bournon has only once seen a specimen that had a tendency to a regular form, which was that of a rhomboidal prism of about 60° and 80°. Longitudinal fracture fine fibrous, the fibres in some specimens interwoven in all directions; cross fracture compact, with a vitreous lustre. Translucent at the edges. Hardness about the same as quartz, when tried in a direction perpendicular to or across the fibres. Gives sparks with steel, and a deep reddish phosphorescent light when rubbed against an hard body. Not electric by friction. Specific gravity about 3.2, being, like all substances not found in a crystallized state, of different degrees of density. Infusible *per se* by the blow-pipe. Analysis by Mr. Chenevix of fibrolite from the peninsula of India and China.

Silica	-	38.	38.
Alumina		58.25	46.
Iron, a trace	—		13.
Loss	-	3.75	3.
		100.00	100.

The remarkable circumstance of the fibrolite from India yielding nothing but silica and alumina, and its always occurring in amorphous masses of a fibrous texture, induced the discoverer to give it the above name. See the interesting paper on Corundum, by the Hon. Mr. Greville and the count De Bournon, printed in the *Phil. Trans.* for 1802.

FIBROUS SYSTEM, in *Anatomy*. This includes a great many organs of the body, composed of the same elementary parts, but differing widely in their forms. This variety, together with the differences of function and position, occasions them to be distinguished by the names of tendon, aponeurosis, ligament, &c. For there is not here any general term, like that of muscle or nerve in the muscular or nervous systems, to denote the organization, whatever the form of the organ may be. There are two leading distinctions of form, under which all the fibrous organs may be arranged, *viz.* the membranous, which is thin and broad; and that of chords, which is thick and elongated.

1st Division. *Fibrous organs of the membranous form*;—including fibrous membranes, fibrous capsules, tendinous sheaths, and aponeuroses. The fibrous membranes are the peritoneum, dura mater, sclerotica, and capsule of the kidney, spleen, &c. They generally envelope certain organs, and enter into their texture. The fibrous capsules are cylindrical bags, surrounding certain articulations, particularly those of the humerus and femur, which they connect very closely to the scapula and os innominatum. The sheaths confine the tendons passing over bones, where they are reflected—wherever, in short, they are subject to displacement from the muscular contraction; and ought, in consequence, transmit imperfectly to the bones the motion imparted by the muscles. They may be arranged in two divisions; 1. Such as are common to the tendons of several muscles, as at the wrist and tarsus; 2. Such as belong to one tendon only, or two, as in the fingers and toes. Aponeuroses consist of large sheets of fibrous texture, being ar-

FIBROUS.

to the locomotive organs, and disposed in some instances so as to form coverings of parts; while in others they afford points of attachment to muscles. Hence they are distinguished into aponeuroses for enveloping, and aponeuroses for insertion. The former either surround the muscles of a limb, forming for it a general sheath, as in the thigh and fore-arm: or else they invest and confine some particular muscles, as that which extends between the two posterior ferrati, that which is placed in front of the soleus, &c. The aponeuroses of insertion either form broader or narrower surfaces, as at the attachment of the triceps femoris, rectus cruris, gastrocnemius, &c.; or they consist of separate fibres, giving distinct attachments to the muscular fibres, as at the origin of the iliacus internus, tibialis anticus, &c.,

or they form arches, which both give attachment to muscular fibres, and at the same time allow the passage of vessels, as at the diaphragm and calf of the leg.

2d Division. *Fibrous organs in the form of chords*;—constituting tendons and ligaments. The former are placed at either of the attachments, or in the middle of muscles. They are generally simple, consisting of elongated chords; but in some cases they are more complicated, being divided into several smaller chords. Ligaments tie together the articular surfaces of bones. They may form either constant and regular fasciculi, as at the elbow, knee, &c. or irregular ones, as at the pelvis.

The following table exhibits the fibrous organs according to the preceding arrangement.

Fibrous Organs,	{	In the membranous form,	{	Fibrous membranes,	{	Partial,	{	Fibrous capsules,	{	General.	{	Fibrous sheaths,	{	For envelopement,	{	Partial,
		In the form of chords,	{	Aponeuroses,		For insertion,		General.		{		In a broad surface,				
				Tendons,		Simple,		Ligaments,		Complicated.		{	In the form of an arch,		{	In separate fibres.
						{				{		{	With regular fasciculi,		{	
						{				{		{	With irregular fasciculi.		{	

Although the numerous organs included in this table belong to parts of very different structures; although they seem disposed irregularly in the animal economy, without mutual connection, and apparently isolated; they are in fact nearly all continuous. The common centre of this system is the peritoneum, with which all its parts are closely connected, excepting the albuginea, the coats of the kidney and spleen, and the perichondrium of the larynx.

Organization of the fibrous system.—This is nearly the same, under all the variety of forms which have been just particularized: and consists of a peculiar tissue, with vascular, cellular, and other textures.

All fibrous organs have for their basis hard, inelastic, and insensible fibres; incapable of contraction; sometimes parallel to each other, as in the tendons and ligaments, sometimes variously interwoven, as in the capsules, membranes, and sheaths; of a white or grey colour, and great powers of resistance.

The latter property enables all these organs to sustain great efforts; and they are employed in offices which require such a power. The ligaments firmly hold the articular surfaces in contact. The aponeuroses confine the muscles and resist their displacement. The tendons are placed between two powers; viz. the powerful energy of muscular contraction, and the greater or less resisting force, which that action is designed to move. The resisting power of the tendons is in many instances superior to that of the bones: thus, the patella, the olecranon, and the os calcis may be broken by muscular contraction. The difficulty of producing luxations in the dead subject, and the great force required in the former barbarous punishment, of fixing four horses to the four limbs of a criminal, in order to tear them asunder, sufficiently exemplify the great strength of this tissue. A tendon requires an enormous weight suspended from it to break it. Yet this resistance, however great, is sometimes overpowered in the living body; and we see the strongest tendons, as that of the calf, ruptured by muscular contraction. We cannot help being surprised, on these occasions, that the

soft tissue of the muscles should not yield rather than the tendons.

Some anatomists have fancied that the fibrous and muscular systems were analogous, and have affirmed that a tendon is formed by the condensation of the muscular fibres. This notion is altogether absurd. The fibrous membranes and aponeuroses are expanded, but they resemble muscular fibres in no respect. The chemical composition, the vital properties, and the apparent texture are widely different. Their functions have not the least analogy. In fact, there is less resemblance between the muscular fibres and the tendon, in which they are inserted, than between the latter and the bone, to which it is attached.

What then is the nature of the fibrous tissue? This we cannot determine, as we cannot recognize in it any very decided characters. Its properties are rather negative. It has not the contractility of the muscular, nor the sensibility of the nervous tissue. It is always passive, and obeys the motion impressed on it, without having any of its own.

The parts, in which this is found, are very different from the skin, the cellular texture, cartilage, &c.; and hence the referring of all these to a common class of white organs is a premature generalization, resting entirely on external appearances, and imperfect analysis, in which the texture, vital properties, and functions of the organs are disregarded.

The fibrous tissue, exposed to maceration at a moderate temperature, does not experience any change for some time. Its density gradually diminishes, and its substance softens, but it does not swell. The fibres may now be drawn asunder, so as to expose the connecting cellular texture. After a very long period they are reduced into a soft whitish pulp, of homogeneous appearance. Tendons are the soonest acted on; then aponeuroses of insertion; afterwards those of envelopment; then the fibrous membranes, capsules, and sheaths; and lastly ligaments.

Any fibrous organ plunged into boiling water, or exposed to considerable heat, curls up, and becomes contracted, like most other animal tissues: its volume is diminished, it be-

comes more solid, and acquires an elasticity, which it had not in the natural state, and which it loses again, when softened. The force with which the fibres contract on exposure to heat is very considerable.

It is sufficient, when bones are boiled for a long time, to produce rupture and detachment of the periosteum; and, when the bones, surrounded by their ligaments, are exposed to the action of boiling water, to lock the articular surfaces so closely together, that they cannot be moved.

The fibrous tissue softens in boiling water, becomes yellow and semi-transparent, and at last is partly dissolved. These changes take place most quickly in the tendons, then in the aponeuroses, the membranes, the capsules, and fibrous sheaths, and lastly in the ligaments. But all ligaments do not resist equally. Those which connect the spinous processes of the vertebrae, at their roots, do not undergo the same changes, but remain white and coriaceous.

The evaporation consequent on exposure to the air destroys the whiteness of the fibrous system; it contracts, becomes yellow and transparent, and is easily broken. By immersion in water, in a few days after being dried, the whiteness and softness are recovered, and the part regains nearly its original appearance. This is particularly the case with the tendons. Nitrous and sulphuric acids soften the fibrous tissue very quickly, and reduce it into a blackish pulp in the latter, and yellowish one in the former case. It curls up and contracts when first plunged into the acid, as it does on exposure to boiling water.

It resists putrefaction for a considerable length of time, and remains unaltered, when skin, muscles, nerves, &c. are completely disorganized. But it yields in the end.

Cellular texture exists in all fibrous organs; being more or less abundant, in proportion as the fibres are more or less approximated. Maceration renders it obvious enough in all cases. As the cellular tissue itself can hardly be perceived, no fat can be distinguished in it. But an adipous exudation has been noticed, in some instances, after fibrous organs, carefully cleaned from all surrounding substance, have been dried. Vessels are found in very different states in different parts of the fibrous system. They are numerous in the dura mater and periosteum, very few in the aponeuroses, and not discernible at all in the tendons. The former organs are the most liable to inflammation and swelling. Absorbents have not been detected in the fibrous system nor nerves.

Properties of the fibrous system.—Its elasticity is very trifling; but becomes considerable, when parts are removed from the body, and dried. Thus tendons, and strips of aponeurosis, which are insusceptible of vibration in their fresh state, produce sound when very dry.

The extensibility and contractility of these organs is not considerable; and it always takes place slowly. The fact is exemplified in hydrocephalus, swellings of the bones, tumefaction of the limbs, distension of the abdomen, &c. If the force be applied suddenly, and the resistance of the fibrous organ be too great, various symptoms arise. Pressure of the most painful kind, and dangerous consequences, is produced on the contained parts, as in inflammatory tumefaction of the limbs, inflammation of the testis, eyeball, &c. When the power is too great, the organ is torn, as in the rupture of the tendo Achillis, of the ligaments in luxations, &c. The contractility corresponds in its kind and degree to the extensibility: as no fibrous organ can be suddenly extended, so it cannot recover suddenly after distension. Hence, when a tendon or aponeurosis is divided in the living state, there is scarcely any separation of the margins. The

separation consequent on rupture of a tendon arises from muscular contraction, or from the position of the limb. Indeed, if the muscle be in a state of action, the end of the divided tendon attached to the muscle is drawn away from the other a little; but that portion of the tendon which is fixed to the bone undergoes no change. When a tendon is divided, while the muscle is relaxed, no separation ensues.

The vital properties of these organs have been a subject of great controversy among physiologists. Numerous experiments have been instituted, and many works published on the question, Whether or no they possess sensibility. Haller and his followers maintain the negative, and their publications contain a vast store of experiments. There is little doubt that they possess feeling, or, what Bichat calls animal sensibility; although this does not shew itself by the usual phenomena. The different mechanical and chemical stimuli produce no pain, unless the organ be inflamed. This is the case with the tendons, the aponeuroses, the fibrous membranes, and the ligaments, when exposed and cut in operations, or irritated chemically in living animals. But, if these parts are suddenly exposed to violent distension or twisting, acute pain is produced. Bichat appeals, for the proof of this statement, to experiments on living animals. And he considers that this mode of sensibility is appropriate to the functions of the organs. They have no concern with exterior sources of excitation; but, in performing their offices, they are liable to be drawn, twisted, and stretched in the motions of the limbs. The sensation, which they transmit in these cases, is a warning of the danger, by which its further progress is prevented. The great pain of luxations, and of the extension employed for their reduction, and of strains, seems to confirm the preceding statement.

These organs possess no animal contractility. They have organic sensibility, and organic insensible contractility in common with all other organs.

The vital powers are more developed in this than in the bony and cartilaginous systems. The peculiar kind of feeling, which we have just explained, is a proof of this. It is much more frequently the seat of pain and inflammation, and the pain is much more acute. This is exemplified in rheumatism, which affects the fibrous organs about the articulations. It seems that this system, hardly in any instance, forms pus.

In the gelatinous substance, of which the embryo consists, the fibrous organs can hardly be distinguished; and they cannot be recognized until several other parts are formed. The fibres are not perceptible until towards the seventh month; and, as they increase, the organs become more hard and resisting. They possess at this time a pearly whiteness. It is only by degrees that they acquire the firmness which particularly characterizes their tissue. The comparative softness of these organs in the first years of life will explain many circumstances both of natural phenomena and disease. As the subject grows up, the fibrous system becomes dense and hard; and it remains stationary in the adult. It is still more compact in old persons; yielding less easily to putrefaction and maceration. Hence the stiffness in the articulation at this period. All the parts now become yellow.

The fibrous membranes will be considered under the article MEMBRANE. The capsules are described in the account of the articulations to which they belong. See EXTREMITIES.

The fibrous sheaths belonging to one tendon form a canal, in which the tendon runs. There is a channel in the bone, completed into a canal by the fibrous organ, and lined

FIBROUS.

internally by a closely adhering synovial membrane, which is reflected to the retained tendons at the extremities of the canal. These sheaths are connected externally to the surrounding parts by a loose cellular texture. They are extremely dense in their texture, and strong in proportion to the efforts which they have to sustain. The particular sheaths will be described in the account of the muscles to which they belong. The larger ones of the hand and foot, common to several muscles, are described in the article **FASCIA**.

The aponeuroses of envelopement are considered under the article **FASCIA**. Those of insertion, belonging essentially to the muscles, will be treated, as well as the tendons, under **MUSCLE**.

The ligaments will be spoken of in the account of the structure of **JOINTS**. This article is drawn entirely from the *Anatomie Generale* of Bichat, vol. iii.

FIBROUS Amethyst, or thick fibrous amethyst. It is generally of a dark violet blue colour, sometimes of a pale and light one, which borders on grey, from which it passes to blueish and yellowish-white. It occurs only massive and in rolled pieces. Internally its lustre is glistening, sometimes shining, and is vitreous. The principal fracture is thick fibrous, and is straight and diverging fibrous: the fracture in some instances is intermediate between thin fibrous and splintery; the cross fracture is generally imperfectly conchoidal, approaching to uneven and splintery. Commonly translucent, but varies from that to transparent. Hard, rather more so than rock crystal; gives sparks with steel. Not very difficultly frangible. Specific gravity 2.750. According to Karsten it is composed of

Silica	97.5
Alumina	00.25
Iron	00.50
A trace of Manganese	—
	98.25

Infusible *per se* in the strongest heat of a wind furnace, but melts upon charcoal when exposed to a stream of oxygen gas.

It is found in agate veins, and is generally accompanied by common amethyst. When both kinds occur together the fibrous is supposed to be the oldest, as it adheres to the sides of the vein.

Its geographic situations are very numerous; it is found in abundance in various places in Saxony, in the East Indies, Spain, the Uralian mountains, &c. The most beautiful specimens are brought from Catherineburg, in Russia.

The loss of its colour by heat indicates either that the colouring matter is very volatile or very little in quantity; and it has been doubted, by some philosophers of great reputation, whether this and many other highly coloured stones owe their colours to metallic oxyds, or to some unknown modification or affection of light; and it is well known that fluor and other phosphorescent stones lose their power of emitting light with the loss of their colour.

FIBROUS Gypsum. See **GYP SUM**.

FIBROUS Limestone. This subspecies is usually divided into two kinds: 1. Common fibrous limestone. 2. Fibrous limestone, stalactite, kalkfinter of Werner.

1. *Common Fibrous Limestone.*—Its colours are white, greyish, or yellowish-white, and sometimes reddish-white. It occurs massive. Lustre glistening, often shining, and is pearly and chatoyant, particularly when cut and polished. Fracture from coarsely to extremely delicately fibrous. The fibres straight, undulating, or contorted, and are gene-

rally parallel, sometimes diverging. Splits easily in the direction of the fibres. Fragment prismatic; cross fracture perpendicular to the former. Moderately translucent. Rather harder than crystallized carbonate of lime, which it scratches. Specific gravity 2.7. The beautiful variety called sartin spar was first discovered, in 1798, by Mr. Mawe, in small veins, lying between pyrites in a calcareo-argillaceous schistus, in the county of Cumberland.

It is said, in some late treatises on mineralogy, to be found in Derbyshire; but this mistake has perhaps arisen from the circumstance of its having been wrought into a great variety of beautiful ornaments, as necklaces, lockets, rings, &c. at the manufactory of Brown and Mawe of Derby and Matlock. A variety, but of inferior quality, for the above purposes, has been very lately found at Ashover, in Derbyshire, in cutting a road to the lime works through the upper bed of toad-stone, where it was very abundant in small veins and nodules; and it is a remarkable circumstance, that all the carbonate of lime found in this toad-stone is fibrous; that of the nodules radiating from a centre. It has a considerable resemblance to fibrous gypsum, but may be distinguished from it by its great hardness, and by its being generally traversed by veins of greenish pyrites. It may be distinguished from zeolite by its greater specific gravity and inferior lustre, and from both these and fibrous gypsum, by its effervescing with acid. Sartin spar is now very rare, the vein being long since exhausted. Analysis by Mr. Pepys:

Lime	50.8
Carbonic acid	47.6
	98.4

2. *Stalactite, Kalkfinter of Werner.*—Its common colour is white, from which it passes into greyish, greenish, and yellowish-white; from these it passes into the various degrees of yellow, brown, green, blue, &c. deriving its colour from the mineral substances by which it is accompanied.

Dr. Kidd, in his mineralogy, says, that the greenish-white stalagmite of Derbyshire owes its colour and peculiar opacity to oxyd of zinc. It occurs most commonly massive, also in a variety of external shapes, but most often stalactitic. Its surface is generally rough and drusy, and the stalactites are frequently terminated either by a single crystal, or group of crystals, sometimes having the appearance of a cauliflower. Its internal lustre varies from glimmering to glistening, and is generally pearly. Fracture straight, and stellularly diverging fibrous. Fragments mostly indeterminately angular, sometimes splintery and wedge-shaped. It occurs most commonly in concentric lamellar concretions, which are bent in the direction of the external surface. The stalactitic and tuberoso varieties are often hollow. It is considerably translucent, in some cases even semi-transparent. Its hardness, frangibility, and specific gravity, nearly the same as crystallized carbonate of lime.

It is found in all countries where limestone, particularly of the older formation, abounds. Its localities are too numerous to mention, but in England the most beautiful specimens are found in Cumberland, Durham, Yorkshire, and particularly Derbyshire, where it is wrought into various ornaments. It is also used for purposes where very pure lime is wanted, as it is free from many impurities that contaminate common limestone.

The alabaster of the ancients is said to be stalactitic carbonate of lime, brought from Arabia, and used for the draperies

draperies of statues. And it is employed at present in Italy for the same, and other architectonic purposes, under the name of Marmo alabastrino. The ramified or coralloid variety, commonly, though improperly, called Flos ferri, as it contains no iron, and on which the count De Bournon has published his observations in the 9th vol. of Philosophical Transactions, under the name of hard carbonate of lime, is brought principally from the iron mines of Stiria, where it is found in veins of sparry iron ore. From the numerous and contorted branches of which it is formed, some have been induced to think it rather the product of sublimation than aqueous deposition; and this idea receives some confirmation from the circumstance of this species of carbonate of lime having been found in the lavas. Its lustre is very splendid and pearly, arising from the minute crystals that cover the branches, and are so inclined to the axes as to reflect the light very abundantly. These crystals are figured and described in the paper above mentioned, and in the mineralogy of count De Bournon, lately published. Its fracture is vitreous, inclining to small conchoidal; hardness sufficiently great to scratch fluor. Specific gravity 2.912. Although chemical analysis does not discover the least difference between this and common carbonate of lime, yet the external characters differ so widely, that it is impossible not to render them as different species; in many respects it agrees with arragonite, yet in others it differs so much from it, that it is at least doubtful whether it ought to be considered as being a variety of this last substance.

FIBROUS Root, in *Vegetable Physiology*, consists entirely of fibres, without any tuberosous or bulbous part, except such a common basis, or point of connection, as is necessary to hold them together. The fibres, or *radicule*, are the only essential part of a root, being what immediately absorbs nourishment from the soil. They are produced afresh every year, when vegetation first awakes from the torpor of winter, and it is only before they shoot forth that plants can be removed, or kept for some time out of the ground, in perfect safety. The radical fibres of such grasses as grow in loose sand, are usually very downy, probably to attach them more firmly to so slippery a support, or to multiply the surface, or points of absorption, in so meagre a soil.

Grasses and annual plants, in general, have fibrous roots. Such have a natural direction downwards, and penetrate with facility through the softest parts of the soil, their extremities chiefly being elongated, or rather formed, as they go. If they grow in water, or a perfectly homogeneous soil, where the resistance is every where equal, the fibres are quite straight; but this being scarcely ever the case in ordinary ground, they assume that contorted and divaricated shape we usually observe in all roots.

Some parasitical plants have a peculiar kind of fibrous roots, which attach them to the branches or stems of trees, and therefore are bare on one side. They may absorb moisture by that side from the air, perhaps in as great abundance as they derive nourishment on the other from the tree. See **ROOT**.

FIBROUS-rooted Plants, in *Agriculture*, are all those which have fine thread-like roots which spread out laterally near the surface of the ground, without striking very deeply into it. They are distinguished into several different sorts from the nature of the roots and the manner in which they grow. See **FIBROUS ROOTS** and **ROOT**.

FIBROUS ROOTS, in *Gardening*, all such as consist principally of small filaments or fibres. There are great numbers of plants which have roots of this kind, both of the flower and other descriptions. They are likewise distin-

guished into different sorts from the nature of the roots: when the roots penetrate downwards in a direct manner, they are denominated *perpendicular*; where they creep under the surface, *horizontal*, and *creeping*; when they are rather thick, *fleshy*; when extremely thin, *capillary*; where they run all the way undivided, *simple*; when they are divided or send off smaller roots, *branched*; and when covered with very fine short fibres on the surface, *hairy*. See **ROOT**.

FIBROUS Shells, in *Natural History*, is a name which certain fossil shells have acquired, on account of their breaking abruptly across, and shewing a fibrous or transversely striated texture, which occasions their thus breaking short, and being so brittle, that very few indeed of the shells can be obtained whole. A very singular kind of these fibrous shells abounds in certain beds of the chalk strata, mostly in square small fragments; and the flints which interlay the chalk beds have often, in these cases, their fragments set or imbedded in their solid substance. Often when these flints are found among alluvial matter, and broken, the pieces of fibrous shells are decomposed and gone, and a singular narrow and deep cavity, like a small mortise-hole, is left; a circumstance which most observers, in or to the west of chalk districts, cannot fail to have noticed. In the great alluvial masses of Bedfordshire, at ten or fifteen miles from the edge or ending of the chalk strata, these flints, with fibrous shells in them, and sometimes large and nearly perfect fibrous shells, are found among the flints and other ruins or spolia (as Woodward calls it) of the chalk strata, which is mixed with the clay of the strata, superior to the chalk, as should seem from the large Ludus Helmontii and others of its products, which are found mixed in the greatest confusion, through the substance of hills, many miles long, one or two wide, and eighty or one hundred feet high, which are there found, of these distant alluvial matters, covering the regular sand and other strata of the district; and wherein fragments of grey-weathers, the produce of the uppermost sand strata above the chalk, are found, some of them weighing a ton or more.

FIBROUS Spar, in *Mineralogy*, is a variety of calcareous spar, (carbonate of lime,) found in Derbyshire and elsewhere, which is often mameled on the surface, owing probably to hollows in the surface of the fissure or crack which it once filled; the fibres or stria of this spar cross it transversely, and occasion its sudden and easy fracture, like the fibrous shell above described. Fibrous spar is very common in the fissures near the top of the first or upper toadstone, as in the entrance cut to Hockley lime-quarry, near Allover town, a quarter of a mile N.E. of Bontal church, in Longstone-edge mine in Longstone, Wessedge mine in Ashover, &c.

Another kind of fibrous calcareous spar (sulphate of lime or gypsum) is dug at Elvaston, Cheltenham, Turbury, and other places, in or near Derbyshire; it lies in thin strata, the fibres or stria of which cross it vertically, and occasion nearly a similar fracture in that direction to those of the spar and shell above described.

FIBULA, in *Anatomy*, the small bone of the leg.

FIBULA, in *Natural History*, a name given to a class of the *cechinodermata*, which have their mouth in the middle of the base, and the aperture of the anus on one edge. These are found principally among the fossil kinds, and seem to have had their shells of the assuluted kind, or composed of small plates joined transversely to one another. Of this class there are two genera, the *ceculas* and *disjunctas*.

FIBULA, in *Surgery*, an instrument in use among the ancients, for the closing of gaping wounds.

Celsus speaks of the fibula, as to be used when the wound was so patent as not easily to admit of being sewed. Op. lib. vii. cap. 25. apud fin.

Authors are somewhat at a loss as to the form of the ancient fibula. Guido says there were iron circles, or femicircles, bent backwards both ways; the hooks whereof, being fastened on both sides to the wound, answered exactly to each other; but as this must have been an insupportable pain to the patient, this description is generally set aside.

Falopius, Sanctorius, and others, take the word fibula to have signified, in reality, no more than the sewing up of the wound with a needle and thread, as used at this day.

FIBULA, *Luxation of.* See LUXATION.

FICARIA, in *Botany*, Pilewort, so called by Brunfelsius and other old writers, on account of the fig-like tubercles of the root, which resembling the disease called the piles, the plant was ingeniously supposed to be a remedy for that complaint. The next step was to affirm it to be so, as we find in such writers, "either applied outwardly, or taken internally." As it is very acrid, and even caustic, we cannot recommend a trial.

Hudson established the *Ficaria* as a separate genus from *Ranunculus*, see Fl. Angl. 244, on account of the smaller number of its calyx-leaves, and greater number of its petals; but he has not been followed. *Ranunculus* is too natural a genus to admit of such a separation on artificial principles alone.

FICEDULA, in *Ornithology*, a name given to several species of *Motacilla*, (which see.) See also *TURDUS trichas*, *MUSCICAPA atricapilla*, and *PARUS Americanus*.

FICHANT, FIGENS, a French term used in *Fortification*: thus, a flank fichant, or a line of defence fichant, is a place, whence the shots made do not only raise the opposite face to be defended, but also enter within it.

The word is formed of *ficher*, to stick a thing in.

FICHE, in *Heraldry*. See FITCHEE.

FICHERUOLO, in *Geography*, a town of Italy, in the department of the Lower Po, on the Po; 13 miles W.N.W. of Ferrara.

FICHTELBERG, a mountain of Franconia, which extends from the vicinity of Barenth to Eger in Bohemia. It is one of the highest mountains in Germany, and contains in it many deserts, rocks, bogs, and morasses. It takes its name from the great number of pines, with which it is covered; it has also many oaks, beech, elm, and other kinds of trees. The extent in length is 22 English miles, and 16 miles in breadth. The summits have various names: the Ochsenkopf being reckoned the highest. The lake, called "Fichtelsee," is a cavity of this mountain, called the See Loh, and is remarkable merely as the source of the White Mayn. Other parts of this mountain give rise to the Eger, which runs to the E., and the Sala and Nab flowing to the N. and S.

FICINUS, MARSILIUS, in *Biography*, a celebrated physician, divine, and philosopher, was born at Florence A. D. 1433. His father being physician to Cosmo de Medicis, the son was noticed by that liberal prince; and on the death of his father, Marsilius obtained the same honourable distinction. He studied not only medicine and divinity, but acquired the knowledge of both vocal and instrumental music and could perform upon several instruments. He was profoundly skilled in the Latin, Greek, and other learned languages. Under the patronage of the house of the Medici,

he might have acquired not only fame, but wealth; more especially after he had, by taking holy orders, rendered himself capable of holding the valuable preferments in the church, belonging to that illustrious family. But, a total stranger both to covetousness and ambition, Ficinus was content with the appointment of a canonry in the great church of St. Laurentius, in his native city, and some small estates in the vicinity, bestowed upon him by his patron. Although now an ecclesiastic, who exercised the duties of his profession, yet he continued to practise physic; the profits from which latter profession he devoted to the use of his nephews and nieces, and other collateral poor branches of his family. The cardinal John de Medicis, having been raised to the sovereign pontificate, under the name of Leo X. Ficinus received an acquisition to his fortune. He was appointed professor of philosophy, he became exceeding popular, and his lectures were crowded with students from every country; many of whom, becoming in their turn celebrated, enhanced still higher the professor's fame. He certainly appears to have possessed great merit in the didactic chair, although in his illustrations he adopted the reveries of judicial astrology; but in this he was not singular; it was a mania that seized most of his cotemporaries among the philosophers. He spent much of his time at his country house, Corregio, near Florence, at which agreeable retreat he was visited by numerous friends, who, like him, could relish the refined pleasures of rational retirement, and the charms of philosophical conversation. So respected was he, that Ficinus could number among his friends some of the ablest of mankind, and the most exalted in rank: doctors, philosophers, bishops, cardinals, and even princes; the celebrated patron of every thing great and good, Lorenzo the magnificent, esteemed it an honour to be classed in the number. The solitude that he adopted arose from motives of inclination and necessity. Habitually contemplative, retirement was pleasing; and naturally exceeding delicate, repose from the bustle and cares of public life at times became essential to his existence on earth. Sensible of his infirmity, he endeavoured to preserve his health by means bordering upon ridiculous superstition. He would, it has been observed, change his capotte, or under cap, six or seven times an hour. All methods, however, proved unavailing, so that he at length fell a victim to a weak constitution, at the age of sixty-six, A. D. 1499. Sweetness of temper, moderation in disputation, and modesty of manners, were features eminently conspicuous in his character; and he was no less distinguished by his extensive learning, than his genuine piety, save that the former perhaps was too much tinged with the Grecian philosophy, and the latter too strongly shaded with the gloom of superstition.

His works are numerous and diversified; they contain observations upon physical, metaphysical, moral, and religious subjects. Opuscula de Sole & Luna, various translations from the works of Plato, Plotinus, Jamblichus, Proclus, and other Platonists; and the Platonic system thus became fashionable in Italy. The translations are not always accurate, and through all a bias is evident in favour of that philosophy. He would feign persuade his readers, the writers of that school must have been believers in divine revelation. His *Theologia Platonica* was printed at Florence in 1482; his *Epistolæ*, in twelve books, at Venice, 1495; and his whole works were collected and published in two volumes, folio, at Basle, in 1576. Moreri, *Grand Dictionnaire Historique*.

FICK, in *Rural Economy*, a term signifying to struggle with

with the legs, as a cow in the tie, or a horse in the fetters, &c.

FICKLETOW, in *Agriculture*, is a term which is sometimes applied to the fore-tackle, or carriage which supports the plough-team.

FICOIDEA, in *Botany*. See AIZOON, species 2d.

FICOIDEÆ, the 87th natural order in Jussieu's system, or the 5th of his fourteenth class. The name is taken from *Ficoides*, applied by Tournefort to the *Mesembryanthemum* of Linæus, which is one of this order. The definition of this class is, *Cotyledons* two. *Flowers* polypetalous. *Stamens* inserted into the calyx, which is of one leaf, superior or inferior, divided more or less deeply. *Corolla* inserted into the calyx, generally polypetalous, sometimes wanting, rarely monopetalous, by a concretion, as it were, of several petals into one. *Stamens* definite or indefinite in number, often distinct, sometimes united by their filaments. *Germen* superior, simple or manifold, or rarely inferior and simple. *Styles* one or many to each germen, sometimes none; stigma entire or divided. *Fruit* sometimes simple, superior or inferior, of one or many cells; sometimes, but rarely, manifold, superior, each pericarp being of one cell. Sometimes, by abortion, the sexes become separate in different flowers.

The *Ficoideæ* are thus characterized. *Calyx* of one leaf, inferior or superior, definitely divided. *Petals* mostly indefinite, inserted into the upper part of the calyx; sometimes wanting, in which case the calyx is coloured within. *Stamens* more than twelve, often numerous, inserted into the same part; anthers oblong, incumbent. *Germen* simple, superior or inferior; styles several; stigmas as many. *Fruit* either a capsule or berry, with as many cells as there are styles, each containing several seeds attached to their inner angle. *Embryo* incurved, surrounding a farinaceous albumen. *Stem* herbaceous or somewhat shrubby. *Leaves* opposite or alternate, generally succulent, mostly various in shape. The first section, which has a superior germen, contains *Reaumuria*, *Nitraria*, *Sesuvium*, *Aizoon*, and *Glinus*, with *Orygia* of Forskall; the second, with an inferior germen, has *Mesembryanthemum* and *Tetragonia*. The plants of this natural order are alkalescent, secreting of themselves soda, or fossil alkali, independently of soil or situation, though they naturally grow for the most part in maritime places.

FICOIDES. See MESEMBRYANTHEMUM.

FICORONI, FRANCISCO DE, in *Biography*, a learned and celebrated Roman antiquary, author of an excellent treatise on the theatrical masques of the ancient Romans, with engravings from ancient gems, cameos, marbles, and bronzes, upon nearly 100 plates well executed, and first published at Rome in 1736, 4to. This work is replete with erudition on the subject, and is at once curious, amusing, and instructive. It is peculiarly connected with dancing, saltation, comic scenes, and the musical declamation and melody of the ancients. The wide mouth in the form of a shell, says Ficoroni, so common in the ancient masks, served to augment the power of the voice, upon the principle of a speaking-trumpet. "Quella bocca a conchiglia, che si vede in altre maschere, serviva per ingrandire la voce, come succede nelle trombe a proporzione." See MASQUES.

FICTA, *Lat.* feigned; as *Musica ficta*, music transposed out of the hexachords to keys that require flats and sharps, used in old times to be thus called. *Fa fictum, f. z.*

FICTION. See TABLE.

FICTION of a person in *Rhetoric*. See PROSOPEIA.

FICTION of Law, *Fictio Juris*. Fictions are allowed of in law, in several cases, but must be framed according to the rules of law, not what is imaginable in the conceptions of man; and there ought to be equity and possibility in every

legal fiction. There are many of these fictions in the civil law; and by some civilians it is said to be an assumption of law upon an untruth for a truth, in something possible to be done, but not done. (Godolphin and Bartol.) The feign of the confee in a fine is but a fiction in our law; it being an inverted form of conveyance only. (1 Lill. Abr. 610.) And a common recovery is *fictio juris*, a formal act or device by consent, where a man is desirous to cut off an estate tail, remainders, &c. (10 Rep. 42.) The proceedings in ejectments are also grounded on a fiction of law. By fiction of law, a bond made beyond sea may be pleaded to be made in the place where made, viz. in Kingston, in the county of Middlesex, &c. in order to try the same here; without which it cannot be done. (Co. Litt. 261.) And thus it also is in some other cases; but the law ought not to be satisfied with fictions, where it may be otherwise really satisfied; and fictions in law shall not be carried further than the reasons which introduce them necessarily require. 1 Lill. Abr. 610. 2 Hawk. 320.

FICTITIOUS PLAINTIFF, denotes one not in being at all, or one who is ignorant of the suit. The offence of suing another in the name of such a plaintiff, if committed in any of the king's superior courts, is left, as a high contempt, to be punished at their discretion. But in courts of a lower degree, where the crime is equally pernicious, but the authority of the judges not equally extensive, it is directed by stat. 8 Eliz. c. 2. to be punished by six months' imprisonment, and treble damages to the party injured.

FICUS, in *Botany*, an ancient Latin word of uncertain derivation. The Fig-tree. Linn. Gen. 555. Am. Acad. v. 1. 23. Schreb. 746. Vahl. Enum. v. 2. 181. Juss. 400. Tourn. t. 420. Gærtn. t. 91. Mart. Mill. Dict. v. 2. Class and order, *Diaccia Triandria*. Linæus placed it in *Polygamia Triacia*, because the *Caprifiscus*, or Wild fig as it is called, has entirely male blossoms, while the cultivated figs have on one tree more perfectly male, on another female, flowers. The different structure of the partial calyx in the two flowers, authorizes its being kept in *Diaccia* at least, though Vahl removes it to *Triandria Monogynia*. Nat. Ord. *Scabridæ*, Linn. *Urticæ*, Juss.

Gen. Ch. *Common Receptacle* somewhat globular, fleshy, concave, closed with several scales within the orifice. Its inside is lined entirely with numerous florets; the uppermost, or those nearest the orifice, being males; the rest, more numerous, females; all separately stalked.—Male, *Cal.* Perianth deeply three-cleft, rarely more, erect; its segments lanceolate, erect, equal. *Cor.* none. *Stam.* Filaments three, bristle-shaped, the length of the calyx; anthers two-lobed. *Pist.* a deciduous twisted rudiment only.—Female, *Cal.* Perianth inferior, in five deep, lanceolate, pointed, straight, nearly equal segments. *Cor.* none. *Pist.* Germen oval, filling the perianth; style awl-shaped, inflexed, lateral; stigmas two, pointed, reflexed, unequal. *Peric.* none, except the perianth enlarged and become pulpy. *Seed* one, roundish, compressed.—The male florets are commonly abortive in all the figs of one tree, the female ones on another. Those figs which are entirely male, as above-mentioned, are considered as most essential for impregnation, and for consequently improving the fruit of the female trees. Hence the curious history of *Caprifitation*. See that article.

Ess. Ch. *Common receptacle* roundish, fleshy, closed, lined internally with separated florets. Male, Calyx in three deep segments. Corolla none. Female, Calyx in five deep segments. Corolla none. Pistil one. Seed one.

The species of this most natural genus are prodigiously more numerous than Linæus had any idea of. His latest

edition contains but 17. Vahl, whose list is the most complete of any, has 92. Even this number we have it in our power greatly to augment.

It is necessary briefly to enumerate all Vahl's species, in order to contrast our new ones with them. We therefore take this opportunity of reviewing the whole genus, as there is much to correct, not only in what he has done, but in what regards the original species of Linnæus, the history of which could not be cleared up, but by an examination of the Linnæan Herbarium.

Section 1. *Leaves undivided and entire.*

1. *F. religiosa*. Linn. Sp. Pl. 1514. (Arealu; Rheede Hort. Mal. v. 1. 47. t. 27.) "Leaves ovate or heart-shaped, entire, very long-pointed. Fruit sessile."—Native of the East Indies, where it is treated by the Hindus with superstitious veneration, their god Vishnu having been supposed to be born under it. Christians civilly call it the Devil's tree. The leaves are evergreen, smooth and shining, of a fine green, alternate, on long stalks, elegantly pendulous. Fruit the size of a large pea, dry and tasteless. This tree grows readily in our stoves.

2. *F. populifolia*. Vahl. Symb. v. 1. 82. t. 22.—"Leaves neatly cordate, acute. Fruit stalked, in pairs."—Native of Arabia, mistaken by Forskall for the preceding. Fruit-stalks an inch long. Whole plant very smooth.

3. *F. pilasibi*.—Leaves ovate, somewhat heart-shaped, pointed, very smooth, finely veined. Fruit solitary, sessile, globose.—Gathered by Dr. Buchanan at Narain hetty in Nepal, in Dec. 1802. The Nawars call it *Pilasibi*. It is a tree, generally parasitical. Leaves about three inches long, on stalks one-third their length, resembling the leaves of a Poplar. Fruit smooth, the size of a black currant.

4. *F. umbellata*. Vahl. Enum. n. 3. "Leaves exactly heart-shaped, long-pointed, smooth. Fruit-stalks three to five in an umbel."—Found by Thonning in Guinea. Tree very tall and spreading. Fruit the size of a plum.

5. *F. nymphæifolia*. Linn. Mant. 305.—"Leaves heart-shaped, roundish, pointed, smooth, glaucous beneath."—Native of the East Indies. Leaves like those of *Nymphaea alba* in size and figure, but very glaucous beneath. *H. Linn.*

6. *F. cordata*. Thunb. Diff. 8. fig. 1.—"Leaves ovate, somewhat heart-shaped, acute, smooth, leathery. Stem shrubby, erect."—Cape of Good Hope. Thunb. A smooth shrub, of a moderate size. Fruit sessile about the upper part of the branches, the size of a small pea.

7. *F. polita*. Vahl. Enum. n. 7.—"Leaves ovate, inclining to heart-shaped, pointed, smooth, even, entire."—Found in Guinea by Hert. Leaves two inches or more in length, veiny. Fruit stalked, smooth, globose, the size of a hazel-nut.

8. *F. Chanas*. Forst. Arab. 219.—"Leaves heart-shaped, rough."—Native of mountains in Arabia, where it is called Chanas. It resembles *F. Sycomorus*, n. 85, except in the asperity of its leaves, and like that has an eatable fruit. We have specimens gathered by the late sir George Staunton in the island of St. Jago, under the name of *Sycomorus*, which appear to be the *Chanas*.

9. *F. costata*. Ait. H. Kew. v. 3. 452.—"Leaves ovate, heart-shaped, with a deep narrow sinus; entire, smooth, acute, green on both sides."—East Indies.

10. *F. levigata*. Vahl. Enum. n. 9.—"Leaves heart-shaped, ovate, pointed, veiny, very smooth. Fruit stalked, globose, smooth."—West Indies. Leaves three or four inches long, very finely veined. Fruit size of a cherry, three-lobed at the orifice. Vahl.

11. *F. lentiginosa*. Vahl. En. n. 10.—"Leaves ovate-oblong, somewhat heart-shaped, pointed. Fruit lateral and

axillary, stalked, in pairs."—Gathered by Mr. Ryan in the island of Montserrat. Leaves thin, three or four inches long, veiny. Fruit the size of a pea, with a minute calyx under it.

12. *F. scabra*. Forst. Prod. 76.—"Leaves ovate, somewhat heart-shaped, oblique, rough beneath. Fruit top-shaped, without a calyx."—Found by Forster at Tanna and Namoka. Leaves half a foot long, remotely toothed; roughish above; rough, paler, slightly downy beneath. Vahl.

13. *F. citrifolia*. Lamarek. Dict. v. 2. 494. (Plum. Ic. t. 131. f. 2.)—"Leaves oval, somewhat heart-shaped, sharpish, entire, ribbed, smooth on both sides. Fruit globose, foliary, stalked, axillary."—West Indies. Cultivated in the Paris garden. Leaves more heart-shaped at the base than Plumier represents them. Figs bigger than a walnut, green, white within, almost tasteless. Lamarek.

14. *F. lucida*. Ait. H. Kew. v. 3. 451.—"Leaves ovate, heart-shaped, entire, smooth, obtuse, three-ribbed at the base. Branches erect."—Imported in 1772, from the East Indies, by Mr. W. Malcolm. Leaves about a foot long, nearly elliptical, stalked, of a fine green, shining, veiny.

15. *F. scandens*. Lamarek. Dict. v. 2. 498. (*F. stipulata*; Ait. H. Kew. v. 3. 452.) Leaves heart-shaped, unequal at the base, smooth, reticulated with veins beneath. Stipulas acute. Branches thread-shaped, creeping.—This is supposed to be a native of the warmer parts of America. It is common in the European stoves. The stems creep up the walls, and throw out numerous, alternate, subdivided, slender, leafy, downy branches, making an elegant evergreen tapestry. Leaves alternate, on very short downy stalks, heart-shaped, obtuse, entire, unequal at the base, dark shining green, smooth, reticulated with palish veins beneath. Stipulas intrafoliaceous, in pairs, as long or longer than the footstalk, brown, membranous, ovate, pointed. It has never fruited in England or France, but we have received from the stoves in the royal gardens near Lisbon, by favour of Mr. Correa, branches laden with fruit, of a top-shaped form, purple, nearly as big as common figs, but insipid, which were positively asserted to be produced by the plant in question. These branches moreover are thick, firm, and straight, furrowed, bearing leaves ten times as large as those above described, quite coriaceous, exactly ovate or elliptical, equal at the base, exquisitely reticulated with prominent veins beneath, and punctated between them, as well as a little hairy. The whole, in short, of these specimens accords with *F. pumila*, n. 46, hereafter described, and nothing but our perfect confidence in our correspondent's accuracy could induce us to believe there were not some mistake. Lamarek mentions Mr. Correa's information, but had seen no specimens.

16. *F. stipulata*. Thunb. Diff. 8.—Leaves heart-shaped, unequal at the base, reticulated with hairy veins beneath. Stipulas acute. Branches round, decumbent.—Native of Japan. Thunb. China. Herb. Linn. The branches are decumbent and creeping, compound, round, minutely downy, reddish brown, often scaly with the permanent stipulas after the leaves are fallen. Leaves much like the last, but the veins at the back are stronger, more crowded, and more curiously reticulated, as well as roughish or hairy. Stipulas like the former. Fruit unknown. We are inclined to think, if this be distinct from the last, of which there is some question, that *F. pumila* may be this in a perfect state.—We have other specimens of creeping kinds, which perhaps undergo a similar metamorphosis when they fructify,

and

and which ought to teach botanists caution in defining the species of this genus.

17. *F. sagittata*. Vahl. En. n. 16.—“Leaves heart-shaped, oblong, acute, rough on both sides. Stem creeping.”—Native of Java, where it runs up trees. *Herb. Linn.* Stem creeping, by roots opposite to each leaf, downy when young. *Leaves* alternate, two or three inches long, heart-shaped, equal at the base, entire, acute, roughish to the touch, dotted beneath. *Footstalks* downy, near half an inch long. *Stipulas* lanceolate. Our description will be found to differ a little from Vahl's, but not materially.

18. *F. pedunculata*. Ait. H. Kew. v. 3. 470. (*F. arbor americana*, &c. Pluk. Alm. t. 178. f. 4.) “Leaves ovate-oblong, heart-shaped, acute, smooth. Fruit globose, on long twin stalks.”—Native of America and the West Indies. Jacquin first sent it to Europe from Martinico, and it was long kept in the gardens for *F. indica*. *Leaves* from three to six inches long, and one or two broad, smooth; paler and opaque beneath. *Fruit* the size of a pea.

19. *F. venosa*. Ait. H. Kew. v. 3. 451. (Tsjakela; Rheede H. Mal. v. 3. 87. t. 64.)—“Leaves ovate, somewhat heart-shaped, acute, smooth, with impressed dots above. Fruit sessile, clustered, globose.”—Native of the East Indies. The *leaves* are a span long, two or three inches broad, on long stalks. *Fruit* the size of pepper-corns.

20. *F. radicalis*. *Leaves* lanceolate, acute, smooth. Fruit in radical clusters.—Gathered by Dr. Buchanan in the East Indies, probably in the Mysore country. *Stem* shrubby, branched, smooth. *Leaves* crowded, three or four inches long, scarcely one broad, pointed, paler beneath, minutely dotted, but not rough to the touch. *Footstalks* scarcely an inch long. *Stipulas* longer, lanceolate, deciduous. *Fruit* in clusters from the root.

21. *F. neriifolia*. *Leaves* elliptic-lanceolate, pointed, smooth, with parallel veins. Fruit top-shaped, sessile, slightly furrowed.—Gathered in Feb. 1803, at Narain hetty in Nepal, by Dr. Buchanan. It is called there *Dud Cushi*. *Stem* arborescent. *Branches* furrowed, smooth. *Leaves* yellowish green, about three inches long, with narrow linear points, and numerous parallel, transverse veins. *Footstalks* furrowed, hardly an inch long. *Fruit* solitary or in pairs, size of a hazel-nut, or perhaps larger when ripe.

22. *F. lutea*. Vahl. En. n. 19.—“Leaves oval-oblong, pointed, somewhat emarginate at the base, smooth. Fruit in pairs, globose, sessile. Calyx four-cleft.”—Native of Guinea. Thonning.—A tall tree. *Leaves* from four to eight inches long, coriaceous, with white ribs, and fine reticulations. *Fruit* axillary, scarcely so big as a cherry, yellow, chestnut-coloured when ripe.

23. *F. ovata*. Ibid. n. 20.—“Leaves ovate-oblong. Fruit sessile, in pairs. Common calyx hood-shaped, deciduous; that of the fruit torn into two parts.”—Gathered by Thonning in Guinea. A tall tree, with somewhat whorled branches, often rooting. *Leaves* from five to eight inches long, rather leathery, with white ribs. Young fruit covered with a fleshy veil, cut round at the base as the fruit swells, and deciduous. *Figs* the size of plums, inclining to ovate.

24. *F. calyprata*. Ibid. n. 21.—“Leaves ovate, rather oblong. Fruit in pairs. Common calyx, and that of the fruit, hood-like, deciduous.”—Gathered by Thonning in Guinea.—A tall spreading tree. *Leaves* rather pointed, somewhat coriaceous, with white ribs and fine veins, five inches long. *Fruit* sessile, globose, orange-coloured, smaller

than a cherry, with a double cap-like deciduous covering.

25. *F. Granatum*. Forst. Pl. Escol. 37.—“Leaves ovate, entire. Fruitstalks terminal, in pairs, horizontally divaricated. Fruit globose, with a calyx.”—Native of the isle of Tanna, where it is also cultivated for the sake of the fruit, which is sweetish, but watery and rather insipid, larger than common figs, red with yellow spots, and slightly downy; internally purple, soft and pulpy. The tree is tall, with an angular rugged trunk, and long ascending branches. *Leaves* a span long, smooth, dark green above, with a few yellow veins; brighter underneath. *Fruit* on short thick stalks, from the bosoms of the uppermost leaves. *Luds* terminal, sharp-pointed, clothed with brown hairs. *Forster*.

26. *F. septica*. Burm. Ind. 226. Rumph. Amb. v. 3. 153. t. 96. (Handur-ala; Rheede H. Mal. v. 3. 77. t. 59.)—Leaves ovate, pointed. Stem erect. Fruit solitary, axillary, top-shaped, on short curved stalks.—Native of the East Indies. “Branches round and smooth. *Leaves* six or seven inches long, broad-oblong, membranous, very smooth, glaucous beneath, veiny, tipped with a sharp point an inch in length. *Stipulas* lanceolate. *Footstalks* round, two inches long, coloured at the top and bottom. Rheede's figure wants the point of the leaf.” Vahl from Jussieu's herbarium.

27. *F. Taab*. Forst. Arab. 219.—“Leaves in pairs, stalked, ovate, entire.”—Gathered by Forstall at Zebid in Arabia, where it is called *Taab*. The *leaves* are four inches long. No other botanist appears to have seen this species.

28. *F. Ampelos*. Burm. Ind. 226. Lam. Dict. v. 2. 496. (Folium politorium, Ampelaas; Rumph. Amb. v. 4. 128. t. 63. Teregam; Rheede H. Mal. v. 3. 79. t. 60?)—“Leaves ovate, acute, rough. Fruit solitary, stalked, rough, with an open scaly mouth.”—Native of Malabar. The *branches*, *footstalks* and *leaves* are extremely rough, with minute cartilaginous points; the latter are about a span long, three-ribbed, but the lateral ribs are short, and run into fine transverse veins, as Rumphius describes them. His synonym appears to us more certain than that of Rheede, whose leaves are too small, and fruit unlike our specimens. The latter may possibly be *F. politoria* of Loureiro, quoted by Vahl under *Ampelos*, as that is said to have small leaves. The fruit in our's is like a small gooseberry, rough, the mouth beset with numerous, prominent, recurved scales. *Fruitstalks* axillary, solitary, recurved, very rough, half an inch long.—The leaves are said to be very useful for polishing fire cabinet work, or toys, of wood, ivory or coral. They are not, however, so fine a file as Dutch rushes, *Equisetum hyemale*. The Amboyna name, as made into Greek by Burmann, only tends to deceive.

29. *F. pyrifolia*. Burm. Ind. 226. (Itty-alu; Rheede H. Mal. v. 1. 45. t. 26, according to Vahl.)—“Leaves ovate, pointed, fringed.”—Native of Japan. *Burm.* East Indies, according to Jussieu's herbarium. *Vahl*. The latter describes the *leaves* as quite smooth, two inches long. *Fruit* globose, rather bigger than a pea, rough with elevated points. *Fruitstalk* very short. It seems not certain that Vahl and Burmann mean the same plant, and the former copies the very same synonym of Rheede, after Linnæus, for *F. benjamina* in his next paragraph.

30. *F. benjamina*. Linn. Mant. 129. (F. arbor, densifloribus foliis parvis integris Amboinensis; Pluk. Phyt. t. 243. t. 4. Varinga parviflora; Rumph. Amb. v. 3. 139. t. 96?) *Leaves* ovate, pointed, transversely striated, smooth-edged. Fruit axillary, solitary, stalked. Found in various

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parts of the East Indies. It forms a tall tree, with innumerable, slender, zig-zag, leafy branches, with a rugged bark. Leaves an inch or inch and half long, stalked, exactly ovate, with an elongated point, entire, very smooth and shining, distinguished by numerous, transverse, straight, parallel veins, which do not reach the edge. The fruit is axillary, solitary, on a stalk a quarter of an inch long, bearing two or three small round scales about the middle, and several more under the fruit, which, in the very early state now before us, is the size of mustard-seed, smooth, crowned with two or three long projecting scales from its mouth, so like stigmas, that if we had not the sanction of the most able botanists, we should have great doubt of this being a *Ficus*.

31. *F. infrafoliacea*. Buch. MSS.—Leaves ovate-oblong, taper-pointed, entire, smooth. Fruit below the leaves, scattered, stalked, globose.—Gathered by Dr. Buchanan in March 1803, by the way side at Lohiar in Nepal. This tree has the aspect of *F. religiosa*. Leaves deciduous, about three inches long, and above one broad, with several parallel transverse veins, and innumerable reticulated ones between them. Footstalks an inch or inch and half long, smooth, channelled. Stipules downy, deciduous. Fruit from about the top of the last year's shoots, globose, smooth, the size of a gooseberry, on shortish thick stalks, mollly ternate.

32. *F. macrophylla*. Roxb. and Buch. MSS.—Leaves roundish-ovate, pointed, five-ribbed at the base; smooth above; finely downy beneath.—Native of the East Indies. Young branches, stipules and footstalks downy, as well as the back of the leaves, which are eight or ten inches long and six or eight broad, wavy at the edge, paler beneath, reticulated with innumerable transverse rectangular veins.

33. *F. bengalensis*. Linn. Sp. Pl. 1514. Trew, Ehrh. t. 50. (Peralu; Rheede H. Mal. v. 1. 49. t. 28.)—Leaves ovate-oblong, obtuse, smooth above; somewhat downy beneath; ribs radiating from above the base. Fruit globose, sessile, crowded.—Frequent in the East Indies. A tall and stout tree. Leaves coriaceous, rather elliptical, four or five inches long, minutely downy beneath, their five ribs meeting a little way above the base. Fruit generally in pairs or crowded, as large as a bullace plum, red, downy, encompassed with a broad calyx, of several downy leaves, at the base. Our specimen from the Hortus Clifortianus agrees with one sent by Dr. Roxburgh from Bengal. In both the leaves are decidedly downy beneath, though described as smooth. We have also from Dr. Roxburgh what seems a variety, with rather narrower leaves, very downy beneath, and fruit no bigger than peas, equally downy, generally in pairs, and very abundant.

34. *F. rufiginosa*, Ventenat Jard. de la Malmaison, t. 114.—Leaves elliptical obtuse; smooth above; downy and rusty beneath. Fruit globose, nearly sessile. Calyx downy, almost as long as the fruit.—Native of New Holland. Cultivated in the greenhouse at Kew, where it fruits about midsummer. Stem shrubby, with thick downy branches. Leaves three or four inches long, and two broad, coriaceous, evergreen, stalked, clothed beneath, especially when young, with soft, dark, rusty, purplish down, and furnished with numerous transverse parallel veins, of which the lowermost do not grow in a radiating manner like the last species. Fruit axillary, solitary, the size of a sloe, reddish, dotted, enveloped, till half grown, in the brown downy calyx.

35. *F. callosa*. Willd. Diff. 25. t. 4. Vahl. Enum. n. 29.—“Leaves oblong, obtuse, narrower at the base, with two callous dots; rough beneath.”—Native of the East Indies. Leaves smooth and shining above, paler be-

neath. Fruit globose, umbilicated, the size of a cherry. Willdenow.

36. *F. microcarpa*. Vahl. En. n. 30.—“Leaves ovate, somewhat oblong, obtuse, smooth. Branches wand-like. Fruit globose, sessile, in pairs.”—Found by Thoning in Guinea. A rather tall and spreading tree, its branches throwing out roots. Leaves three to five inches long, stalked, finely reticulated, pale beneath. Fruit small.

37. *F. parasitica*. Willd. Diff. 25. t. 3. Vahl. En. n. 31.—“Leaves elliptical, bluntish; reticulated and roughish beneath. Fruit stalks in pairs. Fruit globose, umbilicated.”—Grows in the East Indies. Branches round, smooth. Leaves smooth and shining above, coriaceous, most veiny beneath. Fruit axillary, the size of a pea.

38. *F. americana*. Aubl. Guian. 952. (*F. alia, foliis lauri, fructu minore*; Plum. Ic. 124. t. 132. f. 2.)—“Leaves ovate-oblong, veiny. Fruit axillary, stalked, clustered.”—Native of Jamaica. Leaves smooth, two inches long. Fruit small, yellow.

39. *F. racemosa*. Linn. Sp. Pl. 1515. (Atti-alu; Rheede H. Mal. v. 1. 43. t. 25.)—“Leaves elliptic-ovate, acute, dotted on the upper side. Fruit sessile, top-shaped, downy.” Vahl. Native of the East Indies, in sandy soil. A tall and spreading tree. Branches downy in the upper part. Leaves stalked, remote, two or three inches long, narrowed at each end, especially the upper, acute, striated, in a manner, with ribs, somewhat veiny, smooth on both sides, dotted on the upper when examined with a microscope. Footstalks rather downy. Fruit pear-shaped, sessile, downy. Vahl.—We know this only by the above authorities, having no authentic specimen. The fruit is not sessile in Hort. Malab.

40. *F. glomerata*. Roxb. Corom. v. 2. 14. t. 123.—Leaves elliptic-ovate, acute, not dotted above; minutely granulated beneath. Fruit clustered, stalked, top-shaped, downy.—Generally found near villages, and about rivers and water-courses in Bengal, where the soil is rich and moist. Fruit eaten by the natives, but Dr. Roxburgh thought it disagreeable; purplish, the size of a pigeon's egg, growing many together on the young branches, each on a separate stalk. Leaves four or five inches long, smooth above; feeling roughish underneath.

41. *F. indica*. Linn. Sp. Pl. 1514. Lamarck. Dict. v. 2. 494. Clus. Exot. 1. (*F. cotoneastifolia*; Vahl. En. n. 34. Catu-alu; Rheede H. Mal. v. 3. 73. t. 57.)—“Leaves ovato-lanceolate, coriaceous, downy beneath. Fruit sessile. Branches taking root at the extremity.”—Native of the East Indies, where it has been celebrated from the most remote antiquity, for its property of letting its branches droop and take root, so extending itself by that means, that a single tree forms a curiously-arched grove. We cannot therefore approve of Professor Vahl's innovation, in transferring its ancient name to another, which Linnæus thought a variety, but which is totally distinct. See our n. 68.—The leaves are three or four inches long, pointed. Fruit globose, the size of a large gooseberry, reddish, sweet, but not pleasant-tasted.

42. *F. Toka*. Forsk. Arab. 219.—“Leaves two-ranked, rough, ovate, acute, entire, alternate, stalked.”—Found by Forskall in Arabia, where it is called Toká, which is all we know concerning it.

43. *F. punctata*. Thunb. Diff. 9.—“Leaves oblong, emarginate, smooth, dotted beneath. Stem zig-zag, throwing out roots.”—Native of the East Indies.—Stem parasitical, creeping to a great extent, round, rugged, brown, hardly so thick as a goose-quill, branched; the ultimate divisions very short. Leaves obtuse, only from half an inch

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to an inch long, spreading or reflexed, their margin entire, a little reflexed. *Footstalks* very short. *Fruit* obovate, almost as large as the common *F. Carica*. *Thunberg*.—We suspect this ought to be placed near *scandens*, n. 15, but we are unwilling to disturb Vahl's arrangement. It seems by analogy to confirm the report there given of the fruit of that species.

44. *F. pertusa*. Linn. Suppl. 442; excluding the synonym.—Leaves elliptical, pointed, very smooth. Fruit globose, umbilicated, stalked, axillary, in pairs. Calyx in two lobes.—Native of Surinam. Whole plant smooth. *Leaves* two or three inches long and one broad, taper-pointed, with fine transverse veins. *Footstalks* half an inch long. *Fruit* the size of a pepper-corn, on a stalk nearly its own length. *Calyx* small, in two deep, recurved segments. Vahl describes the fruit in clusters an inch long, which is altogether unfounded. He also copies from the *Suppl. Plant.* an erroneous synonym of Plumier, t. 132. f. 2, which he had just before rightly applied to *F. americana*.

45. *F. farmentosa*. Buch. MSS.—Leaves ovate-oblong, pointed; smooth above; downy and glaucous beneath. Fruit solitary, axillary, ovate, hairy, on stalks as long as the footstalks. Stem trailing.—Gathered, in May 1802, by Dr. Buchanan, in the woods of Upper Nepal, where this and others of its genus are called *Bocofsi*.—*Stem* trailing, milky, as thick as the thumb, branching out, at the top of the tree that supports it, into many spreading, alternate, downy, leafy shoots. *Leaves* about three inches long, reflexed at the margin, very veiny, three-ribbed at the base; their under side whitish, downy, finely reticulated. *Footstalks* half an inch or more in length, hairy. *Flower-stalks* rather longer. *Young fruit* the size of a hazel-nut, somewhat angular, obtuse, very hairy. *Calyx* very small, and a little remote, of three hairy leaves.

46. *F. pumila*. Linn. Sp. Pl. 1515, but not Syst. Veg. ed. 14. 922. (*F. sylvestris procumbens, folio simpliciter*; Kœmpf. Amœn. 803. t. 804.)—Leaves ovate, smooth; very closely reticulated beneath. Stem jointed, creeping. Fruit stalked, nearly as long as the leaves.—The only certain knowledge we have of this Figi, from Kœmpfer, who describes it as running up walls and rocks in Japan, the branches being marked with annular contractions. *Leaves* ever-green, scattered, stalked, about two or three inches long, hard, rigid, exactly ovate, but pointed; smooth and of a rather shining green above; paler, opaque, and most beautifully reticulated with prominent veins beneath, so crowded that there is scarcely room for the point of a needle between them. *Fruit* tasteless, on thick, short, recurved, axillary, solitary stalks, the size and shape of a walnut with its coat on, or else pear-shaped, or turbinate with a taper base, hardish, rugged, generally green with a blue bloom, sprinkled with white dots. Nothing can much better accord with the specimens sent us from Portugal than the fruit of *F. scandens*, n. 15. *Thunberg's* description is still more precise, as he says the leaves are obtuse, and branches furrowed. We have seen no authentic specimens of *F. pumila*. Linnæus altered the specific character, and added a description, in his *Systema Vegetabilium*, from a widely different plant in his herbarium, the *creta* of *Thunberg*; see n. 59.

47. *F. Cabur*. Buch. MSS.—Leaves oblong-ovate, taper-pointed, smooth; very closely reticulated beneath. Fruit stalked, axillary, solitary, globose, hairy.—Native of woods in Nepal, where it is called *Cabur*. *Stem* shrubby, three or four feet high. *Branches* downy. *Leaves* alternate, four or five inches long, somewhat revolute; very smooth above; whitish and reticulated, like the last, beneath. *Footstalks* and *fruitstalks* each about half an inch long,

thickish, hairy. *Fruit* the size of a moderate gooseberry, globular, pointed, hairy, slightly ribbed.

48. *F. reflexa*. Thunb. Diff. 11.—“Leaves elliptical, obtuse, smooth. Branches recurved. Fruit globose, sessile.”—Native of the East Indies. *Branches* striated, rugose, ash-coloured, smooth. *Leaves* somewhat obovate, a finger's length, with parallel ribs (or rather veins); *Footstalks* half as long as the leaves. *Fruit* sessile on the branches, either scattered or crowded, smooth, the size of a pea. *Thunb.*

49. *F. trigona*. Linn. Suppl. 441. (*F. folio citri obtuso, fructu sanguineo*; Plum. Ic. 123. t. 132. f. 1.)—Leaves elliptical, smooth, five-ribbed at the base; ribs hairy. Fruit globose, solitary, axillary, stalked; mouth with a triangular border.—Communicated to Linnæus from Surinam. The branches are slightly hairy about the extremities only. *Leaves* alternate, three or four inches long, on very hairy footstalks not an inch in length; both sides are smooth and even; the upper minutely dotted; the under scarcely perceptibly reticulated with veins, but furnished with a strong mid-rib, several very straight, parallel, transverse ribs, and at least two radiating ones, on each side, at the base, all hairy. *Fruit* the size of a black currant, on a short thick hairy stalk, minutely downy, with an oblique variously divided calyx, externally hairy, beneath it, and a singular triangular elevated border round the mouth, which is closed. Plumier's figure seems to agree tolerably well, but there is no certainty in his synonym.

50. *F. nitida*. Thunb. Diff. 10. (*F. microcarpa*; Linn. Suppl. 442. Itti-arealou; Rheede H. Mal. v. 3. 69. t. 55.)—Leaves elliptical, bluntly-pointed, somewhat unequal, smooth, with numerous parallel veins. Fruit sessile, globose, flattened at the top.—Native of the East Indies. Whole plant smooth. *Leaves* two or three inches long, usually oblique or inequilateral, near two inches broad, with a short blunt point; transverse ribs or veins very slender, terminating in one undulating vein within the margin, as in many other species. *Fruit* the size of a pea, enveloped, till half grown, in a strong three-cleft calyx; its mouth is always closed with scales folded over each other.—The *footstalks* are short and thick. Vahl overlooked the Linnæan synonym, and Lamarck could not ascertain it.

51. *F. scabriuscula*.—Leaves elliptic-rhomboid, unequal, acute, roughish on both sides. Fruit axillary, stalked, in pairs, globose, rough.—Native of the East Indies, where the leaves are used for polishing ivory, being a very fine file. Every part of the plant is rough with most minute cartilaginous points, hardly perceptible but by the touch. *Leaves* two or three inches long, of a light green, on stalks half an inch long. *Fruit* the size of red currants, with a tumid, slightly perforated, mouth. We have some doubt whether Vahl's *rhomboidalis*, hereafter mentioned, n. 86, be different from this.

52. *F. comosa*. Roxb. Corom. v. 2. 14. t. 125.—Leaves elliptical, pointed, smooth, with numerous transverse veins. Fruit sessile, in pairs, roundish, with a triangular mouth.—Found by Dr. Roxburgh on the Circar mountains. It is called among the Telingas Pootra, or Pooda, Juvy. A large tree, with slender, often pendulous, branches. *Leaves* two or three inches long, and half as broad; their lateral veins straight and parallel, having numerous reticulations between them. *Footstalks* near an inch long, and rather slender, very different from those of *nitida*, n. 50. *Fruit* when ripe the size of a moderate gooseberry, first purple, then orange.

53. *F. rubra*. Vahl. En. n. 42. (*F. pyrifolia*; Lam. Diœt. v. 2. 497. Variaga rubra; Rumph. Amb. v. 3.

t. 85.)—"Leaves oval, smooth; very minutely reticulated beneath. Fruit globose, nearly sessile."—Gathered by Commerfon in the Mauritius, from whose specimens Lamarck described it. *Leaves* two inches long, one and a half broad, stalked. *Fruit* about the tops of the small branches. We know this species only by the above description.

54. *F. aggregata*. Vahl. En. n. 43. (*F. punctata*; Lam. Dict. v. 2. 495.)—"Leaves oval, obtuse, smooth; dotted on the upper side. Fruit globose, aggregate, sessile."—Gathered by Commerfon in the Mauritius and Madagafcar. *Leaves* about three inches long and half as broad, blunt or emarginate, not coriaceous, dark green dotted with white. *Fruit* small. Lamarck quotes H. Mal. v. 3. t. 55 as resembling his plant, which we judge rather to represent *F. nitida*.

55. *F. politoria*. Lam. Dict. v. 2. 500. Vahl. En. n. 44.—"Leaves elliptic-oblong, with a blunt point, rough with hooked spines. Fruit globose, stalked, axillary, solitary, rough."—Gathered in Madagafcar by Commerfon, one of whose specimens is before us. *Leaves* about two and a half inches long, scarcely one broad, obtuse, with a little broad obtuse point; paler beneath, with largely reticulated veins; both sides, but especially the veins beneath and the edges, are rough with minute white, hooked, rigid prickles, as are the footstalks, fruitstalks, upper part of the branches, and the fruit itself, which is rather larger than a black currant, and purple.

56. *F. mollis*. Vahl. Symb. p. 1. 82. Willd. Diff. 26. t. 5.—"Leaves oblong, downy beneath. Fruit axillary, sessile, solitary, downy." Vahl.—Native of the East Indies. *Branches* round, downy. *Leaves* two inches long; smooth above; veiny beneath, rather soft; obtuse, on downy footstalks, shorter than the leaves. *Fruit* very small.

57. *F. verrucosa*. Vahl. En. n. 46. (*F. septica*; Forst. Prod. 76.)—"Leaves oblique, oblong-ovate, pointed. Fruitstalks in pairs, with a small calyx at the top. Fruit warty." Forster. Found in the isle of Tanna.

58. *F. coriacea*. Ait. H. Kew. v. 3. 453.—"Leaves oblong, smooth, coriaceous; attenuated and heart-shaped at the base; veins sunk."—Grows in the East Indies.

59. *F. erecta*. Thunb. Diff. 9. (*F. pumila*; Linn. Syst. Veg. ed. 14. 922, but not Sp. Pl. 1515.)—Leaves ovate-oblong, sharp-pointed, smoothish; reticulated beneath. Stem nearly decumbent, with upright branches. Fruit top-shaped, stalked, axillary, solitary, smooth.—Found in Japan. *Stem* weak, not perfectly decumbent, round, striated, smooth. *Branches* scattered or aggregate, erect, straight, leafy. *Leaves* from two to four inches long, green, and often minutely bristly, above; pale, and reticulated with numerous downy veins, beneath. *Footstalks* half an inch or more in length, rather downy upwards. *Fruitstalks* rather longer, erect, with a three-leaved calyx at the top. *Fruit* the size of a hazel-nut, rather tapering at the base, sweet and eatable.

60. *F. falcata*. Thunb. Diff. 8. Vahl. En. n. 49.—"Leaves oblong, sickle-shaped, smooth. Stem thread-shaped, creeping."—Native of Java. *Leaves* obtuse, with one side narrower than the other, about an inch long, very finely veined, pale beneath, on very short footstalks. *Stem* and *branches* slender, zig-zag, brown. This seems to be akin to n. 15 and 16, next to which Thunberg has placed it, and we know not why Vahl, who appears to have seen specimens of the *falcata* at least, has removed it to so great a distance.

61. *F. drupacea*. Thunb. Diff. 11.—"Leaves obovate, pointed, smooth. Fruit ovate, rugged, sessile."—Native of the East Indies. *Branches* round, furrowed, smooth.

Leaves coriaceous, four inches long, ribbed; green above; ash-coloured beneath, on thick stalks about half an inch long. *Fruit* towards the ends of the branches, smooth, as big as plums. Thunb.

62. *F. retusa*. Linn. Mant. 129.—"Leaves oblong, obovate, very obtuse, quite smooth; three-ribbed near the base. Fruit sessile, globose, smooth. Calyx downy."—Native of Java. *Branches* smooth, angular. *Leaves* three inches long, stalked; shining above; opaque, paler and veiny beneath; furnished with a straight lateral rib on each side, which vanishes about the middle of the leaf, and several transverse ribs besides. *Fruit* when young enveloped in a calyx which is externally downy; when full grown the size of a currant, smooth, with broad polished scales at the mouth.

63. *F. prolixa*. Forst. Prod. 77. Vahl. En. 52.—"Leaves lanceolate-oblong, pointed; dotted beneath. Fruit mostly in pairs, globose, axillary, smooth, on wavy smooth stalks."—Native of the Society Isles. *Branches* smooth. *Leaves* stalked, three or four inches long, an inch or more in breadth, with very fine nerves, scarcely veined, membranous. *Fruit* the size of a pea, on very short stalks. Vahl.

64. *F. laurifolia*. Lam. Dict. v. 2. 495. Vahl. En. n. 53. (*F. virens*; Ait. H. Kew. v. 3. 451. *F. indica maxima*, folio oblongo, funiculis e summis ramis demissis radices agentibus se propagans, fructu minore, sphaerico, fanguineo; Sloane Jam. v. 2. 140. t. 223.)—"Leaves oblong-lanceolate, smooth, with a few scattered depressed points above. Fruit sessile, solitary, globose, axillary."—Native of the West Indies. A very lofty tree, according to Sloane, whose upper branches throw out long roots. Pigeons of all kinds are fond of the fruit, which is the size of a hazel-nut, scarlet, sweetish and not unpleasant. The leaves seem to resemble those of the Cherry-laurel.

65. *F. grisea*. Vahl. Ennm. n. 54.—"Smooth. Leaves oblong, obtuse, narrowed at the base. Fruit sessile, nearly solitary."—Described by Vahl from Jussieu's herbarium. Its native country is unknown. The branches, according to him, are grey in the upper part. *Leaves* stalked, three or four inches long, paler beneath, very smooth. *Footstalks* an inch long. *Fruit* globose, grey, twice as big as a pea. *Stipulas* lanceolate, attenuated, smooth, as long as the nail.

66. *F. pallida*. Ibid. n. 55.—"Leaves oblong, somewhat wedge-shaped, smooth, even, obtuse. Fruit axillary, in pairs, on short stalks."—Gathered by Von Rohr at St. Martha, in South America. *Branches* greyish. *Leaves* membranous, two or three inches long, and one broad, bright green, minutely veined, with a yellow rib. *Footstalks* slender, smooth, an inch long. *Fruit* globular, smooth, the size of black pepper. Vahl.

67. *F. excelsa*. Ibid. n. 56. (Atti meer alou; Rheede H. Mal. v. 3. 75. t. 58.)—"Leaves lanceolate, somewhat elliptical, acute; narrower on one side at the base. Fruit stalked, globose."—Native of the East Indies. *Branches* and *leaves* smooth; the latter three or four inches long, most veiny beneath, on short stalks. *Fruit* in pairs, axillary, smooth and even, the size of a pea, on stalks longer than those of the leaves. Vahl.

68. *F. amplissima*. (*F. indica*; Vahl. En. n. 57. *F. indica* β; Linn. Sp. Pl. 1514. Tsjela; Rheede H. Mal. v. 3. 85. t. 63.)—"Leaves broad-lanceolate, long-pointed, smooth. Fruit clustered, globose, smooth, on short stalks."—Native of the East Indies. This, according to Rheede, is a tree of vast dimensions, about 70 feet high, and 18 in the circumference of the trunk, with widely-spreading branches. *Leaves* stalked, two or three inches long, with numerous,

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parallel, transverse, slender ribs; the point sometimes an inch long. *Fruit* copious, the size of a pea, insipid, the food of bats, on which account the Portuguese and Dutch call it the Bat-tree.

69. *F. salicifolia*. Vahl. Symb. p. 1. 82. t. 23. (*F. indica*; Forst. Fl. Arab. 179.)—"Leaves lanceolate, pointed, smooth. *Fruit* axillary, stalked, in pairs."—Gathered by Forstall in Arabia, where it is called *Tháab*. Of the bark, dried and twisted, matches for great guns are made. The *branches*, though long and pendulous, do not throw out roots. The whole plant is very smooth. *Leaves* stalked, from three to five inches long, rounded at the base, dotted beneath, not above an inch broad. *Fruit* larger than a pea, smooth.

70. *F. obliqua*. Forst. Prod. 77.—"Leaves lanceolate, very smooth, with a cartilaginous edge. *Fruit*-stalks in pairs, very short. Calyx as long as the fruit, deciduous." *Forster*. A native of the South Sea Islands of Nanoka and Tanna.

Section 2. *Leaves undivided, serrated, or toothed.*

71. *F. semicordata*. Buch. MSS.—Leaves half-heart-shaped, slightly serrated, rough; rather hairy beneath. *Fruit* on radical shoots, stalked, in pairs, downy.—Native of woods in Upper and Lower Nepal, where it was found by Dr. Buchanan, early in 1802. A large tree, with downy or hairy branches. *Leaves* above a foot in length, oblong, sharp-pointed, very unequally heart-shaped at the base, paler and veiny beneath, on short, rough, or downy footstalks, the larger lobe crossing the branch, and furnished with radiating ribs. *Stipulas* long, narrow, smooth, deciduous. *Flowering branches* from the base of the trunk, or even from the roots under ground, drooping, panicle, downy, sometimes leafy towards the extremity. *Fruit* in pairs from each joint of these branches, globose, hairy, on hairy or downy stalks, with a pair of downy bracteas; when ripe as large as a common plum.—The natives eat the figs raw, as well as fried.

72. *F. auriculata*. Lour. Cochinch. 666.—"Leaves heart-shaped, pointed, somewhat serrated, downy. *Fruit* auricled, smooth, in terminal clusters."—Cultivated, and probably wild also, in Cochinchina, where the unripe figs are sliced and eaten in salads, instead of cucumbers, which they resemble in flavour. The tree is large, with ample leaves. *Fruit* turbinate, two inches long, red, in dense, upright, terminal clusters, furnished at its top, besides the usual orifice, with four distant holes, surrounded with a prominent cartilage, and resembling ears.

73. *F. Forskalii*. Vahl. En. n. 61. (*F. morifolia*; Forst. Arab. 179.)—"Leaves ovate, somewhat heart-shaped, rough, serrated, longer than their footstalks."—Native of Arabia. *Leaves* half a span long. *Stipulas* linear-lanceolate. *Fruit* eatable, but unpleasant. *Forst.*

74. *F. mauritiana*. Lam. Dict. v. 2. 499. Vahl. En. n. 62.—"Leaves ovate or heart-shaped, serrated; downy and rough beneath. *Fruit* globose, somewhat turbinate, stalked, on naked pendulous branches."—Gathered by Commerçon in the Isle de Bourbon. *Branches* downy, rather hispid. *Leaves* smooth on the upper side, six or seven inches long, four or five broad, ovate, generally heart-shaped at the base, on footstalks two or three inches in length. *Fruit* larger than a walnut, in pairs. Vahl says, the figure in Hort. Mal. v. 3. t. 61, does not ill accord with this plant. See *F. symphytifolia*, n. 80.

75. *F. lateriflora*. Vahl. En. n. 63. (*F. morifolia*; Lam. Dict. v. 2. 499.)—"Leaves ovate, somewhat heart-shaped, acute, serrated, smooth. *Fruit* globose, stalked, below the

leaves."—Gathered by Commerçon in the Isle de Bourbon. *Branches* brownish. *Leaves* resembling those of a mulberry-tree, stalked, green on both sides scarcely at all rough, about three inches long and two wide. *Fruit* smooth, scattered over the naked part of the branches.

76. *F. ulmifolia*. Lam. Dict. v. 2. 499. Vahl. En. n. 64.—"Leaves ovate, sparingly toothed, pointed, unequal at each end, rough on both sides."—Native of Java, and the Philippine islands. *Branches* round, rough. *Leaves* two or three inches long, ovate-oblong, very rough with little tubercles, terminating in a point an inch long, wavy at their edges, sometimes three-cleft, or somewhat pinnatifid. *Fruit* globose, very rough, rather bigger than a pea, on stalks half the length of the leaf-stalks.

77. *F. capensis*. Thunb. Diff. 13.—"Leaves ovate, acute, serrated, smooth. *Fruit* stalked, smooth, turbinate."—Gathered by Thunberg at the Cape of Good Hope. A very lofty, spreading, smooth tree. *Leaves* a finger's length, spreading, deeply toothed, paler and ribbed beneath, on footstalks an inch long. *Fruit* scattered, bigger than a hazel-nut. *Thunb.*

78. *F. grossularioides*. Burm. Ind. 227.—"Leaves stalked, ovate; entire at the base; serrated at the top; yellowish white beneath."—Found by Garcia at Surat. The *fruit* is yellow, resembling a gooseberry, but poisonous. Such is Burmann's account, who considers Hort. Mal. v. 3. t. 62. as a variety of this, differing only in having shorter footstalks. See *F. rufescens*, n. 102.

79. *F. exasperata*. Vahl. En. n. 67. (*F. scabra*; Willd. Diff. t. 2. Vahl.)—"Leaves oblong-ovate, very rough, pointed, toothed towards the end. *Fruit* stalked, globose."—*Branches* rough when young, afterwards smooth. *Leaves* three inches long, stalked, three-ribbed, downy beneath. *Fruit* in pairs, rough, the size of a pea, on stalks an inch long.

80. *F. symphytifolia*. Lam. Dict. v. 2. 498. Vahl. En. n. 68.—(Perin-teragam; Rheede H. Mal. v. 3. 81. t. 61?)—"Leaves ovate-oblong, acute, minutely toothed; rough on both sides. *Fruit* hairy, stalked, somewhat whorled, in long clusters."—Native of Java, and other parts of the East Indies. Lamarck described it from Sonnerat's specimen, and remarks, that the figure in the Hortus Malabaricus would be tolerably exact if the leaves were represented with small teeth. The *leaves* are nine or ten inches long, stalked, with hairy ribs. *Fruit* globose. Vahl describes the fruit sessile, the size of a cherry. Rheede's plant is a very large long lived tree, laden with fruit, as well as leaves, all the year long.

81. *F. maculata*. Linn. Sp. Pl. 1515. (*F. castaneæ folio, fructu globose maculato*; Plum. Ic. 122. t. 131. f. 1.)—"Leaves oblong, pointed, serrated. *Fruit* globose, sessile, in long spikes."—Native of America. Plumier's figure, whence the above characters are taken, is our only authority for this species. The *fruit* is an inch in diameter, besprinkled with spots or warts. *Leaves* a foot long, regularly and sharply serrated, with innumerable straight, parallel, transverse veins.

82. *F. hispida*. Linn. Suppl. 442. Thunb. Diff. 13.—"Leaves elliptic-oblong, pointed, obscurely serrated, rough on both sides. *Fruit* turbinate, stalked, axillary, solitary, very bristly."—Native of Java. The *branches* and *footstalks* are nearly smooth, the latter an inch or an inch and quarter long. *Leaves* near four inches long, rough with minute points, furnished with several unequal, curved, bristly, lateral ribs, and reticulated veins; the edges waved, but scarcely serrated. *Fruitstalks* full half an inch long, covered, like the *fruit* itself, with numerous rigid, shining, tawny bristles.

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Had we not one of Thunberg's own specimens, we should hardly have recognized the plant by his description.

83. *F. oppositifolia*. Roxb. Corom. v. 2. t. 4. l. 124. (F. Dæmonium; Vahl. En. n. 71. *F. scabra*; Jacq. H. Schoenbr. v. 3. 36. t. 31. —Leaves opposite, oblong, slightly ferrated; rough above; more downy beneath. Fruit stalked, angular, very hairy.—Gathered by König and Roxburgh in moist rich soil, about the banks of rivulets, in the East Indies. It is but a small tree, with hollow jointed, hairy branches, which sometimes take root about their extremities. Leaves very unequal in size, from one to five inches long, one or two broad, on thick, shortish, hairy stalks; the upper side is extremely harsh to the touch; the under hoary, and strongly reticulated. Fruit the size of a large nutmeg, very fealy at the mouth; axillary and solitary on the young branches; on the older ones racemose or clustered; tawny, hoary, seldom eaten. This species being, as far as hitherto discovered, singular in its genus for having opposite leaves: we greatly prefer Roxburgh's name to any other. The milky juice is said to be poisonous, as in several more.

84. *F. montana*. Burm. Ind. 226.—“Leaves oblong, with wavy ferratures. Fruit very small.”—Native of hills in Java. Known by Burmann's short character only.

Section 3. *Leaves angular or sinuated.*

85. *F. Sycomorus*. Linn. Sp. Pl. 1513. (F. Cypria; Rauwolf. H. 57. t. 57. Sycomorus; Matth. Valgr. v. 1. 259.)—Leaves oval-heartshaped, bluntly angular, wavy, smooth on both sides. Fruit from the main stem, obovate, stalked.—Native of Egypt, from whence we have specimens gathered by Dr. Delile. It is rarely seen in collections, and unknown in our gardens. The leaves and habit so much agree with *F. Chanas*, n. S. that we should have placed them next to each other, had we not for convenience followed Vahl's arrangement; they differ however from that species in being smooth. The fruit grows, either solitary or on branched stalks, from the main stem of the tree, (which is of very large dimensions), and resembles common figs in shape, but are smaller, paler, sweet and delicate, but not always well ripened. The operations of an insect called *Cynips Sycomori* are supposed necessary to their coming to perfection. (See CAPRIFICATION.) The specific character is very unjustifiably perverted in the *Systema Vegetabilium* from a synonym of Plukenet, t. 178. f. 3, which belongs, as Lamarec observes, to *Hibiscus tiliaceus*, a plant with downy leaves.—By no less strange a perversion, the name of Sycamore has become attached to our greater Maple, *Acer Pseudoplatanus*.

86. *F. rhomboidalis*. Vahl. En. n. 74.—“Leaves oblong, or somewhat rhomboid, veiny. Fruit stalked, globose, rather downy.”—Gathered by Dr. Rottler in the East Indies. Branches round, thick, subdivided, smooth, grey. Leaves scattered, stalked, pale green, entire, smooth on both sides; sometimes acute, sometimes obtuse, at the summit; acute at the base; often furnished with a prominent angle, about the middle, on each side. Fruit axillary, solitary, umbilicated, the size of a pea. Vahl.—This description agrees, in many points, with our *scabriuscula*, n. 51, but surely the roughness of the leaves, which are used as a file, could never have been overlooked by Vahl, nor the fruit called villose.

87. *F. reticulata*. Thunb. Diff. 12.—“Leaves elliptical, somewhat angular, toothed, pointed, smooth; reticulated beneath. Fruit globose, solitary, stalked.”—Found in the East Indies. Branches erect, smooth, purple. Leaves obovate, tapering at the base, three or four inches long, spreading, paler underneath, on shortish thick footstalks.

Fruit axillary, smooth, larger than a pea, on a stalk a line in length.

88. *F. Sur*. Forsk. Fl. Arab. 180. Vahl. En. n. 76.—“Leaves lanceolate, waved, very smooth, somewhat heart-shaped at the base. Fruit clustered on the main stem.”—Native of Arabia, where it is called *Sur*. This tree resembles the *Sycomorus*. The young branches, stipulas, and under side of the footstalks, according to Vahl, are hairy. Leaves rather coriaceous, broadish-lanceolate, with wavy teeth; pale and reticulated at the back. The fruit is described by Forskall as the size of a pigeon's egg, and eatable.

89. *F. aspera*. Forsk. Pl. Escul. 36.—“Leaves unequally heart shaped, sinuated or toothed, rough on both sides. Calyx obsolete, united to the base of the turbinate fruit.”—Cultivated in the gardens and shrubberies of the Isle of Tanna, for the sake of its fruit, which is sweet and pleasant, as well as of the leaves, which when boiled afford the inhabitants an agreeable dish. Tree four or five fathoms high, with jointed leafy branches. Leaves a span long, on very short stalks, rough and hairy, one side narrower than the other. Fruit axillary, in pairs, sessile, downy, white; the size of a common fig. Forster; who cites H. Mat. v. 3. t. 62. as having some resemblance to this species; see *rufescens*, n. 102.

90. *F. sinuata*. Thunb. Diff. 12.—“Leaves elliptical, sinuated or toothed, pointed, smooth. Fruit globose, aggregate, sessile.”—Native of the East Indies. Branches erect, smooth, grey. Leaves obovate, toothed, and somewhat angular towards their points, with a reflexed margin: entire towards the base; pale, ribbed and reticulated beneath, three or four inches long, on stalks the length of the nail. Fruit scattered or aggregate upon the small branches, sessile, knotty, scarcely so big as pepper. Such is Thunberg's description, and yet, in his specific character, he calls the fruit stalked.

91. *F. subincisa*. Buch. MSS.—Leaves oblong, pointed, harsh, naked; here and there jagged. Fruit ovate, tuberculated, axillary, stalked, solitary.—Gathered by Dr. Buchanan on the rocks of Upper Nepal, Jan. 28, 1803. A tree with very numerous, rigid, crooked branches, leafy at the ends only. Leaves two inches or more in length, with a taper point almost an inch long, elliptic-lanceolate, mostly entire, but often cut, toothed or wavy in the upper part at one or both edges, veiny, rough to the touch, paler beneath. Footstalks short. Fruit towards the end of each branch, the size of a nutmeg, pointed, covered with prominent warts, not hairy, on stalks twice as long as those of the leaf, thickened above the middle, where there is a small three-leaved involucre.

92. *F. rostrata*. Lam. Dict. v. 2. 498. Vahl. En. n. 79.—Leaves oblong, unequally angular and wavy, with a linear obtuse point; smooth above. Fruit globose, smooth, on short stalks.—Gathered by Commerçon in Java. Branches slender, roughish with minute points when young. Leaves on short rough stalks, two or three inches long, of a singular abrupt and irregular figure, irregularly veiny, reticulated; paler and somewhat harsh beneath; the point almost an inch long, rather broadest towards the end. Fruit the size of pepper, axillary, two or three together, on very short stalks. The leaves of this species suggest some idea of the fish called *Chætodon longirostris*, figured in Bronsionet's *Ichthyologia*.

93. *F. difformis*. Lam. Dict. v. 2. 500. Vahl. En. n. 80.—“Leaves oblong, acute, rough, of various shapes; undivided; somewhat angular; sinuated; or deeply lacinated.”—Native of the Philippine islands. We know nothing of it

it but the above definition of Lamarck, who quotes a synonym of Ray which we would rather apply to *F. heterophylla*, n. 99. if that be different from the present, which we doubt. Lamarck indeed appears to have had two distinct plants under these names, but his *heterophylla* is not that of Linnæus. See *rufescens*, p. 102.

Section 4. *Leaves divided.*

94. *F. palmata*. Vahl. Symb. v. 1. 84. t. 24. Forsk. Fl. Arab. 179.—Leaves ovate or lobed, ferrated, acute, rough; heart-shaped at the base. Fruit pear-shaped, smooth, stalked, axillary, solitary.—Native of Arabia. *Branches* smooth. *Leaves* from two to four inches long, sharply ferrated throughout, veiny; paler, with purple veins, beneath; on slender *footstalks*, full an inch long. *Fruit* the size of a hazel-nut, its stalk shorter than that of the leaf, with a small two-leaved involucre.

95. *F. hirta*. Vahl. En. n. 82.—“Leaves oblong, undivided or three-lobed, finely ferrated; somewhat heart-shaped at the base; smooth above. Fruit sessile, bristly.”—Native of China. *Leaves* distant, three-lobed towards the extremity; lobes pointed, the lateral ones smallest; ribs hairy beneath. *Footstalks* hairy, an inch and a half long. *Fruit* axillary, solitary, the size of a pea. Vahl saw a Java specimen with some leaves undivided; and two or three fruits together, twice the above size.

96. *F. truncata*. Vahl. Symb. v. 1. 83.—“Leaves oblong, undivided or lobed, entire, rough. Fruit stalked, oblong, abrupt.”—Native of the East Indies. *Branches* angular, smooth. *Leaves* above two inches long, on short rugged *footstalks*, either undivided, or with three, sometimes five, oblong lobes, the lateral ones bluntest. *Fruit* rough with minute points, its top as it were cut off abruptly.

97. *F. ferrata*. Ibid. 83. Forsk. Fl. Arab. 179.—“Leaves oblong, undivided or palmate, rough, with wavy teeth. Fruit stalked, globose, very rough and hairy.”—Gathered by Forskall in various parts of Arabia, where the leaves are used to clean and polish rusty iron. *Branches* and younger *leaves* very rough with numerous extremely minute points. *Fruit* the size of a hazel-nut, on short stalks.

98. *F. toxicaria*. Linn. Mant. 305. (*F. toxica*; Thunb. Diss. 14. *F. Padana*; Burm. Ind. 226.)—“Leaves ovate, or heart-shaped, cut and lobed, somewhat toothed; white beneath. Fruit stalked, ovate, downy.”—Found near the town of Padana in Sumatra, by Garcin, who reports it to be extremely poisonous. The *leaves* are a foot long, being equal in size to those of *F. benghalensis*. *Burmans*. *Fruit* the size of a plum. *Thunb.*

99. *F. heterophylla*. Linn. Suppl. 42. (*F. denticulata*; Vahl. Symb. v. 1. 83. *F. indica sylvestris*, *indis Ifis*, &c; Raii Hist. v. 3. append. 50. n. 12?)—Leaves oblong, undivided, three-lobed and cut, unequally toothed; harsh on both sides. Fruit solitary, stalked, globose, tuberculated, roughish.—Gathered by König in the East Indies, where it is called *Nir Aui*, water fig, from its inhabiting the banks of rivulets and other watery places, so overrun with the prickly rattan, *Calamus Rotang*, as to be hardly accessible. The *branches* are reddish-brown, slender, roughish; angular and downy at their ends. *Leaves* on shortish rough stalks, green and very rough to the touch, on both sides, with extremely minute cartilaginous points; their shape remarkably various, some being oblong, undivided, acute, partly entire, partly toothed for a considerable space, but quite irregularly; others with a deep wide rounded entire sinus at one, or oftener both, sides, thus become two or three-lobed, and are toothed unequally like the former.

Veins pale, forming large quadrangular reticulations. The length of each leaf is from two to four inches. *Fruit* the size of a musquet-ball, pale, covered with very minute rough points, and with scattered slightly prominent warts, its mouth obtuse, closed with broad flat scales. *Fruitstalks* axillary, thick, shorter than the *footstalks*, rough with little prickles, and bearing an involucre of three small obtuse concave leaves, a little below the fruit. The synonyms of Linnæus and Vahl are determined by authentic specimens; that of Ray we can only guess at, but his description answers exactly to our plant. He says the leaves are used for polishing wooden furniture, and that the fruit is mawkishly sweet, eaten by children and birds only, but useful for cataplasms when boiled and bruised. The inner bark is given in decoction for the gonorrhœa, and to throw out the measles. We cannot account for Linnæus's describing the fruit as smooth, nor can we answer for Vahl's *heterophylla* being the same as our's, though it is very possible he might happen to see young fruit only; but our's even in an early state is rough.

100. *F. repens*. Roxb. MSS.—Leaves unequally heart-shaped, finely toothed throughout, rough on both sides; undivided; or three or four-lobed. Fruit solitary, stalked, obovate, abrupt, bristly.—Communicated by Lord Viscount Valentia from the East Indies. *Branches* slender, downy when young. *Leaves* on some branches four or five inches long and three broad, heart-shaped, with one side of the base much larger than the other, on slender *footstalks* two inches long; on other branches unequally heart-shaped at the base in a similar manner, but much smaller, and deeply three-lobed, one lateral lobe usually divided, their *footstalks* scarcely an inch long, and more downy; these seem to be younger leaves than the undivided ones; all are rough with minute points and bristles, paler beneath, minutely but sharply toothed throughout, somewhat pointed. *Fruit* axillary, the size of a silberd or bigger, tapering at the base, lopped at the end. *Fruitstalk* shorter than the *footstalk*, with a small three-leaved involucre about the middle, which is close to the fruit when very young. This is probably nearly related to the following, which we have not seen, but the descriptions of their leaves can scarcely be made to agree.

101. *F. canabina*. Lour. Cochinch. 668.—“Leaves of the stem hastate, cut; those of the branches ovato-lanceolate, slightly ferrated. Stem nearly erect.”—Native of the plains of Cochinchina. A *shrub* six feet high, branched, with a smooth tough and fibrous bark. *Leaves* stalked, scattered, very rough. *Fruit* oval-top-shaped, on long, simple, solitary, lateral stalks, with a three-cleft rounded involucre.

102. *F. rufescens*. Vahl. En. n. 89. (*F. heterophylla*; Lamarck. Dict. v. 2. 499. Valli-teregam; Rheede H. Mal. v. 3. 83. t. 62.)—“Leaves ovate-oblong, somewhat toothed, undivided or lobed, rough. Fruit slightly stalked, hairy like the stalks and branches.”—Native of China, and the East Indies. *Sonnerat*. *Leaves* green on both sides, about five inches long, and half as broad, on stalks not an inch in length; some of them undivided, others with three or four deep lobes, almost as in the common fig-tree. *Fruit* clothed with reddish hairs or bristles. *Lamarck*. Rheede says his plant is a climbing shrub six or seven feet high, throwing out long trailing branches in every direction.

103. *F. morifolia*. Ibid. n. 90.—“Leaves in three deep divisions, very rough; their segments lanceolate, angular, and somewhat pinnatifid.”—Native of the East Indies. *Branches* slender, scarcely rough, a little downy in the upper

upper part. *Leaves* stalked, alternate, obtuse at the base, three-ribbed; veinless above; slightly veiny beneath; destitute of pubescence, but very rough on both sides with minute points, the upper side appearing under a magnifier as if covered with small white, membranous scales. The segments are narrow and tapering. *Vahl*.

104. *F. simplicissima*. Lour. Cochin. 667—"Leaves palmate. Stem perfectly simple. Fruit compressed."—Native of the woods of Cochinchina. A *shrub* five feet high, with a straight upright stem, destitute of branches. *Leaves* large, stalked, scattered, rough. *Fruit* small, axillary, sessile, solitary, roundish, saffron-coloured. *Lourciero*.

105. *F. Carica*. Common Fig. Linn. Sp. Pl. 1513. Miller Illustr. t. 100. Trew Ehrh. t. 73, 74, excellent. (*Ficus* and *Chamæficus*; Ger. em. 1510.)—*Leaves* palmate, bluntish, wavy, or somewhat toothed, rough. *Fruit* top-shaped, umbilicated, smooth.—Native of the south of Europe and some parts of Asia, where it is also generally cultivated, but will not bear the severe winters of the north of Europe, nor even our own, without protection. *Stem* branched from the bottom, from six to twenty feet high, with long, twisted, pliant, round, greyish branches, rough when young. *Leaves* deciduous, a span long, in three or five deep rounded lobes, of which the central one is the largest, the outermost much the smallest; they are of a deep green, scarcely paler, but rather more hairy; beneath, furnished with radiating ribs, one to each lobe, and many transverse veins. *Fruit* solitary, on a short thick stalk, tapering at the base, and furnished with a three-leaved involucre. Its colour is generally purplish, its pulp soft, sweet and fragrant. There are numerous varieties of cultivated figs, of which the most hardy is the Common Purple. Others are either more tender, worse bearers, or less desirable in flavour. Several excellent kinds however are found in the southern parts of France, Italy, Spain and the Levant. In those countries figs are usually brought to table, with melons and mulberries, in the beginning of the dinner, as well as at breakfast, and do not in general make a part of the desert.

The *F. Carica* in its wild state is a more humble and distorted shrub, bearing fruit which comes to no perfection as to flavour, but the parts of fructification are very perfect, and the seeds are duly ripened, even in France. Such figs as seem to fall off before they arrive at maturity, are commonly those in which the stamens are most numerous or effective, and which have therefore attained their final perfection. These are carefully collected in the Levant to impregnate the female blossoms of the cultivated fig, their pollen being probably more perfect than what is produced by the stamens of such individuals as have, on the other hand, more perfect pistils. In other words, the plants are incompletely dioecious, like the mulberry and many others. This will explain the mystery of *Caprifigation*, whether wounding the fruit be useful to promote its ripening, or whether the perfection of the pulpy receptacle be owing chiefly to the vigorous growth of the female flowers consequent to their impregnation. Though both causes seem to co-operate, we should lay most stress on the latter, which the analogy of other fruits confirms. See **CAPRIFIGATION**.

All the species of *Ficus* are either trees or shrubs, whose secreted fluids are milky, more or less acrid or fetid, however sweet and wholesome the fruit of several, though not of all, may be. The leaves are simple, stalked. Stipules lateral, not intrafoliaceous, in pairs, membranous, decidu-

ous, generally taper-pointed. Flowers more or less polygamous.

We have in the above synopsis of the species added fourteen to those of Vahl, though we have presumed to reduce two of his to one; see n. 99. Possibly some of the rest, which he, as well as ourselves, have been obliged to adopt upon trust, may, on a future examination, prove not distinct from each other, while it is probable that numerous undescribed species may still be latent in the wilds of Asia and America. S.

Ficus, in *Gardening*, a tree of the deciduous fruit kind, of which the species cultivated are, the common fig-tree (*F. carica*); the Egyptian fig tree, or sycamore (*F. sycomorus*); the poplar leaved fig-tree (*F. religiosa*); the Bengal fig-tree (*F. Bengalensis*); and the Indian fig-tree (*F. Indica*).

Of the first species there are several varieties, the chief of which are the following:

Brown Ischia fig.—This is a sort which has a large fruit, short, globular, with a pretty large eye, pinched in near the footstalk, of a brown or chestnut colour on the outside, and purple within; the grains large, and the pulp sweet and high-flavoured; it often bursts open as it ripens, in the end of July, or the beginning of the following month. This has its fruit ripening well on standards in warm soils and situations.

Black Genoa fig.—This is a kind which has a long fruit, that swells pretty large at the top, where it is obtuse; the lower part is very slender towards the stalk; the skin of a dark purple colour, almost black, and has a purple farina over it, like that on some plums; the inside is of a bright red, and the flesh very high-flavoured. It ripens early in August.

Small white early fig.—This is a sort which has a roundish fruit, a little flattened at the crown, with a very short foot-stalk; the skin thin, and, when fully ripe, of a pale yellowish white colour; the inside white, and the flesh sweet, but not high-flavoured. It ripens in August, as in the preceding kind.

Large white Genoa fig.—This is a kind which has a large globular fruit, a little lengthened towards the stalk; the skin thin, of a yellowish colour when fully ripe, and red within. It is a good fruit, but the trees are not good bearers in general.

Black Ischia fig.—This, which is a short fruit, of a middling size, a little flattened at the crown, has the skin almost black when ripe, and the inside of a deep red; the flesh very high-flavoured. It bears well, and ripens in August in this climate.

Malta fig.—This, which has a small brown fruit, much compressed at the top, and greatly pinched towards the foot-stalk, has the skin and inside of a pale brown colour; the flesh very sweet, and well flavoured. When the fruit is permitted to hang upon the trees till shrivelled, it becomes a fine sweetmeat.

Murray, or brown Naples fig.—This is a kind which has a pretty large globular fruit, of a light brown colour on the outside, with faint marks of a dirty white, the inside nearly of the same colour; the grains are pretty large, and the flesh well-flavoured. It ripens the latter end of August in general.

Green Ischia fig.—This is a sort which has an oblong fruit, almost globular at the crown; the skin is thin, of a green colour; but, when fully ripe, stained through by the pulp to a brownish cast; the inside purple, the flesh high-flavoured. It ripens about the end of August.

Madonna, Brunswick, or Hanover fig.—It is a kind which

which has a long pyramidal fruit of a large size; the skin brown; the flesh of a light brown colour, coarse, with little flavour. It ripens the end of August, and the beginning of September.

Common blue, or purple fig.—This is a sort which is oblong, it is a great bearer. The fruit ripens in August in general.

Long brown Naples fig.—This is a kind which has the leaves deeply divided; the fruit long, somewhat compressed at the crown; the foot-stalks pretty long; the skin of a dark brown when fully ripe; the flesh inclining to red; the grains large, and the flesh well-flavoured. It ripens in September.

Yellow Ischia fig.—This is a sort which has a large fruit of a pyramidal form; the skin is yellow when ripe, and the flesh purple and well flavoured. It is not a good bearer, but ripens in September in moist cases.

Small brown Ischia fig.—This is a sort which has a small pyramidal fruit, with a very short foot-stalk; the skin of a light brown, the flesh inclining to purple, of a very high flavour. It ripens late in September. It is not a good bearer.

Gentle fig.—This sort has a middle-sized globular fruit; the skin, when ripe, yellow; the flesh also inclines to the same colour; the grains large, and the flesh well-flavoured, but it ripens very late, and is a bad bearer.

There are also other sorts, as the best early white, black Provence, Cyprian, Ford's seedling, green Naples, large black, large blue Marquises, Milward, small black Ischia, white Ischia, yellow Cæsar.

Those which are most proper for a small garden, according to Mr. Forsyth, are; the large white Genua, early white Murray, small brown Ischia, and the black Ischia.

It is asserted by the same writer, that in a good season the brown, or chestnut coloured Ischia, the black Genua, the small white early, the Murray, or brown Naples, and the common blue, or purple fig, will ripen on standards.

The second sort is often here called the lycamore-tree, and mulberry fig-tree. This, and not the great maple, is the right lycamore.

The fifth sort is often known by the name of banyan-tree, and is a native of the East Indies.

Method of Culture.—The first sort and varieties may be readily increased, either by suckers, layers, or cuttings, but the two last are the best methods, according to Mr. Forsyth, who has had great experience in raising fruit-trees of this kind.

The suckers should be taken off from the roots as low down as possible, and, after being trimmed, planted out in nursery-rows, at the distance of two or three feet from each other, with the tops entire, to take their natural growth, when intended for standards; but when for walls, espaliers, or dwarfs, in the situations where they are to remain. In the latter case, they should be cut or headed down to six or eight inches in the early spring, to induce lateral shoots to be thrown out near the ground.

The layers should be made from the well-ripened woody shoots of the bearing trees, and be laid down in the autumn, or early in the spring, being protected from frost during the winter by tan or some sort of strawy material. When the plants are sufficiently rooted, as in the following autumn, they should be taken off and planted out in the places where they are to remain, as they do not bear transplanting well, being covered at the roots with dung, tan, or litter during the winter. The cuttings should be taken from the well-ripened, woody shoots of the former year, which, without being shortened, may be planted out in the

beginning of the autumn, on beds of loamy earth, in a warm, sheltered situation, to the depth of eight or ten inches, protecting them with tanners' bark and litter during the winter; the litter being removed as the spring advances. When they have stricken good root in the following autumn; they should be taken up and planted where they are to grow and remain.

These sorts of trees are mostly cultivated as standards in warm climates, but in this in general against walls or as espaliers; and only sometimes as standard.

The sorts usually cultivated against walls are those of the *blue* and *purple* kinds, but several of the others succeed well in this management, where they are duly attended to.

But for espaliers, and as standards, the first, second, third, ninth, and tenth varieties are probably the most proper.

In their culture as wall-trees, they should always be placed in sunny situations, for the purpose of the fruit being the most effectually ripened, as in that of a full southern exposure, but an east or west aspect will answer very well when that cannot be had with convenience.

In the planting them out, where the walls are of considerable height, fifteen or eighteen feet distance may be sufficient; but in low walls, twenty or more are not too much space. Mr. Forsyth advises from twenty to twenty-four feet, as the most suitable distance for planting these trees at, in general.

Where the trees are planted against fire-walls, they should not be kept too close, be drawn by glasses, or have the heat too great, but have at all times, when the weather is favourable, a good share of free air admitted, and if the trees are young, care should be taken that their roots are not extended beyond the reach of the covering; they must be frequently watered when they begin to shew fruit, otherwise it will drop off; but old trees, whose roots are extended to a great distance, only require to have their branches now and then sprinkled over with water. Where these trees are properly managed, the first crop of fruit is greater than upon those which are exposed to the open air, and ripens six weeks or two months earlier, and a plentiful second crop may also be obtained, which ripens early in September, and sometimes in August; but the fires should not be added to these trees till the beginning of February; as when they are forced too early, the weather is frequently too cold to admit a sufficient quantity of fresh air to set the fruit; but the covers should be put over the trees a month before, to prevent the shoots from being injured by the frosty state of the weather.

The management of the trees in the common method after they have been headed down or shortened in the manner mentioned above, whether they be on walls or espaliers, is that of training them horizontally, so as to preserve the branches in an equal and regular manner on each side, at the distance of from six to eight inches from each other, and, for the most part, keeping their full length without any shortening, that as large a proportion of young or bearing wood as possible may be preserved. Some, however, advise their not being laid in so close, considering a feet or eighteen inches as little enough room for them.

And in the pruning of these trees, Mr. Forsyth advises that it should never be done in the autumn or winter, but in the early spring months. The best time he conceives to be about the latter end of April or beginning of the following month, as by this period it may be ascertained what branches have been destroyed by the severity of the winter. And as the ends of these branches, the wood of which has not ripened well in the autumn, will be most injured, they should

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be cut into the sound wood as near to an eye or bud as possible.

In cases where the branches have been permitted to run up, so as to leave the bottom in a naked state, every other branch is advised to be cut out as near to the ground as it can be done, by which the walls or espaliers will be provided with good young wood, care being taken to stop the ends of the shoots in summer, as about the beginning of June, in order to induce side-shoots to be thrown out for fruiting the following summer; by which time plenty of fine wood will be provided, and then the remainder of the old branches may be cut out as before, pruning their young shoots as in the preceding case, constantly pinching off the ends of all the strongest shoots at the top bud, except such as are leading ones.

But in the spring prunings, as the fruit is produced near the tops, the bearing shoots should never be shortened, nor should the fine short side and fore right shoots be cut off, except when decayed; as they ripen better than the long strong ones, and are not so apt to be destroyed by frosts in the winter season. By this practice, it is contended that the trees will be covered with fruit from the tops to the bottoms of the wall, &c., instead of having a few only at the top, as is the case in the common method of management with these trees.

In summer, as many shoots are sent off, some of those that are irregular and useless may be rubbed off, and the others trained in for the forming of future bearing wood. The proper period for this is about the beginning of June, and in the two following months.

After the fruit has attained the size of small nutmegs, the points of the top buds are recommended by Mr. Forbyth to be pinched or cut off with a sharp knife, some of his powdery material being immediately applied, to prevent the oozing out of the milky juice, and the consequent exhaustion and injury of the trees.

In order to prevent the necessity of cutting the trees down in the above manner, they should be covered in winter before the approach of frost, which would destroy the ends of the shoots before the wood was ripened and rendered hard.

Where fig-trees are greatly injured in the winter, the best practice is to cut them down as near the ground as possible, as in the following year, by the above management, they may be got into a good bearing state.

The best mode of protecting these trees is, according to Mr. Forbyth, to "cover them with bentings, or short grafs, from the pleasure-ground, which he finds answers the purpose very well; after it is thoroughly dry, it may be put in a cock, covering it with straw, to prevent the rain from penetrating into it, which would cause it to heat and rot;" or it may be put into a shed. If grafs cannot be procured, some dry moss may be employed. In performing the work, "first cover the trees with laurel, yew, fir, or spruce boughs, and then tuck in the short grafs or moss among the branches, beginning at the top of the tree, tucking in the grafs, &c. as you descend, till you come to the bottom." Fern, when well dried, he says, makes an excellent covering. The trees may be thatched on the outside with the long leaves of the common fern; and where these can be got, there will be no occasion for short grafs. When it can be procured, which it may in most country places, it will, he says, be found preferable to laurel.

They may also be sheltered in winter by wrapping hay or straw bands round the branches of the trees; and then opening the ground, laying in the branches, and covering them over with mould about nine inches deep, leaving the ends of

the shoots about three inches out of the ground, and covering the ground over with some rotten leaves, or old tan, &c. to keep out the frost. The roots of the trees may likewise be covered in the same manner. Where the walls are low, and the borders broad all the branches may be brought front ways; but when they are high, only the side branches can be brought forward in the above manner. It is the practice of some to cover with reeds and straw; the latter he does not by any means approve of, as it is very apt to harbour rats and mice, on account of some of the grain being left in it at the time of threshing.

In putting in the grafs, care should be taken that no mice, &c. have got amongst it; and during the winter, it should be seen that no rats or mice get among the branches of the trees that are covered against the walls; as if they do they will infallibly bark the branches, and in that case there will be a necessity of heading the trees down in a complete manner.

These animals may be destroyed by setting traps near the roots of the trees, as soon as they are covered. See *GARDEN TRAPS*.

Great care, he says, should be taken not to uncover the fig trees too soon in the spring; and it should be done partially, as there are frequently frosts and cutting winds in the months of April and May, which will infallibly kill the young fruit as they make their appearance in the spring.

Those branches which have been laid into the ground should be taken up in the month of April, having the hay or straw-bands taken off, and then nailed to the wall. Some fern leaves, or any other light covering, may be fluck in among the branches, to protect them from the drying winds and frosts till the fruit comes to the size of a large walnut, or rather till the leaves are sufficiently large to protect the fruit.

It is observed, that the Italians, when they wish to forward the ripening of figs, drop in a little sweet oil, from a quill, into the eye of the fruit; but care must be taken not to hurt the skin, which will make the fig burst. This will make a difference at least of a fortnight in the ripening of the fruit.

It is also recommended, as soon as the leaves begin to fall, to brush them off with a broom, but by no means till they will come off easily. If they are forced off before they begin to wither and decay, the trees will bleed at the foot-stalks. At the same time the stalks should be cleared of all the small late fruit, which, if suffered to remain during the winter, will rot, and injure the tree, so as to prevent it from bearing the ensuing summer. If any milk be observed oozing from the foot-stalks, a little of the composition should be used, which will stop it, and heal the injured part. See *COMPOSITION*.

By doing this, the ripening and hardening of the wood will be assisted before the winter frosts set in.

In standard-trees of all sorts little pruning is necessary, only just to take out the very irregular branches and the young shoots, when too much crowded, and the dead ends of the shoots, as well as any dead wood that there may be in them.

Mr. Forbyth, however, observes, that as the branches of standard fig-trees are very liable to be killed in severe winters, it will be necessary to lay them also in the ground, wrapping them up in hay or straw-bands, as directed for wall-trees. It will be sometimes impracticable to lay down the middle branches; they must, therefore, be well covered with hay or straw-bands, and the outside ones laid down, going regularly round the tree, and taking particular care

not

not to hurt them with the spade, then to mulch them with rotten leaves, &c.

Where Mr. Forsyth has been under the necessity of cutting fig-trees down near to the ground, after hard winters, he has found, by the use of his composition, that "in the course of two years, the new wood has covered over the old stump, and the branches filled up the former space, bearing also plenty of fine fruit."

The other species are easily propagated by cuttings during the summer season. When the cuttings are taken from the plants, they should be laid in a dry shady place for two or three days, that the wounds may be healed over, otherwise they are apt to rot; after which, they should be planted in pots filled with sandy light earth, and plunged into a moderate hot-bed, where they should be shaded from the sun, and two or three times a week gently refreshed with water, if the season is warm; but they must not have too much moisture, as it would infallibly destroy them. When the cuttings have taken root sufficiently, they should be each planted into a separate small pot filled with undunged earth, and replunged into the hot-bed, shading them until they have taken fresh root; then they should have a large share of free air admitted to them at all times when the weather is favourable, to prevent their drawing up weak, and to give them strength before the cold comes on. In autumn the pots should be removed into the stove, and be plunged into the tan-bed, where they should constantly remain, and be treated in the same manner as other tender plants from the same countries; for although two or three of the sorts may be treated in a hardier manner, yet they will not make much progress. They may likewise be increased by layers when necessary.

These are shrubs in this climate which afford variety in stove collections.

FICUS, in *Conchyliology*, a name given by authors to a peculiar species of sea-shell. It is of the genus of the *dolium*, and has a remarkably depressed clavicle. See **CONCHOLOGY**.

FICUS, or *Ficatio*, in *Surgery*, signifies a tubercle, or excrescence, about the anus, or pudenda. The term is said to be derived from *fero*, to produce, or else from the Hebrew *phig*.

FIDARI, in *Geography*, a river of European Turkey, in Livadia, which runs into the sea, eight miles N. of Patras.

FIDD, an iron pin used at sea to splice or fasten ropes together; it is made tapering and sharp at one end.

There are also fidds of wood, which are much larger than the iron ones.

The pin also in the heel of the topmast, which bears it upon the chefs-tree, is called a fidd.

FIDD-hammer, is used for a hammer, the handle of which is a fidd, or tapering into that form.

FIDDES, **RICHARD**, in *Biography*, a learned divine, and polemical writer, was born at Hunmanby, in the county of York, in the year 1671, and went first to study at Cambridge, but afterwards was admitted of University College, in Oxford. Entering into holy orders, he obtained the living of Hullham, in his native county, but the air of the place not agreeing with his health, he was forced to forego all thoughts of residing on his living; having while there lost the use of his speech, which he never after perfectly recovered. He was appointed chaplain at Hull, but he spent the latter part of his life at Putney, where he died in 1735. In 1718 and 1720, he published a *Body of Divinity*, in two volumes, folio; in consequence of which, the university of Oxford conferred upon him the degree of doctor in

divinity. In 1721, he published two letters on the soul's immortality, occasioned by the epitaph on the duke of Buckinghamshire. In 1724, appeared a *Life of Cardinal Wolsey*, in which the free manner he had treated some opinions induced a belief, that he was favourably inclined to the Catholic tenets. The same year he published a treatise on morality, and he also wrote fifty two practical discourses. His first publication was a prefatory epistle concerning some remarks to be made on Homer's *Iliad*, addressed to Dean Swift, &c. *Gen. Biog. Dict.*

FIDDICHOW, or **VIDUCHOVA**, in *Geography*, a town of Hinder Pomerania, on the Oder, 22 miles S.W. of Star-gard. N. lat. 53° 13'. E. long. 14 33'.

FIDDLE, probably from *Fides*, Latin. This is the vulgar name for the violin, which is a modern instrument, as the use of the bow cannot be traced in antiquity. The earliest mention which we have found of the fiddle in England, is in the legendary life of St. Christopher, MS. Vernon. Bodl. Lib. (119) written about the year 1200.

"Christofre him served longe.

The king loved the melody of fithel and of songe."

The fiddle, however, did not seem in common use in feasts, mummeries, and processions, for some hundred years after this period. It is mentioned by Chaucer, but was not allowed to be a concert instrument, till the reign of Charles II. who, in imitation of Louis XIV., established a band of twenty-four violins, alias fiddles, which gave birth to Tom Durfey's song of "Four and Twenty Fiddlers all on a Row," &c., a humorous production in which there is a mockery of every instrument, and almost every trade; and which, in our own memory, used to be performed between the acts, or between the play and farce, by some man of humour at benefits. See **VIOLIN**, **REBEC**, and **BOW**.

FIDDLE-shaped leaf, in *Botany*, *folium panduriforme*, is oblong, broad at the two extremities and contracted in the middle, like a fiddle or some sort of guttar, and not like the ancient *pandura* or reed-pipe, as the Latin name implies. See **LEAF**.

FIDDLE Word. See **CITHAREXYLON**.

FIDDLER'S ELBOW, in *Geography*, a bend of Wood creek, between the outlet of South bay, and the mouth of the creek at the northern end of lake Champlain, opposite to the mouth of East bay. The mouth of Wood creek lies in N. lat. 43 32'. W. long. 73 15 12".

FIDE-JUSSORES Affidui. See **ASSIDUUS**.

FIDE-jussor, in the *Civil Law*, is a surety, or one that obliges himself in the same contract with a principal, for the greater security of the creditor or stipulator. See **BAIL** and **CAUTIONRY**.

FIDEI-COMMISSUM, in the *Roman Law*, the appointing of an heir, or bequeathing a legacy to a person on this condition, that he surrender the inheritance or legacy to another person, for whom the same is originally meant; or it is an inheritance left in trust with any one, for the use of another.

Fidei-commissa were much used among the Romans. In the French law the thing is become odious; as being, ordinarily, no other than an expedient in favour of persons to whom the laws forbid any thing to be given. In order to this, some trusty friend is chosen to be made legal heir, under a tacit agreement to deliver the inheritance to the person incapacitated by law. But of later times the same expedient has come in use with regard to persons capable of inheriting, to whom the testator, for particular reasons, does not care to leave the inheritance directly.

As it happened that the fidei-commissioners did not always faithfully restore what was trusted to them, Augustus

took proper measures to oblige them thereto; to this end a prætor was erected, whose business was restrained to the single matter of fidei-commissions.

As a testament was null without the institution of an heir, and it frequently happening that the fidei-commissioner refused to accept the trust, upon which the testament fell to the ground; to engage somebody to accept it from a consideration of advantage, the Paganian senatus consultum decreed, that the fidei-commissioner should be at liberty to retain a fourth of the fidei-commission.

FIDELES, in *Church History*. See BELIEVERS.

FIDENÆ, or FIDENA, in *Ancient Geography*, a town of Italy, upon the Tiber, N. of Rome and S. of Veii. It was founded on the territory of the Sabins, by a colony of All a, and seems to have been very powerful before the foundation of Rome, as it sustained a war against it, which lasted from the year of Rome 17 to the year 327, when the Fidenates were subdued by the dictator Emilius Mamercus.

FIDENTIA, a town of Gallia Cispadana, situated towards the S.E.; near which the troops of Carbon were cut to pieces by those of Sylla.

FIDICULÆ, in *Antiquity*, is often used to signify the same with *equuleus*, a kind of punishment used among the ancients.

FIDICULÆ, in a more proper sense, denotes the cords wherewith the criminals' limbs were distended on the equuleus.

FIDMIN, in *Geography*, a town of Egypt; five miles W. of Fayoum.

FIDRA, a small island near the east coast of Scotland, at the entrance of the Forth; three miles N.W. of North Berwick. N. lat. 56° 5'. W. long. 2° 49'.

FIDULEA, a small island in the Grecian Archipelago; four miles S.W. of Staphelia.

FIEF, the same with *feud* or *fee*; which see.

FIEF D'HAUBERT, a name given by the Normans, and adopted by the Mirour, to that species of tenure denominated *knights-service*, which see.

FIEGO, or FIJOOGO, in *Geography*, a sea-port town of Japan, on the S. coast of the island of Nippon, with a large harbour in the bay of Ofaca; 24 miles S.S.W. of Ofaca, and 4° S.W. of Meaco.

FIELD, in *Agriculture*, is a portion of land mostly inclosed by some sort of fence, and employed either in tillage or as pasture. Fields should be proportioned in size to the nature of the husbandry under which they are chiefly managed; where they are of the arable kind, they may be much larger than where they are of the grass or grazing description. (See *INCLOSING of Land*.) For the method of finding the contents of a field, see *AREA*, *CHAIN*, and *SURVEYING*.

FIELD-Fallow, a term frequently made use of to signify a common field, which is occasionally cultivated under the fallow system. See *FALLOW*.

FIELD-Grass, any sort of grass cultivated or grown in the field. See *GRASS*.

FIELD-Husbandry, those sorts of husbandry or cultivation which are practised in the field, whether they relate to tillage or grass. See *HUSBANDRY*.

FIELD-Well, the name of a pit or small sort of artificial watering-place for cattle in a field. See *DRINKING POND*.

FIELD-Work, that sort of work which relates to the field, and which is of very different kinds.

FIELD-Scabius, the common name of a perennial weed often met with in tillage lands. The stem is upright and branching, rising to the height of a foot or a foot and a half. It is spotted, rough, and hairy. The lower leaves

are oval, and indented about the edges; but those on the stalk are divided and pinnated. The flowers are blue, and of the compound kind, consisting of a great number of small ones, each divided into four parts, and having one seed under them. The plant has a bitter disagreeable taste.

FIELD-Ale, or *Fildale*, in our *Ancient Customs*, a kind of drinking in the field, by bailiffs of hundreds; for which they gathered money of the inhabitants of the hundred to which they belonged. But this custom has been long since prohibited.

FIELD, *Campus*, in *Antiquity*, is frequently used for a public place, or square in a city, &c.

Such were the Field of Mars, *Campus Martius*; and Field of Flora, *Campus Flora*, in Rome; and the Field of May, *Campus Maii*, among our ancestors, &c.

FIELD of Mars was denominated from a temple of that deity, built therein; it was the scene or place of the assemblies called *comitia*. Tarquin the Proud at length appropriated it to his own use; but after the expulsion of the kings, the consuls Brutus and Collatinus restored it to the public use again, for assemblies and elections.

Originally it was no more than a meadow on the banks of the Tiber, where horses grazed, and the Roman youth were exercised to war. But it was afterwards erected into a magnificent square, adorned with statues, &c. See *CAMPUS Martius*.

FIELD of Flora, was the place where the laws, edicts, and constitutions, were published.

FIELD of May. See *CAMPUS Maii*.

FIELD Basil, in *Botany*. See *CLINOPodium*.

FIELD Basil, *American*. See *MONARDA*.

FIELD Basil, *Syrian*. See *LIZIPHORA*.

FIELD, *Close*, was anciently a place enclosed, or railed in with a barrier, for jousts and tournaments to be performed in.

FIELD, *Elystan*. See *ELYSIUM*.

FIELD, RICHARD, in *Biography*, an able champion of the doctrines and discipline of the church of England, was born at Hempstead in Hertfordshire, in the year 1561. In 1577 he was admitted a member of Magdalen college, Oxford, where he took his degrees with high reputation. His great learning and talents pointed him out as adapted to fill certain useful and important places in the church, till at length he was chosen divinity reader to the society of Lincoln's Inn. In this situation his services gained him many friends among the learned members, one of whom presented him to the valuable living of Burrowclere in Hampshire, and in a short time after he was offered the still more valuable rectory of St. Andrews, Holborn, but he chose to adhere to that in the country, as affording him more ample opportunities for study, on which his mind was very intent. In 1598 he took his degree of doctor of divinity, and became chaplain in ordinary to queen Elizabeth, and was soon after made prebendary of Windsor. On the death of the queen he succeeded to the same office of chaplain with her successor James; and was entrusted with the management of some special commissions issued for ecclesiastical causes, and the exercise of spiritual jurisdiction within the diocese of Winchester. In 1604 he obtained a prebendary of Windsor, and when the king went to Oxford to witness the scholastic exercises at that university, Dr. Field was sent for to take a part in the divinity act; and the manner in which he performed his part reflected the highest degree of credit on his learning, and afforded uncommon satisfaction to the splendid audience.

In 1610 the king bestowed upon him the deanery of Gloucester, but he continued to reside and labour at Burrow-

clere, only going to Gloucester occasionally to preach when his particular duty required him. Some time, in the winter months, he usually spent at Windsor, and was often selected to preach before the king, who exclaimed on first hearing him, "This is indeed a *Field* for God to dwell in." The monarch held Dr. Field in so high esteem that he was anxious to promote him to the bishopric of Salisbury, but his courtiers prevailed upon him to give it to another. The king, however, determined to raise him to the see of Oxford, which was expected to become vacant in a short time, but before the vacancy occurred, Dr. Field died of an apoplexy, in the year 1616, in the fifty-fifth year of his age. His principal work, as a literary man, was entitled "Of the Church," four books, folio. This was published in the year 1606, and in 1610 the author added a fifth book, with an appendix, containing a "Defence of such Passages of the former Books that have been excepted against, or wrested to the maintenance of Romish Errors." Dr. Field was universally respected, and at his death generally lamented. "He was," says Wood, "much against disputing about the high points of predestination and reprobation, nor did he like that men should be busy in determining what God's decrees in heaven are. He was one that laboured much to heal the breaches of Christendom, and was ready to embrace the truth wherefoever he found it. His desire, his prayers, his endeavours, were for peace, to make up the breaches of the church; not to widen differences, but to compose them." Gen. Biog.

FIELD, in *Heraldry*, is the surface or face of the shield, or escutcheon; thus called, as containing the achievements anciently acquired in the field of battle.

The field is the ground whereon the colours, bearings, metals, furs, charge, &c. are represented. In blazoning a coat, we always begin with the field: he bears sable, &c.

Among the more modern heralds, field is less frequently used than shield or escutcheon.

FIELD of Battle, in the *Military Language*. The possession of this, after an engagement, is generally supposed to denote which party has obtained the victory; the worsted army, for the most part, retiring with the view to rally, and eventually to make a fresh stand at some advantageous position. But it does not always follow that possession of the field remains with those to whom the greatest merit attaches: we sometimes see an inferior force repel the attacks of pursuers, and following its route, leaving to the discomfited assailants that site on which a large portion of them may breathe their last, while the victorious band, though somewhat diminished in numbers, effect a safe retreat. Retention of the field under such circumstances denotes the want of power to follow, and, according to the military phrase, is "a ruinous victory;" usually to be classed with those sad effects produced by severe contests in an enemy's country, where the latter are constantly obtaining both supplies and reinforcements, from which the invaders are, or should be, completely cut off. We cannot give a stronger representation of this position than is afforded by the glorious struggle maintained by our Spanish allies, who, though certainly in the first instance by no means competent to repel their invaders, at length were roused to a due sense of their situation, and displayed their national character for loyalty, piety, and bravery, in the most glowing colours.

A previous knowledge of the field on which an army is about to engage, cannot but become an object of great importance, not only to the commander-in-chief, but to all those in charge of divisions of the troops under his authority. An intimate acquaintance with various minutie,

such as broken ground in which cavalry cannot act; swamps in which they as well as artillery would be fixed, or at least be unable to fulfil their intention; strong situations, such as natural lines made by precipices bordered by banks, or fringed with underwood; elevated spots, on which batteries could be placed to advantage, and behind which large bodies of cavalry might be concealed; bridges within command, by means of which a safe retreat might be made; and all such points, are indispensable towards the successful issue of the day.

We do not mean to assert that every commander has it in his power either to choose the field on which he will make a stand, or that, when he has chosen it, he must be thoroughly acquainted with all localities; but it may be permitted us to observe, that no man, whatever rank he may have attained, or whatever service he may have seen, is competent to be placed at the head of an army, but more especially one acting upon the defensive, whose eye does not most keenly search for natural advantages, or who does not, when those advantages are apparent, profit by them in a suitable manner. We particularize the defensive, because that system rarely fails to afford those highly valuable acquirements in regard to the several strong positions every country affords, more or less; but which may not always be sufficiently ascertained by an invading army. Thus, it must be evident, that during the apprehension of invasion, our generals, throughout the country, had the fairest opportunities for most accurately reconnoitring every defensible point, whereby they would have been enabled to act with the greatest effect, and to choose their field on almost every occasion, which could not have fallen to the lot of hostile troops, whose advance must invariably have been attended with some uncertainty, and all its train of mischiefs.

In reviewing the great number of plans that have at times been published, wherein the positions of the contending parties and their several movements have been laid down, one obvious feature appears common to a very great majority; namely, that the party which awaited the attack of its adversary, had its flanks, or at least one of them, covered by woods, rivers, villages, morasses, or broken ground. The great object appears to have been there, to throw impediments in the way of the enemy's horse. Hence we see, that so soon as any part of the centre gave way, the whole were thrown into confusion, bearing down the several lines in succession, and offering opportunities for a dreadful display of the powers of cavalry. It appears rather doubtful how far an equal force should so place itself, and is to defend some valley, &c. through which alone the enemy could penetrate into a country.

FIELD-FORTIFICATION, relates to the formation of such temporary lines of defence, redoubts, &c. as well as of such batteries, of various descriptions, as may be deemed necessary either for the maintenance of a position, or for driving an enemy from that he may occupy. It would be utterly impracticable to afford instructions suited to every case; there being such varieties of locality, as well as of circumstance, which can only be provided for on the spot, and never could come under any general description. Although we are apt to consider the science of fortification, in all its branches, to appertain, rather exclusively, to the corps of engineers, yet no general should be entrusted with the command of an army, unless possessing either an intimate acquaintance with that science, or such a ready conception of the advantages and disadvantages of every position he may assume, as should enable him, as it were by inspiration, to adopt or reject it without hesitation. We fear that this excellent quality rarely comes, as Dogberry says, "by nature,"

ture," and that few nations can boast any great list of such "heaven-born generals." Not but that many individuals possess this admirable talent: the misfortune is that its possessors too often are placed in situations totally unsuited to their genius; or, if they do enter within the pale of military orders, either linger in subaltern capacities, or eventually fall among the too many victims immolated at the shrine of what we call glory, long before their abilities could be duly appreciated!

Field-fortification is generally divided under two heads: the offensive, and the defensive: the former of course relates to attacks, principally sieges, and the latter to the covering of armies, or posts, so as to render them stronger, and to throw every obstacle in the way of assailants. The offensive branch affords the greatest latitude for deliberation, but requires no less judgment than the defensive; it is usually confided entirely to the management of the engineer department, by whom the distances, bearings, and extent of the several batteries are determined. Thus, when an army invests a fortress, the engineers, especially if not previously furnished with a correct plan of its defences, proceed to reconnoitre, in the most exact manner, the several lines of fire to which certain spots would be exposed, and the effects likely to be produced by batteries, both of cannon and of mortars, erected thereon. Two great objects must always be held in view; namely, to obtain a *direct* fire, as near as may be practicable to the work to be battered, and the placing the necessary batteries in such manner, that, while the best effects may be produced, the cannon and their portion of artillery-men, together with every necessary apparatus, may not be subjected to enfilade. (See ENFILADE.)

Field-works are rarely constructed in a durable manner; they are for the most part formed by the excavation of the soil, correspond in figure with the parapet to be formed, and, from the resemblance of the ditch, are called *trenches*. The soil thrown up being arranged in a proper manner, and secured by means of *fascines* (which see), from falling back into the excavation, occasions the shelter to become duplicate in its ratio to the actual depth excavated. Thus, in digging a trench of four feet in depth, there will be formed a covert-way of eight feet in depth, in consequence of the height to which the soil is thrown. The lower four feet, that is, so far as the trench reaches, will be solid; the rest, being loose soil, just thrown up, will for a while be less competent to resist heavy shot. Those parts intended for cannon will demand an ample stock of fascines, for the purpose of keeping the merlons in proper form and duly compacted. The places of arms, &c. which are generally made at the extremities of parallels, in order that the besiegers may take advantage of any forties, as well as to guard the flanks of the trenches, will usually require ample equipments for the insuring of safety to those on duty. Where mortar batteries are made, they will not require any obvious embrasures, though the interior slope of the parapet may be made with a much smaller angle from the horizon opposite each piece, provided the works be sufficiently thick to allow such a diminution; otherwise the mortars must be brought back until they may bear depression to a proper angle for throwing grape, say about 12° or 15° , without endangering the crest of the parapet.

In this species of fortification little or no attention is paid to any arrangement of the batteries for the purpose of causing them mutually to become flanks, as must be done on defensive principles. The besiegers being generally far more numerous than the besieged, and the greatest attention to the prevention of enfilade being imperiously requisite, induce to paying attention chiefly to one object; namely, the ob-

taining a *direct* fire. However, as enfilading batteries are generally necessary, and as it is always expedient to silence those which flank the battered angle, it very generally occurs that such a cross-fire can be obtained as serves to give every necessary support to contiguous lines of approach. The batteries raised for the purpose of breaching any part of the *principal*, cannot well be too close thereto; provided their elevation be such as not to be commanded from the principal. This approximation is, however, the work of time, and cannot be attempted until the fire of the tenailles, lunettes, ravelines, and generally the counter-guards be silenced; after which the approaches may be carried up to the very crest of the glacis, there to make a lodgment, as well as in the covert-way. This being effected, it is usual for the besiegers to storm, unless owing to weakness of the garrison, or the timidity of its commandant, the place should surrender.

In defensive field fortification a few general rules should be well understood. 1. Never to occupy a position, by choice, whereof any important part is commanded by places of which the adversary can take possession: this applies far more strictly to permanent defences; which, in such case, would be of little or no avail. 2. Always to make the weaker points the first objects of attention; afterwards strengthening the stronger parts, so as to secure the others, and forming such a general connection of the whole as may, so far as practicable, render the wholly equally formidable. 3. To avoid all positions which are deficient in supplies, especially of water; and never, on any account, to extend beyond the means of a firm defence; observing, that however much the reverse may have been practised, rather to leave one flank weak, than to hazard any thing in the centre; where, if the enemy should succeed in penetrating, ruin to both flanks must follow in detail.

The expert engineer never fails to render such mills, houses, churches, &c. as may be within his scope, subservient to the purposes of defence. Where small parties are to be covered, the interiors of such edifices should be fitted up in the best manner that may be practicable for enabling the occupants to do execution among the assailants. A trench may be dug within the whole circumference, and loop-holes be made for the purpose of allowing one row of the defenders to gall the enemy from nearly a level with the exterior; a position not easily to be overcome, while others fire standing: every angle in a building becomes more or less a flank, and enables the occupants to make a desperate struggle. When time admits, various flanking walls should be thrown up, either of masonry or of thick planks; the last are best. A good breast-work, made on a flanking principle around any church, or solitary house, and especially a brick-built wind-mill, having many floors or stories, in each of which loop-holes can be cut, or even cannon of small calibre be mounted, as in a block-house, will enable a handful of men to stand out against a great superiority of force.

The passage of a ford, a detroit, and a bridge, may all be covered, much in the same manner, by what is usually called a *tête de pont* (i. e. bridge-head), of which a sketch is given in fig. 6. *Plate I. Tactics*: this kind of defence is usually thrown up on that side of the river nearest to the enemy, beyond the bridge, and again covered by works on the hither side, to which the defenders can retire, and dispute the passage, when the *tête de pont* may not be tenable.

Lines of defence, drawn merely as a check to cavalry, or for the generally covering an inferior army from attacks at the pleasure of the enemy, may consist of various kinds of works, according to the nature of the ground, the time allowed for constructing them, and the number of men that

can be spared for their occupation. When only cavalry is to be opposed, nothing more is necessary than an abbatis, (*fig. 7*), formed by felling large trees, and after lopping off the more minute branches, placing them, side by side, in a compact manner, with their stems inwards; and either flaking the whole down, or securing them together with bines, or ropes, &c. so as to prevent them being easily drawn away by an enterprising enemy. It is, in general, found best to make even this kind of defence of such a form as may afford flanking fires; observing to place a few guns along the curtains, so as to fire, as it were, in barbet over the upper boughs that point towards the assailants.

Some situations are naturally so strong as to require nothing more than a breast-work; such, for instance, as the borders of a precipice which cannot be taken by assault, and from which a direct fire in every part affords the best means of defeating any party that should approach. In such very strong places a straight line may answer, but, in most cases, flanks should be thrown out, as in *fig. 8*, of which the general tendency must be governed by local circumstances. Whatever may be their direction or form, it is proper that no part of the lines intended to afford mutual defence should exceed what is termed the point-blank range of a musket ball; which is generally understood to be about 200 or 250 yards, according to the charge of powder. When within 150 yards, the advantages will be greatly augmented.

Fig. 9. represents a continued uniform line, composed of short curtains, *a, a, a, a*, with the redans, *b, b, b, b*; these latter must bear such an angle, or be placed at such a distance from each other, as may allow a perpendicular drawn from their faces, at the point of junction, as at *c*, to pass just clear of the salient angle, *d*; if this be not attended to, the defenders of one redan will pour their fire into that adjoining. And, if the angle be too great, that is to say, more than 100° or 105° , the defences will be weakened in every part, on account of the great obliquity necessary in directing the fire, both in the curtain and in the redan; which, in the firing of musketry, is always attended with bad consequences.

Fig. 10. shews a line of the same kind as that just described, with independent redans, *e, e, e, e*, thrown up before the curtains, by which they are commanded. These should be placed at sufficient distance in advance, to prevent the enemy, in case they should be able to carry them, from assaulting the curtain under cover of the flanks; which they might easily do but for that precaution. The angles of the independent redans should correspond with those of the intermediate ones, which may be about 60° , or 65° degrees, according to circumstances.

Fig. 11. shews a very good mode of making alternately short flanks in a regular order, so as to resemble the overlapping of tiles: the usual designation is "en cremaillaire," from the French word *cremaillon*, signifying that kind of pot-hook which can be lengthened at pleasure by means of ratchets. The termination of this sort of indented line ought to be strong; otherwise it would be subject to assault at the point, *A*, where the addition of the redan, *B*, adds greatly to its security.

Fig. 12. shews a line of obtuse angles, called swallow-tails, *a, a*, which would not afford a sufficient flanking fire; therefore it is expedient to mix them alternately with redans. This is an excellent mode for lines not finished with redoubts, or with advanced redans.

Fig. 13. is a line of swallow-tails, *a, a, a*, mixed with obtuse bastions, *b, b, b*, wherein it will be seen there is great strength. The addition of a cavalier, *c*, in each bastion, with

such a line truly formidable.

Fig. 14. exhibits a line of curtains, *a, a*, flanked with bastions, and having redoubts, *e, e*, in their centres. This is also attended with great strength, especially as the latter prevent the enemy from following up any advantage. We shall conclude this article with observing, that field-fortification must usually be extremely irregular; therefore on lines of any extent it may be expected to see the whole of the above-mentioned defences intermixed according as the ground may suit them respectively. In some parts, where deep fissures or crags may intervene, the line will of course be broken; there it will be necessary to place batteries on the most commanding situations, as well as to scarp, and otherwise add difficulties to the ascent, so as to prevent the enemy from making a push in such situations; which, when well defended, may be considered impregnable.

In carrying field-works over rising grounds, some parts of the defences will sometimes expose their flank; when this happens, an epaulement must be thrown up, of sufficient height to obstruct, not only the point-blank, but the ricochet ranges of the enemy's shot.

Circular bastions have been properly exploded; it being evident that the general tendency of their fire was weakened; while, at the same time, that portion most advanced towards the enemy could not possibly be flanked by any other work.

We shall now offer to the consideration of our military readers a few practical observations derived from a small work possessing considerable merit; these are selected because they furnish, in concise terms, the very elements of that highly important topic now under consideration.

1. The spot on which works are to be constructed should determine their figure; nor should any attention be paid to preserving a regular form, which does not occupy the ground to advantage.

2. Every line must be so disposed, that the slope of hills all around, even to the very bottom, be open to the small arms of the garrison, and every part should be discoverable to the distance of at least 500 paces.

3. Works thrown up for the defence of a defile should always be within musket shot of it; which must not be more than 200 yards.

4. The best defence in works that are flanked, or where one side is defended by the fire of another, is that formed by right angles.

5. A salient angle should never be less than 60° , nor a re-entering angle less than 90° , nor greater than 120° .

6. The entrance into the work should always be in that part least exposed to attack, and if possible in a re-entering angle.

7. Endeavour to present, if possible, a longer front to the enemy than he can occupy in making the attack.

8. Avoid all ground commanded by an eminence, either in front, flank, or rear.

9. Never leave your rear so exposed that an enemy can attack so as to turn it.

10. Always make the angles of a work in the directions least exposed to attack; and consequently endeavour to present a front to the enemy's batteries, &c.

11. The garrison should never be drawn up more than two deep; allowing an ordinary pace of two feet for each file, and from six to eight paces for each piece of ordnance.

12. If a work is so large as to be defended by a battalion or two, a reserve should be allowed of about one-sixth of the number.

13. The space within a work should always be sufficient for

for the men to move and lie down; every soldier will require at least 18 square feet, and every piece of ordnance about 216.

14. Provided the work be not too extensive, the more inward space there is the better.

15. A parapet, to resist cannon, should never be less than 12 feet thick, and for musket shot not less than six feet.

16. The height of the parapet must be regulated by the situation of the work, and of the adjoining ground; with this consideration, that the height (of its crest) above the banquette should not exceed $4\frac{1}{2}$ feet: if higher, men of rather a short stature will not be able to fire over it.

17. The depth and breadth of the ditch must be regulated by the quantity of earth required for the parapet and banquette.

18. A tête de pont, or any work intended to cover the embarkation of troops, or the passage of a river, &c. should, if possible, be made where the line of the river or coast forms a kind of re-entering angle, that the flanks of the corps, as well as those of the works, may be covered. See *Field-FORTIFICATION*.

To carry on the work.—The number of workmen must be proportioned to the time allotted for carrying on the work, the quantity of labour, and the number of hands capable of being employed at the same time. When the ditches are broad, the workmen must be posted in two rows; but, if narrow, only in one. In the first case the earth will be thrown by those who are on the outward edge of the ditch to the second row, and by them upon the parapet: for which reason the second row, to keep pace with the first, ought to be twice as numerous. The workmen should never be placed nearer than two paces, or four feet from each other, and two men with shovels should be preceded by one with a pick-axe. If more than usual expedition be required, one more with a wheel-barrow, or basket, may be added to six or eight with shovels. Another row of workmen should also be placed on the parapet, to spread the earth and beat it down as it is thrown up. In fixing the fascines, three men will suffice for every 24 feet of the work; these should be provided with two mallets, one saw, and one hand-bill or hatchet.

In order to form some idea of the time in which a field-work may be completed, compute the number of cubic feet of earth to be excavated, thus; multiply half the sum of the breadth of the ditch, at top, by the depth, for the number of square feet in the profile; this multiplied by the distance between the workmen in feet, will shew the number of cubic feet each man has to dig: or being multiplied by the length of the ditch (in feet) will give the cubic contents of the ditch. Now, one man is supposed to be able to move 216 cubic feet of earth in a day during the summer; but this is not always the case. If a field-work be completed in 24 hours, it will be as much as the most diligent workmen are capable of. This time is generally allowed for the formation of a weak profile; 48 hours for that of a stronger, with a revetement of fascines; and 72 for the strongest.

The different slopes for the works must depend upon the nature of the soil, and the materials of which the work is composed. The interior slope of the parapet, though it be fascined, should be one-sixth of its height, and the slope of the banquette equal to its height. The slope of the scarp, or counterescarp of the ditch, should be from half its height to its full height, according to the soil. The superior slope of the parapet must depend entirely upon the situation of the work, and that of the surrounding country. The interior slope of the parapet is generally lined with fascines, to keep up the earth; but it is not absolutely necessary to

fascine the exterior slope, if the soil be tolerably stiff. The embrasures are commonly made 20 inches wide within, and nine feet on the outside. They must always be lined with something to retain the earth; turf is generally preferred, as fascines are so apt to take fire. The manner in which *fascines* are made may be seen under that head.

It sometimes happens that the soil is so hard as to render it impossible to throw up works by the means of excavation; and where it is a loose sand, equal difficulty would occur regarding its retention, even when kept up by revetements of fascines. In either of these cases, the batteries, &c. must be formed by placing *gabions* (which see) in such order, and contiguous, as may serve to give a proper form to the merrons. The gabions may be either lined with leaves, sacking, &c. where the soil is a running sand, or they may be rammed full of clay, or whatever stiff soil may be at hand; wool, cotton, chips of leather, bark, or whatever may serve to confine the sand, may answer according to circumstances, observing that, in some instances, the whole interior must be gabioned. It will be evident that on a bad soil, such as above described, no ditch could be rendered both efficient and permanent; if lined with fascines, they might prove the destruction of the whole work, should the enemy throw carcasses or shells into it. A battery formed of gabions may be run up with great celerity, provided proper materials for filling them be at hand, and plenty of labourers at command. In very hard, rocky soils, there is great difficulty in fixing gabions, on account of the impracticability of driving the necessary stakes. To resist mucketry, sand bags are often found sufficient. These are particularly serviceable in situations where the opposing troops are very close: being placed so as to lean towards each other, but leaving a small interval, like a loop-hole, and being again crowned with an entire layer of the same kind; they offer an excellent screen, from behind which the assailants may be galled in the most disheartening manner. Sand bags, arranged along the top of a low wall, add considerably to the means of defence, especially where the wall is so irregular as to offer the means of flanking.

Field-Piece, a species of artillery intended for service in the field, in contradistinction to such pieces of ordnance as are appropriated to the defences of fortified places, to naval warfare, and to battering in breach. Field-pieces are in general made of brass, or rather of gun-metal, which consists of from 8 to 12 lbs. of tin to 100 lbs. of copper; the largest proportion of tin being used for mortars. The ordnance under description is usually divided into three classes, *viz.* battalion guns, artillery of the park, and horse artillery. The battalion guns include all light pieces attached to regiments of the line, which they accompany in all manœuvres, to cover and support them. The following natures of field ordnance are attached to battalions of infantry, by the different powers in Europe:

The French have	two	4-Pounders	<i>per</i> battalion.
English	two	6 do.	do.
Danes	two	3 do.	do.
Austrians	three	6 do.	do.
{ Prussians	two	6 do.	in the 1st line }
	two	3 do.	in the 2d line }
Hanoverians	two	3 do.	<i>per</i> battalion.

The artillery of the park is composed of every class of field ordnance. It is intended to form batteries of position, that is to say, to occupy advantageous situations, independent of the movements of the troops, but with the view to support them, and to produce the greatest effects. Sometimes the park is divided into the several parts of the line; sometimes it is advanced under cover of cavalry, which,

which, suddenly retiring, at a proper moment, unmask the battery, and surprize the enemy by the fatal disclosure.

The park should be sufficiently numerous to afford supplies in the event of any pieces being taken by the enemy; but, on the other hand, it is bad policy to burthen an army with too large a train, which not only occupies a great length of line, which in some instances exposes the whole to injury, but demands so large a stock of forage for the horses, &c. as to occasion considerable inconvenience on the score of provisions. The common rule is, to attach to the park twice as many field-pieces, of various natures, as there may be battalions of infantry in the army. The most approved proportions are these: 2-fifths of the whole to be 12-pounders; 2-fifths to be 6 pounders, and 1-fifth to be 3-pounders. But in different countries it is found necessary to lower the establishment to the following standard; viz. only 1-fourth to be 12-pounders; 2-fourths to be 6-pounders, and 1-fourth to be 3-pounders. For every 100 pieces of cannon it is supposed that four howitzers should be added; but we generally see a much larger proportion of the latter; perhaps as far as 18 or 20 to the 100: the French even exceed that proportion, and class their field-pieces into 12, 8, and 4-pounders; which, as their pound weight exceeds our's considerably, their ordnance may be rated at about 1-fifth heavier than the British.

Horse artillery.—In the French service this consists of 8-pounders, and 6-inch howitzers; a weight of metal requiring the greatest exertions to move with due rapidity, and rather tending to subject this department to delays, or

even to capture. With respect to the latter point, the French seem to entertain fewer scruples about relinquishing their ordnance than we do; they rarely make exigency subservient to honour, but look principally to effects; being certain that a few field-pieces may always be supplied from their park of artillery.

The English horse artillery consists of light 12-pounders, light 6-pounders, and light 5½-inch howitzers. It remains to be proved how far this selection is eligible; but, in addition to the foregoing comment on the French establishment, we may perhaps be correct in hazarding an opinion, that, except in the discharge of grape, in which branch the howitzers possess a decided superiority, the French 8-pounders may be considered as very nearly on a par with our 12-pounders; the former weigh only 10-cwt. 3qrs. while the latter amount to 8-cwt. 3qrs. 4 lbs.; or, upon the new scale now chiefly in use, to 12-cwt. But our medium 12-pounders have only a very small limber-box, lately added, which carries 6 round, and 6 case shot, with a proportion of small stores. They are attended each by two waggons, having the ammunition, generally about 150 rounds, divided equally between them. The light 6-pounders carry 34 round and 16 case-shot in their limbers, and for each pair of guns about 260 rounds of sorts in one waggon. The 5½-inch howitzers carry 22 shells, 4 case-shot, and 2 carcasses, in their respective limbers, and are attended by two waggons, carrying 24 case-shot, 24 shells filled, and 120 empty, and 4 carcasses. The horse artillery pieces have waggons on a peculiar construction, which carry as follow:

For 12-Pounders, light, on the limber—	12 round,	4 case,	4 shells	} total 92.
— do. — in one waggon—	52 —	10 —	10 —	
For 6-Pounders, light, on the limber—	32 —	8 —	—	} total 150.
— do. — in one waggon—	97 —	13 —	—	
For 5½-inch howitzers, on the limber—	—	5 —	13 —	} total 73.
— do. — in one waggon—	—	10 —	41 —	
For 3-Pounders, heavy, with curriple—	6 —	6 —	—	} total 136.
— do. — in one cart—	100 —	24 —	—	

The British parks of artillery are composed of the following ordnance: medium 12-pounders, 4; Desaguliers's 6-pounders, 4; and light 5½-inch howitzers, 4. These are called brigades, according to their respective calibres, or natures; each brigade consisting of 4 or 6 pieces, with a reserve of about 1/3th of the whole number, which should be placed behind the first line; but if the front be extensive the reserve must be divided.

All field pieces are mounted on carriages, standing on one pair of wheels five feet in height, and when travelling have their trails, or rear, (which then precedes the gun itself,) hooked up to the rear of the *limber*, or carriage, on equal sized wheels, allotted to the conveyance of the ammunition in chests; thence called *limber-boxes*.

Field-Staff, is a staff carried by the gunners, in which they screw lighted matches, when they are on command; which is called arming the field-staffs. See *LINSTOCK*.

Field-Marshal, is the denomination of the modern military rank in England, but superior to all others; having the chief command of the whole army.

Field Officers. See *OFFICERS*.

Field of Vision, in *Optics*, is that conical space indefinitely extended before us, so as to include all objects that can be seen at one view, or without turning the eyes. The precise limits of this space are not easily ascertained. In looking at a small distance, we have an imperfect glimpse of objects through almost the extent of a hemisphere, or at

least for above sixty degrees each way from the optic axes; but towards the extremity of this space objects are very imperfectly seen; and the diameter of the field of distinct vision does not subtend an angle of more than five degrees at most, so that the diameter of a distinct image on the retina is less than .06 of an inch; but it is probably much less. See *VISION*.

Field-Fare, in *Ornithology*, the English name of a bird of the thrush kind, called by authors *Turdus pilaris*, which see.

It is a bird of passage, and visits us in England toward the end of autumn in vast flocks, and leaves us in spring; it is not certainly known where these birds breed. They feed on berries, particularly those of the holly, and are well tasted birds.

This bird is easily taken with water bird-lime in the following manner: take out a gun, and kill two or three field-fares with it; by that time the gun has been discharged two or three times, the rest of these birds will be so fat, that there will be no coming near them; then tie one or two of those that were shot to the upper branches of a bushy tree, in such manner, that they may seem alive and sitting there. Then prepare two or three hundred twigs, covering them well with the water bird-lime, made warm for that purpose; take a good birchen bough, and in that place all the twigs; tie this fast to the tree, just underneath where the other field-fares are tied, and let this be in a place

where they come in a morning to feed, for they always use one haunt for feeding so long as there is any food left there. By this means the field-fares will fettle in whole flocks, near those which they fee tied to the bush; and two or three dozen may be in this manner taken at a time.

FIELD-Fare, American. See *TURDUS Migratorius*.

FIELD-Lark. See *ALAUDA Arvensis*.

FIELD Book, in *Surveying*, a book used for setting down angles, distances, and other things, remarkable in taking surveys.

The pages of the field-book may be conveniently divided into five columns. In the middle column the angles at the several stations taken by the theodolite are to be entered, with the distances from the stations. The distances taken by the off-set staff, on either side of the station line, are to be entered into the columns on either side of the middle column, according to their position with respect to that line. The names or characters of the objects, with proper remarks, may be entered in the columns on either side of these last mentioned. See *SURVEYING*.

FIELD of a Painting, &c. is more usually called the *ground* thereof.

FIELDING, HENRY, in *Biography*, a distinguished writer, was born in 1707 at Sharpsham, near Glastonbury in Somersetshire. After receiving the rudiments of education at home, he was removed to Eton school, where he laid in a respectable stock of classical learning. From Eton he went to Leyden, where he studied the civil law, but soon after his return he commenced writer for the stage. His first piece was a comedy, entitled "Love in several Masks," and the success which he obtained in this instance led him to make numerous efforts in the same way; but his early comedies are all forgotten: many of them were little more than translations from the French.

At the age of about twenty-six, or twenty-seven, he married a young lady of great beauty, and with some fortune, which, with what he obtained by the death of his mother, put him in possession of an estate of rather more than 200*l. per annum*. With this fortune he assumed the style of a country gentleman, with a retinue of servants, horses, and dogs. In three years he had exhausted his property, and involved himself in considerable difficulties. He now resolved to study the law, with a view to future support, and entered himself in the Temple. While he was keeping the terms required, he supported himself and family by his pen. He wrote for the stage, and published many essays which displayed a fund of good sense, and acquaintance with mankind. His first attempt at the humorous and satiric delineation of character, was in the "History of Jonathan Wild," which displays a familiarity with the scenes of low profligacy, which it is wonderful that a person in decent life should ever acquire: but his early course laid the foundation of too much knowledge of this kind. In 1742 he published his first proper novel, entitled "The History and Adventures of Joseph Andrews, and his friend Mr. Abraham Adams." The scenes introduced in this piece are chiefly those of low life: the grave Cervantic humour is imitated, and the principal character, parson Adams, is rendered the Quixote of the piece. His success as a novel-writer was not favourable to his professional pursuits, and he did not attain to any considerable eminence at the bar. He received little emolument from his legal practice, and his other supplies were inadequate to the demands of his family. In the midst of anxious cares and broken health, he had the misfortune to lose his wife. By this stroke he was so far overwhelmed as to be unequal to all exertion. At length, the love of liberty and the cause

of protestantism re-activated his fervour, and, in 1745, during the rebellion, he wrote and published a periodical paper, entitled "The true Patriot," which was followed by "The Jacobite Journal." These efforts in favour of the government and constitution, obtained for him the appointment to the office of a Middlesex magistrate, in the discharge of the duties of which he was very exemplary, and took every method for preventing crimes, and for improving the police. In 1749 he published "A Charge to the Grand Jury," containing an accurate account of the institution and particular duties of grand juries. This was followed by an "Enquiry into the Causes of the late increase of Robbers," dedicated to the lord chancellor Hardwicke; and by "A Proposal for the maintenance of the Poor:" both these pieces were esteemed judicious and useful performances, and as exhibiting much diligent research into difficult subjects. While he was thus employed in the serious avocations of his magisterial office, he found leisure to write his "Tom Jones," which must ever be regarded as a matter-piece of art, replete with the most striking delineation of manners, and exhibiting extraordinary skill in managing the intricacies of a plot so as to wind up with the happiest effect. His third novel was entitled "Amelia," which came out in 1751; after the publication of this his constitution began to give way very rapidly, but the powers of his mind were still in high vigour, and he engaged in a new periodical work, entitled "The Covent Garden Journal," which continued with much success for about a year, when the author's ill-health obliged him to suspend his literary labours. As a last resource, he was advised to try the climate of Portugal, but the voyage did not contribute to his recovery: he lived long enough to describe the occurrences which he had witnessed in passing from London to Lisbon, and died October 8th, 1754, in the forty-eighth year of his age. Fielding was possessed of many solid virtues of the heart, and the powers of his understanding were unquestionable. His novels, though liable to objections, afford many valuable moral lessons. His scenes are often drawn from low life, and display too much of the vices and crimes of mankind, yet they are relieved by a considerable admixture of nobler matter, and contain many affecting pictures of moral excellence. His fame as a writer has not declined since his death. He is still regarded as much at the head of the department of comic romance as Richardson is at that of the sentimental. His sister, Sarah Fielding, is known for two novels, entitled "David Simple," and "The Cry;" and for a translation of the "Memorabilia" of Xenophon: and his half-brother, sir John Fielding, was long at the head of the public office, London. *Biog. Brit.*

FILELWEER, in *Geography*, an island near the W. coast of Norway, about 22 miles long and 4 broad, with a town. N. lat. 63. 30'.

FIELSA, a town of Swedish Lapland; 45 miles S.S.E. of Afela.

FIEN, a town of Persia, in the province of Irak; 5 miles S.W. of Cashan.

FIENVILLE, in *Geography*, a town of France, in the department of the Somme; five miles S.W. of Dourlens.

FIENUS, or FIENS, THOMAS, in *Biography*, a physician of eminence in the sixteenth century, was born at Antwerp, where his father exercised the same profession, on the 28th of March, 1567. He pursued his medical and mathematical studies at Leyden, and afterwards at Bologna, which he visited in 1590. On his return to his native country his talents were soon made known: in 1593 he was invited

to Louvaine, in order to fill one of the vacant professorships of medicine in that university, in which he took the degree of doctor about the end of that year. He resigned his chair after seven years of residence in that school, and went to Munich, having been appointed physician to Maximilian, duke and afterwards elector of Bavaria; but he returned to his post at the end of one year. In 1616, he was offered the professorship of medicine in the university of Bologna, with a salary of a thousand ducats; but the archduke Albert immediately increased his salary at Louvaine to the same sum, in order to do away the temptation of leaving that city. Accordingly he remained there until his death, which occurred on the 15th of March, 1631, at the college of Breughel, of which he had been for a long time president. Fiennus has been ever regarded as an intelligent and able physician; he had few equals among his contemporaries in the knowledge of natural history and surgery; not to mention his acquaintance with the Greek, and mathematics. His works likewise contributed greatly to advance his reputation; they were as follows. 1. "De cauteriis Libri quinque," Louvaine, 1598. 2. "Libri Chirurgici XII., de præcipuis Artis Chirurgicæ controversiis," Francfort, 1602. This work, which passed through many editions, treats of the principal surgical operations. 3. "De viribus Imaginationis Tractatus," Louvaine, 1608. 4. "De Cometa anni 1618," Antwerp, 1619. In this tract he combats the opinions of Copernicus respecting the motion of the earth. 5. "De vi formatrice fœtus Liber, in quo ostenditur animam rationalem infundi tertiâ die," *ibid.* 1620. This work was attacked by Louis du Gardin, a professor of Douay, who maintained the better ground in this undeterminable argument. Fiennus replied in, 6. "De formatrice fœtus adversus Ludovicum du Gardin, &c.," Louvaine, 1624. His opinion was also impugned by Santa Cruz, the physician of Philip IV., which produced, 7. "Pro sua de animatione fœtus tertiâ die opinione Apologia, adversus Antonium Ponce Santa Cruz, Regis Hispaniarum Medicum Cubicularem, &c.," Louvaine, 1629. 8. "Semiotice, sive de signis medicis Tractatus," Leyden, 1664. The father of the preceding, Dr. John Fiennus, published a treatise at Antwerp in 1582, entitled, "De Flatibus humanum corpus molestantibus Commentarius novus ac singularis," which passed through many editions. Eloy, Dict.

FIERAS, in *Geography*, a town of Sweden, in the province of Aland; twelve miles N.N.W. of Wårdberg.

FIERI FACIAS, in *Law*, a judicial writ, which lies at all times within the year and day, for him that hath recovered in an action of debt and damages; it is directed to the sheriff, commanding him to levy the debt and damages on him, against whom the recovery was had. This species of execution is called *feri facias* from the words in it which command the sheriff, *quod feri faciat de bonis*, that he cause to be made of the goods and chattels of the defendant the sum or debt recovered. This lies as well against privileged persons, peers, &c., as other common persons; and against executors or administrators with regard to the goods of the deceased. The sheriff may not break open any outer doors (5 Rep. 92.) to execute this writ; but must enter peaceably, and may then break open any inner doors, belonging to the defendant, in order to take the goods. (Palm. 54.) And he may sell the goods and chattels, even an estate for years, which is a chattel real (8 Rep. 171.) of the defendant, till he has raised enough to satisfy the judgment and costs: first paying the landlord of the premises, upon which the goods are found, the arrears of rent then due, not exceeding one year's rent in the whole. (Stat. 3 Ann. c. 14.) If part only of the debt be levied on a

feri facias, the plaintiff may have a *capias ad satisfaciendum* for the residue. (1 Roll. Abr. 904. Cro. Eliz. 344.) See EXECUTION.

FIESCO, JOHN LEWIS, in *Biography*, count of Lavagna, a noble Genoese, was born in 1525. He became possessed of a large estate at the age of eighteen, and, surrounded with flatterers, began, at their suggestions, to aspire after that power and distinction in the state to which his birth and opulence seemed to entitle him, but from which he was precluded by the superior influence of the Doria family. (See DORIA, *Andrew*.) Fiesco, who possessed all the talents proper to ingratiate himself with a party, resolved to attempt a revolution in Genoa which might raise him to the station that Doria now occupied. His courteous manners rendered him a favourite with the people. He obtained the interest of the court of France, and the concurrence of the Pope, who accommodated him with some galleys. Notwithstanding the preparations that he was making, Doria did not, and would not, suspect any thing to the prejudice of Fiesco, though the destruction of himself and family formed an essential part of the conspiracy. The day fixed for the bloody enterprise was January the 2d, 1547, and, on the preceding morning, Fiesco prepared a galley under the pretext of a cruise against the corsairs, and then paying a visit to Doria, he requested permission to depart early from the harbour, and took his leave with much apparent respect, and every demonstration of affection. In the evening he assembled his adherents, and having exhorted them to join him in an attempt to free their country from its oppressors; he went to make known his project to his wife, who, distracted with the idea of the impending danger, entreated him, on her knees, to desist from his desperate undertaking. He had, however, made up his mind, and was immovable; rushing from her apartment, he exclaimed, "Madam, you shall never see me again, or you shall see every thing in Genoa beneath you." In the dead of night he sallied forth at the head of 500 armed men, surrounded by his fellow conspirators. He dispatched parties to all quarters, and proceeded himself to secure the dock in which the galleys lay. In passing over a plank, placed between two vessels, it gave way and he fell into the water. The weight of his armour sunk him to the bottom, from whence he never rose, and thus, at the early age of twenty-two, his life was sacrificed at the shrine of ambition. The confederates had gone too far to recede with safety; they determined therefore to strike the desperate blow, but the death of their leader was fatal to the attempt. Doria escaped unhurt; the senate recovered its authority, and the family of Fiesco paid the penalty of the crimes of their leader by ruin and proscription. Mod. Univer. Hist.

FIESCO, in *Geography*, a town of Italy, in the department of the Upper Po; 4 miles E. of Crema.

FIESOLE, GIOVANNI DA, in *Biography*, an historical painter, who was born at Fiesoli, in 1387. His real name was Montorioli; from his excellence in painting the expressions of saints and angels, he was also called Giovanni Angelico. He was first placed as a disciple with Giotto; He afterwards became a Dominican friar. His first works of consequence were painted at Florence, by order of Cosmo di Medici; who having built the church and convent of St. Mark, commissioned Fra. Giovanni to paint the Chapter-house, in which he represented, in fresco, on the walls, three subjects. 1st, The Passion of Christ. 2d, All the Saints, Founders of Religious Orders, weeping at the feet of the Cross, and on the other St. Mark the Evangelist with the Virgin, the three Marys, and Saints Cosmo and Damiano, present at the Crucifixion. Under these, by way of frieze, he

he represented a tree, at the foot of which was St. Dominico supporting the branches, which in their turn upheld portraits of all the popes, cardinals, bishops, saints, and doctors in theology, who were of the Dominican order. His fame procured him an invitation to Rome from pope Nicholas V., who employed him to paint his chapel and ornament manuscripts. He became so warm an admirer of Giovanni, that he offered him the archbishopric of Florence, which his humility and perhaps love of his art, led him to decline accepting for himself, and the person whom he recommended was installed in his stead. He generally painted his pictures smaller than life: Vafari speaks of them with great delight, but they are not of a grand class, and are often defective. He died in 1445, aged sixty-eight, having been exceedingly industrious, and leaving behind him an immense number of works, principally at Florence and Rome.

FIESOLI, in *Geography*, a town of Etruria, the see of a bishop, suffragan of Florence, three miles N.E. of Florence. This is the ancient *Fesula*, one of the twelve cities of Etruria.

FIFE, a small shrill flute, blown at the side, like a German flute. It is in almost every musical band, and as the tabor and pipe enliven the dance, the fife and drum animate the soldier, particularly in the quick step. The fife has six notes, and furnishes two octaves from the lowest D in the treble, to D in alt. The Swiss first brought this instrument into France, after the battle of Marignan, under Francis I.; since which time it has been admitted into regimental music, in preference to the common octave flute, being made less false from its having a key which the *fifi à bec* has not. Laborde.

The *fife* is an instrument, particularly intended for the use of regiments, and forms, in conjunction with the drum, the only music with which many corps are provided. This little shrill tube is usually about fourteen inches in length, and of one piece, though some are made to take to pieces; but such are not suited to military use: it may be considered a small kind of flute, especially if provided, as some are, with a key; but such are rare, the generality being confined to only six finger holes, and an embouchure, or mouth-hole. The want of a key necessarily occasions a difference in the fingering of many notes; but the compass, or extent, is about the same as that of the German flute; namely, from D below the treble staff, to D in alt.; but all beyond B in alt. are more or less harsh, and cruelly piercing to a sensible ear. Fifes are made of three several sizes, denominated A, B, and C, respectively; A being the largest and deepest toned, and one minor third below concert pitch; the next size is made to correspond with the B b of the musical scale, and is generally used when playing with military bands, using what are called B b clarionets. The C fifes are those at concert-pitch, and are chiefly used for the ordinary service of these instruments. Such an assortment requires some vehicle or receptacle; accordingly we find that where such a diversity is allowed, each fife is provided with a

FIFE-case, which is a tin tube, about twenty inches long, and three in diameter, having two diaphragms of tin pierced for the several fifes to pass through, so as to be kept separate. There is a tin lid which fastens down, and either locks or is fixed by a spring pin. This case is generally painted to conform with the ornaments on the drums of the regiment, and is slung over the shoulder by means of a cord with tassels. Though certainly decorative, we cannot but view this appendage as both useless and extravagant.

FIFE-rails, in a *Ship*, are those that are placed on banisters

on each side of the top of the poop, and so along with lances or falls. They reach down to the quarter-deck, and to the stair of the gangway.

FIFE'S Passage, in *Geography*, a channel in Broughton's Archipelago, about eleven miles in length and two in breadth. N. lat. 50° 50'. E. long. 233° 11'.

FIFENESS, a cape of Scotland, on the E. of the county of Fife, with a village of the same name; a ridge of rocks, called the Car rocks, extending a considerable way into the sea, renders the passage of the cape dangerous to seamen. N. lat. 56° 15'. W. long. 2° 39'.

FIFER, a person who plays on the fife: of these one is generally appointed to each company of infantry, who, in company with the drummer, plays to the corps while marching for the relief of guard, or when the arms are carried; also at the times of beating the reveillez, the assemblez, the retreat, the tattoo, and other regular or incidental duties. The most disagreeable part of the duty of the fifers and drummers, consists in the infliction of such punishments as offenders are sentenced by courts-martial to undergo in preference of their companions in arms, occasioning this class of persons to be often treated with marked odium, and to receive the opprobrious designation of "Bloody Thumbs." This term is derived from the stains of blood attaching to their hands, in consequence of their occasionally straightening the several cords of which a cat-o-nine-tails is composed, and which in the act of flugellation are apt to become entangled, so as to fall heavily, en masse, upon the delinquent's shoulders. We cannot let pass this opportunity of expressing our conviction, founded on the best authorities, that corporal punishments are as unnecessary as they are disgraceful; and that it is not only very practicable, but has in many instances been found very effectual, to substitute moderation for severity, and an attack on the pride of an offender, for one on his flesh. Under the exiling system we can never be led to envy the feelings of the fifers and drummers of a regiment; nor can we entertain the opinion that this class of our soldiery will be exempted from those opprobrious epithets, and those sarcastic reflections, which affix a stigma of the most obnoxious description.

FIFESHIRE, in *Geography*, is a county of Scotland, almost surrounded by the rivers Forth and Tay, the friths or estuaries of which nearly form it into a peninsula. The former river on the south divides it from the Lothians; and the latter separates it from the shires of Perth and Angus; on the east it is bounded by the shires of Kinross and Clackmannan; and on the west by the German ocean. The length is 60 miles by 18 in breadth, comprising about 480 square miles. The rivers by which it is watered, besides the two already mentioned, are the Eden and the Leven. The Eden has its rise on the borders of Perthshire, between the towns of Strathmiglo and Abernethy; and taking a course of 17 miles due east, falls into the sea in the bay of St. Andrew's. Though a tide river, its stream is comparatively placid, and its fine salmon fishery is greatly annoyed on this account with the notorious enemies of that fish, the plover or seals, which is elegantly alluded to by the poet Johnstone.

"Arva inter nemorosque umbras, et pascua lata
Lene fluens, vitreis labitur Eden aquis."

The Leven flows out of Loch Leven, a beautiful lake of nearly 12 miles in circumference, partially included in the shires of Fife and Kinross, the fertile plain of which forms its west and northern boundary, and to the east and north it is overlooked by the towering Lomond hills. These and other interesting surrounding objects, particularly the royal residence

residence of the ancient line of Scottish or Pictish kings, will be noticed in their respective places. This river, after running 17 miles in an easterly direction, falls into the sea near the village of Leven. It has frequently been confounded, by the admirers of Smollet for his beautiful ode on Leven Water, with a river of the same name in the shire of Dumbarton.

This district anciently formed part of the provincia *invieta* Caledonia which name the Romans had given to the country north of the river Tay, previous to their taking possession; for Camden observes, the Tay was the utmost northern boundary of the Roman empire in this part of Britain. Julius Agricola, the best of generals under the worst of emperors, Domitian, though he was enabled to penetrate further by incurive inroads, even into the heart of the highlands; yet sagaciously perceiving no benefit could arise by conquering a country, naturally unproductive, and thinly peopled, wisely withdrew his army from what he termed the Barbarians; and to resist retaliations erected a chain of forts across this part of the island, and established the Tay for his hostile frontier. Some Roman remains have been discovered northward in Perthshire, but many more in those parts of ancient Fifeshire, which now constitute the counties of Clackmannan and Kinross. The face of this part of the country is agreeably diversified; towards the west, it is mountainous, and a ridge of hills extends north-eastward nearly the whole of its length, dividing the county into two natural districts; on each side the country gradually falling to the respective friths of Forth and Tay. The low lands exhibit a fine fertile country, the high lands most extensive and beautiful prospects; and both are tolerably well wooded. The two conical hills, called the Lomonds, stand very conspicuous, and are visible out at sea to a great distance. The eastern Lomond, the most regular and beautiful in its shape, is about 1650 feet above the level of the town of Falkland, which stands at its base. On the summit of this hill is a small lake, which has the appearance of a volcanic crater, similar to those described by Spallanzani in his travels through Sicily. The western Lomond is less regular in its form, but has greater elevation; and on the summit is a heap of loose stones, denominated by antiquaries a cairn.

The natural productions are numerous and varied. The whole of the south side of the county abounds in coal, and the pits are numerous. The western and midland districts produce iron; lead has been discovered in the eastern Lomond, and mines of this ore are profitably worked in the parish of Kemback. Limestone is abundant, and of an excellent quality; there are valuable freestone quarries, and plenty of marble. The pebbles, much admired for the high polish they take, have been discovered in different places; and various kinds of agates, with rubies of a fine water, highly valued by lapidaries.

Agriculture appears to have early occupied the attention of the inhabitants of Fifeshire; and its artificial productions evince a spirit of industry and improvement, surpassed in few parts of Scotland. The property is pretty equitably divided; there being few large estates, and the proprietors in general reside and cultivate their own. From this kind of equitable distribution of land, its value is increased, selling from 25 to 30 years purchase. To enumerate the seats of the nobility and gentry is not a part of our plan; but those of Aberdour, Leslie, Melville, and Ely, are particularly deserving notice. In several parts of the county are the remains of royal seats; at Dumferline, Falkland, Kinghorn, and St. Andrew's. These ruins will soon cease to be interesting; for in the words of lord Rochester, "they

are in the full perfection of decay." Almost surrounded by the sea, this county is furnished with several good harbours; particularly Burntisland, in the frith of Forth, opposite Leith, which is inferior to none in the island. From the circumstance of the towns principally lying upon the coast, king James VI. compared this county to "a grey mantle with a gold fringe." These towns were regarded by that monarch with peculiar attention, who endeavoured to make them subservient to his grand and wise design of raising Scotland high in the scale of commercial nations; a rank her natural capabilities entitled her to hold. For this purpose he granted the inhabitants divers privileges and immunities; and by every inducement encouraged them to cultivate their local advantages. And though many of those privileges by the main have been rendered unimportant, yet they remain a standing monument of the just discernment and political sagacity of the royal grantor. The county sends one member to the British senate. The number of royal burghs or parliament towns, as they are usually called, is thirteen, *viz.* Cupar, the county town, St. Andrew's, Inverkeithing, Dumferline, Burntisland, Kinghorn, Kirkaldy, Dysart, Pottenweem, Anstruther, Kilrenny Easter, Kilrenny Wester, and Crail. Several others, formerly privileged with elective franchise, have lost it, from having been unable to defray the expence of representation, by sending a commissioner to the Scottish parliament. Among this number may be mentioned, the towns of Auchtermuchty, Strathmiglo, Newburgh, Falkland, Kilconquhar, Ely, Earlsferry &c. which, though not very large places, deserve notice from their former importance. The county is divided into sixty-three parochial districts, and by the enumeration returned to parliament in 1801, the number of houses was 17,065, and inhabitants 93,743, being 196 upon every square mile; a much greater population than is to be found in any other part of Scotland. In its ecclesiastical distribution it contains one full synod and four seats of presbytery. The people are variously employed. Many in the salmon, herring, and especially what is denominated the white fishery, which is very productive on this part of the coast; others in digging coals, great quantities of which are carried coastwise, and by the Caledonian canal, to other parts of Scotland. The iron mines employ numbers, the ore of which supplies the Calder, Carron, and other iron works; and still more are engaged in manufacturing linen and cotton cloths; with a kind of the latter, under the name of green cloth, the London calico printers have been long supplied from the markets of Fife. This county anciently constituted an earldom, and the honour was possessed by the family of Macduff; a title conferred on the thane of Fife, by Malcolm III. for the services the former had done that monarch, in restoring him to the throne, which had been previously possessed by the usurper Macbeth. This title having become extinct, was recently revived in the Dulls of Braco, lateral descendants of the ancient family. General Statistical Account of Scotland.

FIFTEENTH, *Decima quinta*, or *Quinziesme*, an ancient tribute or imposition of money, laid upon any city, borough, or other town, through the realm: not by the poll, or upon this or that man, but in general upon the whole city or town.

It is so called, because it was supposed to amount to a fiftieth part of that which the city had been valued at of old; or to a fiftieth part of every man's personal estate, according to a reasonable valuation.

This was imposed by parliament, and every town throughout the realm knew what a fiftieth for themselves amounted to, because it was always the same; whereas the subsidy, which

was raised of every particular man's lands, or goods, must needs be uncertain.

The fifteenth seems to have been a rate anciently laid upon every town, according to the land or circuit belonging to it. Camden mentions many of these fifteenths in his *Brian*. *viz.* p. 171. "Bath geldabat pro viginti hidis, quando fchira geldabat, &c." And p. 181. "Old Sarum pro quinquaginta hidis geldabat, &c." Which rates are according to Doomsday. But in after-times the fifteenth came to be understood as imposed only on goods and chattels, not on lands. It was first granted by parliament, 18 Edw. I. *viz.* "Computus quintæ decimæ regi, an. 18. per archiepiscopos, episcopos, abbates, priores, comites, barones, & omnes alios de regno, de omnibus bonis mobilibus concessæ." The city of London said that year for the fifteenth 286*l.* 13*s.* 8*d.* and the abbey of St Edmund's 66*l.* 13*s.* 4*d.* which was by composition; and thereupon had all the temporal goods of their district discharged of the fifteenth.

In the 8th of Edw. III. it was reduced to a certainty, when, by virtue of the king's commission, new taxations were made of every township, borough, and city, in the kingdom, and recorded in the exchequer; which rate was, at the time, the fifteenth part of the value of every township, and the whole amounted to about 29,000*l.*; and, therefore, it still kept up the name of a fifteenth, when, by the alteration of the value of money and the increase of personal property, things came to be in a very different situation. So that when of later years the commons granted the king a fifteenth, every parish in England immediately knew their proportion of it; that is, the same identical sum that was assessed by the same aid in the 8th of Edward III.; and then raised it by a rate among themselves, and returned it into the royal exchequer.

The way of collecting it was by two assessors appointed in every county by the king, who appointed twelve more in every hundred to make a true valuation of every man's personal estate upon which the fifteenth part was levied.

FIFTEENTH, in *Music*, is an interval whose ratio is $\frac{1}{16}$ th, or the double octave or replicate thereof = 1224 Σ + 24*f* + 106*m*; see table of CONCORDS.

FIFTEENTH Stop on an organ, is a range of pipes, so called because each note therein is tuned a double octave or fifteenth above the diapasons, which are reckoned the standard. In accompanying choral parts in a concert, or in church-singing, this stop, the twelfth, the principal, and the two diapason stops, are generally used together.

FIFTEENTH-Mile creek, in *Geography*, a river which rises in Pennsylvania, and runs into the Potomack, in Maryland. N. lat. 39° 40'. W. long. 78° 25'.

FIFTH, in *Music*, is a perfect concord, the next in perfection to the unison and octave; in the division of the monochord its ratio is 3 : 2, that is, the third part of a string is a 5th to the octave of the whole string. (See MONOCHORD and FUNDAMENTAL *Bas.*.) The 5th is a principal sound in the triad or common chord. It is made a discord by the 6th; the false 5th is a discord in itself, and must be prepared and resolved. The perfect 5th is seven half notes above the base. It is so perfect a concord that no succession of 5ths with the base, or any of the other parts, can be borne, ascending or descending together. Dr. Pepusch has given all the warrantable means of preparing and resolving it as a discord, and for the unwarrantable succession of 5ths, see Padre Sacchi delle quinte successive. The 5th of a key, falling to the key-note, in the base, being regarded as a full cadence or close, has given

birth in France to the denomination of dominant, as it governs or leads to the key-note or tonic of every key. Thus, G is regarded as the dominant of C, and D of G, &c.

The *fifth*, or *major Fifth*, is one of its most important intervals, and the most perfect or agreeable in its harmony of any other interval within the octave; it is usually marked V in writings on the theory of music, and consists of seven of the half-notes of keyed instruments, which have 12 sounds in the octave. Its ratio is $\frac{3}{2}$ = 358 Σ + 7*f* + 31*m*; its common logarithm is .8239087,4094, and its binary or Euler's log. = .584962, which is its decimal relation to the octave (1) of which it is nearly the $\frac{3}{4}$ d part: it contains 32.639526 major commas, is composed of a major and minor third, and is the complement of a minor fourth to the octave: it is equal to the sum of a major tone and minor fourth, a semidiapente and a medius semitone, a tritone and major semitone, three major tones and a limma, three apotomes and four limmas; two major tones, one minor tone, and a major semitone also compose it, (see QUINT.) Two circumstances have concurred to render this concord the most proper to be used in the tuning of keyed and stringed instruments, *viz.* its great perfection, by which much facility is given in tuning, and it being the only concord which will bear repeating 12 times in succession (with, or without descending octaves) and each time produce a note answering nearly to the 12 notes in common use, and on the 13th repetition fall very nearly on an octave of the note first started from: which circumstances occasion this concord, tempered in different degrees, to be almost exclusively used in the tuning of instruments. Besides the above, various other intervals bear the names of fifth, as

Flat fifth, the semidiapente of the ancients, or false fifth of some, being less than a tone or major-fifth by the medius semi-tone, and consists of six half-notes; its ratio is $\frac{45}{64}$ =

311 Σ + 6*f* + 27*m*, = $\frac{3^2 5}{2}$; its common logarithm is

.8470325,3979: its binary log. = .508148, and it is = 28.3534 major commas. It is the complement of a tritone, is equal to a minor fourth and a major semitone, a tritone and minor comma, to the difference between two minor thirds and a major comma; a major, a minor, and two major semitones also compose it; and it is the difference between two 4ths, and a III, whence it may be tuned on an organ.

Sharp fifth, or diesis defective minor sixth, the superfluous fifth of Tartini, consists of eight half notes; it exceeds the true fifth by a minor semitone; its ratio is $\frac{16}{25}$ =

$\frac{2^4}{5^2}$ = 394 Σ + 8*f* + 34*m*; its common logarithm is .8061799,7398; its binary log. = .64856, and it is = 35.92564 commas; it is the complement of the flat fourth; it is equal to two major and two minor tones, and is equal to the difference of a minor sixth and enharmonic diesis, also to 2 VIII - 2 6ths, 2 V - 2 3ds, 2 VI - 2 4ths, or to 2 III: whence it may be tuned.

Comma deficient fifth, or lesser fifth of Holder, and deficient fifth of others, is less than a true fifth by a major comma, as its name imports; its ratio is $\frac{27}{40}$ = $\frac{3^3}{2^3 5}$ = 347 Σ + 7*f* + 30*m*; its common logarithm is .8293037,7283, and its binary log. = .567042: it is = 31.639524 major commas. It is equal to one major, two minor, and one major semi-tone,

tone, and to a minor fourth and minor tone; it is also equal to the difference between two 4ths and a 3d, whence it may be tuned.

Comma-deficient flat fifth, is an apotome less than a true fifth: its ratio is $\frac{729}{1024} = \frac{3^3}{2^7} = 300\Sigma + 6f + 26m$:

its common logarithm is .8524275,7167, and its binary log. = .490228; it is = 27.35340 major commas. It is the complement of three major tones; is equal to two comma-deficient minor thirds: to two major tones and two limmas, and is also the difference between four 4ths, and two Vths, whence it may be tuned.

Comma-redundant fifth, or greater fifth of Holder, is a major comma larger than a true fifth; its ratio is $\frac{160}{243} = \frac{2^5}{3^3} = 369\Sigma + 7f + 32m$; its common logarithm

is .8185137,0905, and its binary log. = .602881, it is = 33.639526 major commas, three major tones, and a major semitone, and is the difference between two Vths and a 3d and two 4ths, whence it may be tuned.

Comma-redundant sharp fifth, or superfluous fifth of some, is a semitone medius larger than a true fifth; its ratio is $\frac{256}{405} = \frac{2^8}{3^5} = 405\Sigma + 8f + 35m$; its common logarithm is .8007849,4209, and its binary log. = .661776: it is 36.92564 major commas, two major thirds, and a major comma; it is the difference between a major sixth and a limma; and between two Vths and a IIIId and two 4ths, by which it can be tuned.

Comma-redundant flat fifth, or tritone maximum of Euler, also the diminished fifth of some, is a minor semitone less than a true fifth; its ratio is $\frac{25}{36} = \frac{5^2}{2^2 \cdot 3^2} = 322\Sigma + 6f + 28m$, its common logarithm = .8416375,0790, and the binary log. .526068: it is = 29.35340 major commas: it is equal to two major tones and two major semitones, also to two 3ds, whence it may be tuned.

Diaschisma-defective fifth, is a diaschisma less than a true fifth; its ratio is $\frac{177,447}{262,144} = \frac{3^{11}}{2^7} = 346\Sigma + 7f + 30m$; its common logarithm is .8297938,7996, and its binary log. = .565417; it is = 31.548683 major commas: it is equal to the difference of four minor tones and a chromatic diesis; to the sum of a minor fourth and two limmas, to five limmas and two apotomes; to the difference between seven octaves and eleven 6ths, or seven minor fourths and four 5ths, whence it may be tuned. It is the resulting fifth, or that between the *hearing notes*, when eleven successive *perfect* 5ths are tuned in an octave.

Double deficient fifth, is two major commas less than a true fifth; its ratio is $\frac{2187}{3200} = \frac{3^7}{2^7} = 336\Sigma + 7f + 29m$; its common logarithm is .8346988,0472, and its binary logarithm = .549121: it is = 30.63952 major commas, and to a major tone, two minor tones, and a limma; and it is the difference between two Vths, two 4ths, and three Vths, whence it may be tuned.

Double superfluous sharp fifth, is an apotome greater than a true fifth, and two major commas greater than a sharp fifth: its ratio is $\frac{496}{6561} = \frac{2^3}{3^8} = 416\Sigma + 8f + 36m$; its common logarithm is .7953899,1021, and its binary log.

= .67,696: it is = 37.92564 major commas, also to four apotomes and four limmas, to two major thirds and two major commas; to four major tones; to the difference between eight Vths and four VIIths, or between four Vths and four 4ths, from either of which last, this interval may be tuned.

Minimum fifth of M. Henfling, or extreme diminished fifth of some, is exceeded by a true fifth, the quantity of two minor semitones and a major comma: its ratio is $\frac{375}{512} = \frac{35^3}{2^7} = 275\Sigma + 5f + 24m$; its common logarithm is .8647613,0675, and its binary or Euler's logarithm = .149253, and it is = 25.06728 major commas: it is equal to the difference between a XIth and three IIIIs, whence this interval may be tuned.

Fifth-monarchy Men, in *Ecclesiastical History*, the denomination of wrong-headed and turbulent enthusiasts, who sprang up in England during Cromwell's usurpation; and who expected Christ's sudden appearance on earth to establish a new kingdom; and, acting under the influence of this illusion, they aimed at the subversion of all human government, and were for turning all things into confusion.

FIG, in *Botany*. See *FICUS*.

FIG, *Indian*. See *CACTUS*.

FIG, *Infernal*. See *ARGEMONE*.

FIG, *Pharaoh's*. See *FICUS* and *MUSA*.

FIG, *Marygold*. See *MESEMBRYANTHEMUM*.

FIG *tree, Cochineal*. See *CACTUS*.

Fig-wort, the common name of a plant of the weed kind, which is frequently met with in pasture lands. The roots are of the oblong knobby kind. The leaves are heart-shaped, cornered, and placed on foot-stalks. The flowers have much resemblance to those of crow-foot, but differ in having the cup divided into three parts only, the petals being about eight in number, and narrower. It is a low plant, which runs very much by the roots, choaking up most others which are near it. It has likewise the names of pile-wort, lesser centaury, &c. See *SCROPHULARIA*.

FIG, *Petrified*, in *Natural History*. Among the numerous pyritic substances of Sheppy island, Mr. Jacob collected two which he thought to be figs; which Dr. Parson afterwards referred to a recent fungus, but perhaps with not much better reason.

Figs, in the *Materia Medica*. They are moderately nourishing, grateful to the stomach, easier of digestion than any of the other sweet fruits, and soften the asperities of the breast, &c. and accordingly are used in medicine, to make gargarisms against disorders of the throat and mouth; and as an ingredient in pectoral decoctions, and in lenitive electuaries. They are also applied externally to soften, digest, and promote maturation.

Figs are dried either by a furnace, or in the sun, having first dipped them in scalding hot ley, made of the ashes of the fig tree. The Latins call them *carice*, or *ficus passa*, when thus dried.

In this condition they are used both as medicine and food; being both the wholesomer, and easier of digestion, when thus cleared of a quantity of their aqueous and viscid parts.

Figs, in *Commerce*. The best figs are the produce of Turkey, Italy, Spain, Provence, &c. The islands of the Archipelago yield figs in great abundance; but they are much inferior in goodness to those of Europe. Yet the Greeks in those islands cultivate them with wonderful care and attention; as making the principal food, and a considerable part of the riches of the country.

They

They have two kinds of fig-trees; the first, called *ornus*, or the wild fig-tree; the second, the domestic fig-tree.

The method of cultivating and ripening these figs makes a peculiar art, by the ancients called *caprificatio*: often spoken of among them in terms of admiration. Some of the modern naturalists have looked on it as a chimera; but Mons. Tournefort has assured us of the contrary, and given us that process, as he learnt it upon the spot. See CAPRIFICATION.

FIGS, in *Antiquity*, were used in divination. See SYCOMANTIA.

FIG, in the *Mange*, is a sort of wart, or spongy excrescence on the frush, and sometimes all over the body of a horse. The figs that appear in the frush or sole make an evacuation of stinking malignant humours, that are very hard to cure. The only effectual remedy for these excrescences is extirpation.

FIG, *Insect*, in *Natural History*, a name given by the English to the creature called by the French, after Mr. Reaumur, the *sans puceron*, or *falso puceron*, from its very much resembling the puceron in external appearance, but being extremely different from it when nearly examined. These insects are, when at their full growth, of the bigness of the head of a pin of the largest size, but there are usually found among them several that are smaller, down to such as are scarce perceivable to the naked eye. They are found in great plenty on the back, or under-side of the leaves of the fig-tree, but they never are seen in clusters like the puceron.

The body and breast of this insect are green, and the cases of the wings are white, and beset with hairs. This creature has two antennae or horns, which it can exert at pleasure; but they usually are lodged under the furrows of the wings, and are not to be seen, unless the animal be turned belly upwards; the head also is bent downwards, and the eyes seem directed to look at objects only placed under them.

It has six legs, and a fine small trunk issuing from the extremity of the head; this is but short, and is of a lively green; it is terminated by a sharp point, and has a fine brown filament like a hair, which it thrusts out of the body of the trunk at pleasure, and which seems a sort of engine or organ destined to convey into the body the juices extravasated by the wound and suction of the trunk. The creature usually remains in perfect quietness on the leaf on which it is found; but has this peculiarity, in its position, that it is always found with its head resting upon one of the ribs of the leaf, and its body on the plain part; by this means, the anterior part of the head is raised above the surface of the plain part of the leaf, and the creature can, by that advantage, move his trunk about at pleasure, and fix it into different parts of the leaf, while his body is perfectly still at the time.

These creatures throw off their skins many times in their growth, the furrows marking the places where their wings are, and the protuberances made by their cases are always seen, however young they are examined.

In the months of May and June these insects all become winged, and afford a peculiar species of a four-winged fly, which is remarkable for hopping; but as its hinder legs are not greatly larger than the rest, it leaps but a little way at a time. The body of this fly is green, its wings are bordered with yellow, and its legs are white; it has a trunk of the same nature with that of the creature before its winged state, and with this it continues to suck the juices of the leaves of the fig-tree as it did before.

The manner in which these animals propagate their spe-

cies is not yet known. The pucerons, to which they more approach in figure than to any other animals, have always young ones found within them; but these, if examined in whatever state, never have any such appearance, not even so much as eggs being found in them; it should seem that their eggs are too minute for our inspection, but that they are oviparous, not viviparous animals. Reaumur's Hist. vol. vi. p. 98.

FIG-shell. See DOLIUM.

FIG-tree cloth of *Otabeite*, in the South sea, is a coarse and harsh cloth, of the colour of the darkest brown paper, made of the bark of a tree which resembles the wild fig-tree of the West Indies. This cloth has the quality of resisting water; and the greater part of it is perfumed, and worn by the chiefs as a morning dress. For the method of manufacturing and colouring this cloth, see AOUTA. Hawkefworth's Voyage. vol. ii. p. 210, &c.

FIG-wort *Worm*, in *Natural History*, the name of an insect which feeds on the leaves of the scrophularia, or fig-wort, and which is usually esteemed a caterpillar, but is one of those insects called by the French *sausse chenilles*.

FIG-eater, in *Ornithology*, a name given by Albinus and Latham to the *MOTACILLA navia*, which see.

FIGALO, CAPE, in *Geography*, a cape on the coast of Epire, at the entrance of the gulf of Arta. N. lat. 39° 20'. E. long. 20° 34'.

FIGARUOLO, an island in the gulf of Venice, near the coast of Istria. N. lat. 45° 10'. E. long. 13° 43'.—Also, a town of Italy, in the department of the Lower Po; 13 miles N.W. of Ferrara.

FIGEAC, a town of France, and principal place of a district, in the department of the Lot, seated on the Selle; 46 miles N. E. of Montauban. The place contains 6452, and the two cantons 23,800 inhabitants, distributed on a territory of 275 kilometres, in 23 communes. This was originally a Benedictine abbey, founded by Pepin, A. D. 755, and secularized by Paul III. It was formerly a place of some strength, but falling into the hands of the king, during the religious war, A. D. 1612, its citadel and fortifications were demolished. N. lat. 44° 37'. E. long. 2° 8'.

FIGER, or FISJU, a rich and extensive province of Japan, on the W. coast of Ximo.

FIGGING, in the *Mange*, a kind of cant term among dealers in horses for thrusting "a corn" (as they call it) of ginger into the fundament of a horse, or vagina of a mare, at the time of their being led out for show, for the purpose of producing irritation, and causing them to lift up the tail. The London dealers, it is said, are in general so much in the habit of recurring to this artifice, that they permit no servant to shew a horse without having previously figged him, under a certain forfeit.

FIGHIG, in *Geography*, a town of Africa, situated on the south side of the Atlas, in the country of Biledalgerid. The women manufacture woollen cloth of exquisite fineness, much valued in Barbary, and sold at a high price. The inhabitants carry on a great trade with Fez and Morocco, and with the negroes: 240 miles E. S. E. of Mequinez. N. lat. 32° 5'. W. long. 1° 5'.

FIGHT. See BATTLE and ENGAGEMENT.

FIGHTS, in a *Ship*, are the wattle-cloths which hang round about her in a fight, to hinder the men from being seen by the enemy.

FIGHTS, *Cloze*, denote those bulkheads afore or abaft the ship, which are put up for men to stand secure behind, and fire on the enemy, in case of boarding. See CLOSE.

FIGHTS,

FIGHTS, *Running*, at *Sea*, those where the enemy do not stand the battle, but are continually chased.

FIGHTING, in the *Military Art*. Under the head of **ENGAGEMENT** we have given a description of the ordinary occurrences in both military and naval warfare, and we have endeavoured to give a popular idea of those fluctuations which must ever be expected to attend every contest, even where the superior numbers of one party should seem to threaten the other with complete destruction. We shall, in this place, add, that every circumstance tends to render the conclusion of a fight the most awful and most decisive. The cannonade, which generally ushers in the conflict, is rarely very destructive, though, as approximation takes place, and that case or grape-shot are substituted for round-shot, the carnage is certainly increased beyond all proportion. It is nevertheless curious to observe, that even in those late battles in the neighbourhood of Vienna, wherein not less than 800 pieces of ordnance, and full 250,000 men were engaged, for at least 30 hours, in which it is asserted the Austrians alone discharged more than 3,000,000 of musket ammunition, the killed and wounded (setting the prisoners apart) did not amount to 80,000 men. Consequently not one in forty of the latter took effect; even if we suppose the vast trains of artillery attached to both armies to have remained inactive. But when we consider that a very large portion, commonly two-thirds of the whole number killed and wounded, are struck with cannon-shot of some description, and that of the remainder many are wounded by the bayonet only, we must feel our astonishment excited to the highest pitch at the comparative insignificance of musketry. Such, however, is the fact.

Bush-fighting, which relates to a more desultory and secret mode of opposition, is far more destructive. In this, each individual acts independently as a rifle-man; he conceals himself under banks, behind trees and bushes, and either fires at the enemy, or assails him with the bayonet, or sword in hand, according as circumstances may demand, the great art being to destroy without being seen. To this kind of hostility all uncivilized nations at first resort, using spears, slings, swords, and clubs of various descriptions, and particularly using their bows with great dexterity. In general, regular troops are not much employed in bush-fighting, except in close countries, where banditti-harbour, and especially when popular insurrections take place. It is a species of service very trying both to the courage and the constitution, and though even performed in the highest style by our gallant soldiers, is considered by them as a most arduous and hazardous duty.

Prize-fighting, however much it may be upheld by amateurs, as conducive to the support of a certain kind of courage among the lower classes, cannot be noticed by the more enlightened, as teeming with barbarity, and often with the most wanton acts of cruelty. The man who, merely for pastime, or as a speculation, can encourage two of his fellow-creatures to enter the lists, and to do all in their power to maim, or even to murder each other, must in his heart be a complete ruffian. That every individual should, in these days, be able to defend himself, will not be denied; but, in admitting thus much, we pass a most severe censure on the dispositions of those who are too often indiscriminately termed peaceable citizens, and who, we are apt to think, if less induced by a certain kind of emulation, towards which prize-fighting greatly contributes, might perform their several duties in life, and pass each other in the streets without either provoking others, or pretending to have received insults from others of a more praise-worthy disposition.

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Without attempting to enter on their merits in other respects, as we reserve ourselves for a full exposition of their principles in its proper place, we cannot refrain from remarking that the possibility, as well as the good policy, of refraining from blows, is conspicuously proved by that class of dissenters generally called quakers.

FIGHTING ISLAND, in *Geography*, called by the French "Grose île aux Dindes," lies about four miles below *Detroit* (which see); it is valuable for pasture, but has very little wood. In the summer the Indians make it a place of encampment, and some of them plant a little corn.

FIGHTWITE, **ΦΙΤΗΩΙΤΑ**, in the Saxon times, signified a mulct for making a quarrel, to the disturbance of the peace. "Mulcta ob commissam pugnam in perturbationem pacis, quæ in exercitu regis 10 solidorum erat." Blount and Jacob, in transcribing this passage, have inserted 120 sols.

FIGI, in *Geography*, a town of Japan, in the island of Ximo; 10 miles N. E. of Funai.

FIGIN, a river of Norway, which runs into the North sea, 10 miles S. of Stavanger.

FIGLINÆ, in *Ancient Geography*, a town of Gallia Narbonnensis, marked in the Itinerary of Antonine between Valence and Vienne.—Also, a town of Gaul, belonging to the Allobroges, situated upon the left of the Rhone.

FIGMAN, in *Geography*, a town of France, in the department of the Upper Garonne; 7 miles N. N. W. of Toulouse.

FIG-TREE BAY, a bay on the N. E. coast of the island of Jamaica. N. lat. 18° 18'. W. long. 76° 29'.—Also, a bay on the W. coast of the island of St. Christopher, near Sindy Point.

FIGUERAS, a town of Spain, in Catalonia, containing 4640 inhabitants, where the Spaniards, in 1786, began to erect a fortress, which they designed should be impregnable. It was to contain quarters for 150 companies of infantry, with 500 horse, apartments for 60 officers, with suitable accommodations; one long range of magazines for provisions, and four for powder. The works were made bomb-proof. The glacis is for the most part formed of the rock, and the whole is protected by proper bastions. It is said that 12,000 men are sufficient to defend these works. Nevertheless, the place was taken by the French in 1794; three leagues from Janquera, and seven from Gerona. The adjacent country is agreeable; the hills are shaded with evergreen woods; the plains are well cultivated, and divided by hedges of aloes and wild pomegranate. The road from hence to Gerona is diversified with gentle eminences and fruitful plains. Two of these hills exhibit some volcanic appearances.

FIGUERO-DOS-VINHOS, a town of Portugal, in the province of Estremadura, situated near some lofty mountains, on a small river, which runs into the *Zezere*; celebrated for its wine: 20 miles north of Thomar.

FIGURA, in *Musick*. See **FIGURE**.

FIGURAL, or **FIGURATE numbers**, such as do or may represent some geometrical figure, in relation to which they are always considered; as triangular, pentagonal, pyramidal, &c. numbers. See **NUMBERS**.

FIGURATE, or **FIGURATIVE**, that which has a relation to figure, or that teaches under some obscure resemblance. Thus a figurative style is that which abounds in figures. (See **FIGURE** and **STYLE**.) The figurative style, F. Bouhours observes, is neither the most just, nor the best. For this reason Cicero directs us to the ancients, who not having yet bethought themselves to use figurative expressions,

but keeping to the most proper and natural way, have almost all wrote well. "Sunt enim illi veteres, qui nondum ornare poterant ea, quæ dicebant, omnes prope præclare locuti."

Long use, say the grammarians, renders that proper in all languages, which at first was figurative. The same thoughts appear more lively when expressed by a figure, than when in simple terms. The reason is, that figurative expressions denote not only the principal matter, but also the emotion and passion of the person who speaks.

FIGURATIVE is also much used in speaking of the mysteries and figures of the old law. In this sense manna is said to be figurative of the eucharist.

FIGURATIVE is also used in the Greek grammar for what we otherwise call characteristic, *viz.* a letter that characterizes certain tenses of the Greek verbs; or that distinguishes and specifies them.

In the first conjugation of the barytonous verbs, the ϕ is characteristic, or figurative of the præter tense, and the ψ of the future.

FIGURATIVE, or *Figurative counter-point*, in *Music*, is that wherein there is a mixture of discords along with the concords. See COUNTER-POINT and SUPPOSITION.

Where the discords are used as a solid and substantial part of the harmony, the counter-point is properly called the harmony of discord.

FIGURE, FIGURA, in a general sense, denotes the surface of terminating extremes of a body.

All bodies have some figure; whence figurability is generally ranked among the essential properties of body or matter. A body without figure would be an infinite body.

The corpuscular philosophers account for every thing from the figure, bulks, and motions of the atoms, or primary corpuscles of bodies.

For the figure of bodies, considered as objects of sight, see VISION.

The schoolmen dispute whether or no the quality of figure be the same with that of form; and if they differ, what it is that constitutes the difference? Boëthius will have figure only predicated of inanimate bodies, and form of animate. Others extend figure to all natural things, and form to all artificial ones; whence the verse,

"Formam viventis, picti dic esse figuram."

Others apply figure indifferently to all kinds of bodies, but not in all relations. If only the bare circumference, or circumscription, be considered, they call it figure; but if the circumference be considered as endowed with colour, they then call it *form*, which see.

FIGURE of the *Earth and Planets*.—This subject has been so fully treated under DEGREE and EARTH, that very little remains to be said in this place. The general spherical form of the earth seems to have been known in ages of the most remote antiquity, but this knowledge was often confined only to philosophers and mathematicians, during the middle ages, the doctrine was even disputed, and the spherical figure denied by some of the fathers of the church; and it is only since the revival of learning in modern Europe that it has been universally received and acknowledged by every class of people. It is now nearly 100 years, that the first mathematicians of Europe have directed their particular attention to the exact determination of the real figure of the earth; an historical account of these labours, and of the result obtained from them has already been given under the articles above mentioned. Since these were written, the measurement of the arc of the meridian has been continued in our own country, and our continental neighbours have

likewise occasionally published some additional documents, relative to their great survey. Nothing however has occurred to alter any of the principal results which we have given; every thing seems to confirm the opinion, that though the mean figure of the earth approaches very nearly to the spheroid, whose ellipticity is $\frac{1}{230}$, yet that the irregularities in the densities of the different masses are very great, so as to render all the partial measurements entirely unsatisfactory. Europe, in general, appears to be much flatter than accords with the general form; other parts of the globe mult of course be more protuberant; but observations are still wanting to enable us to pronounce in what manner these irregularities are distributed, so as to compensate each other; nor can we flatter ourselves this question will soon be determined, considering the uncivilized state of the great portion of the globe, compared with that requisite to conduct the operations necessary for these investigations. It appears that the project, once entertained, of determining the exact difference of latitude and longitude by geodetical measurement, must now be abandoned, or at least confined to very small tracts of country, as the errors of astronomical observation, when well conducted with perfect instruments, are less than those which arise from the irregularity of the earth's figure. This observation, however, only applies to particular cases, where extreme accuracy is required; for, in general, the situation of places, determined by national survey, is always extremely near the truth, and the limits of error may almost always be known. Our knowledge of the natural history of the earth has not yet been very materially improved by the investigations which have been made relative to its figure. It does not appear that the earth has ever been in a state of entire fusion or fluidity, for then it would probably have taken a more regular figure; yet it approaches much nearer to the figure assigned by theory than could have arisen from the crumbling of its solid particles, as some have supposed. This intermediate state seems consistent with the information derived from our chemical knowledge, and other sources of information. Though a satisfactory solution of these difficulties is at present beyond our reach, yet science is advancing towards this object with rapid strides, and many years will not probably elapse before the mystery is removed, that at present obstructs our researches into the original nature and conformation of the earth.

FIGURE of the *Planets*. See the planets respectively.

FIGURES, in *Architecture* and *Sculpture*, denote representations of things made in solid matters; such as statues, &c. Thus we say, figures of brass, of marble, of stucco, of plaster, &c.

But, in this sense, too, the term is more usually applied to human representations than to other things. Thus we say, an æquelrian figure, for a man on horseback.

Daviler observes, that those, either represented sitting, as popes, &c. or kneeling, as on monuments, &c. or laid all along, as rivers, &c. are more properly called figures than statues.

FIGURES, in *Architecture*, are said to be detached, when they stand singly, in opposition to those compositions which are called *groupes*.

FIGURES, in *Arithmetic*, are the numeral characters; or the characters whereby numbers are expressed, or written.

Thus the number of four hundred and fifty is written, or expressed, by three figures, 450.

The figures in arithmetic are the nine digits; 1, 2, 3, 4, 5, 6, 7, 8, 9, and 0.

These figures were first brought into Europe by the Moors

FIGURE.

of Spain, and into England, as Dr. Wallis apprehends, about 1130. See ARITHMETIC and CHARACTER.

However, from some ancient dates, supposed to consist wholly or in part of Arabian figures, some have concluded, that these figures originally Indian, were known and used in this country at least as early as the tenth century. The most ancient date discovered by Dr. Wallis was that on a chimney-piece at Helmdon, in Northamptonshire, M 133, *i. e.* 1133. Other dates discovered since, are 1090, at Colchester, in Essex; 1016, with the Roman M for a thousand, at Widgel-Hall, near Buntingford, in Hertfordshire; 1011 on the north front of the parish-church of Rumsley in Hampshire; and 975 over a gate-way at Worcester. Dr. Ward has urged several objections against the antiquity of these dates. As no example occurs of the use of these figures in any ancient manuscript, earlier than some copies of Johannes de Sacro Bosco, who died in 1256, he thinks it strange, that workmen should have made use of these figures so long before they appear in the writings of the learned; and he also disputes the fact. The Helmdon date, according to him, should be 1233; the Colchester date 1490; that at Widgel-hall has in it no Arabian figures, the *i* and *6* being *I* and *G*, the initial letters of a name; and the date at Worcester, he supposes to consist of Roman numerals, and to be really MXV. Martyn's Abridg. of Phil. Transf. vol. ix. p. 420, &c.

FIGURE, in *Astrology*, a description, or draught, of the state and disposition of the heavens, at a certain hour; containing the places of the planets and stars, marked down in a figure of twelve triangles, called *houses*.

This is also called a *horoscope* and *theme*.

FIGURE of an *Eclipse*, in *Astronomy*, denotes a representation of the path or orbit of the sun, and the moon, during the time of the eclipse, upon paper; with the number of digits eclipsed, and the beginning, middle, and end, of darkness. See ECLIPSE.

FIGURE, or *Delineation*, of the full moon, such as viewed through a telescope with two convex glasses, is of considerable use in observations of eclipses, and conjunctions of the moon with other luminaries. In this figure of the moon are represented the maculae, or spots, of the moon, marked by numbers; beginning with the spots, which usually enter first within the shade at the time of the great eclipses, and also emerge the first.

FIGURE, in *Conics*, denotes the rectangle made under the latus rectum and transversum, in the hyperbola and ellipsis.

FIGURE of the *Diameter*. The rectangle under any diameter, and its proper parameter, is in the ellipsis and hyperbola, called the figure of that diameter.

FIGURES of *Plants*, since botany became a study, have come into general use to promote a knowledge of the various species and genera of the vegetable kingdom. The oldest drawings of plants of which we have any knowledge, are in a manuscript of Dioscorides, in the Imperial library at Vienna, of which we have already given an account. (See DIOSCORIDES.) These are supposed to be as ancient as the third century of the Christian era, and serve at least to shew what was understood concerning the plants of this writer at that period. After the invention of printing, figures of plants were very soon introduced into botanical or medical books, and were at first cut on wooden blocks, and printed in the pages of letter-press. Fabius Columna, in his *Phytobasanos*, published at Naples in 1592, gave the first copper plates of plants. We know not exactly how soon the practice began of colouring the figures in books; but from some copies of Dorstenius and Tragus in our pos-

session, it appears to have been usual about the middle of the 16th century. The above-mentioned drawings at Vienna are coloured, but in the rudest possible style. Engravings in botanical books were not coloured till the early part of the 17th century. Bessler's *Hortus Eysellensis*, published in 1613, was perhaps one of the earliest; but it is always difficult to say whether such works were actually published coloured, or whether, as often happened, they were painted subsequently by some of their possessors. All these old works were painted by hand, and not printed in colours. This last method was first introduced, we believe, by the late professor Martyn, in his splendid *Historia Plantarum rariorum*, published at London in 1728, the drawings of which came from no hands a hand than Van Houfsum. But the execution of the plates in mezzotinto, and the colouring, are far inferior to the apparent merit of the drawings. The French at present excel in this art of printing in colours, as may be seen by the exquisite publications of Redouté and Ventenat, not to mention others of birds and quadrupeds. Bulliard led the way in his *Herbier de la France*, which is now far excelled by other similar works in this respect.—Nor are the French less eminent at present in their engraved uncoloured botanical figures. Some admirable performances of this kind appeared in the reign of Louis XIV. In our days the works of l'Heritier have justly been admired, and are now even excelled.

In Germany and England the greater part of botanical plates are slight engravings, coloured by the hand, though some of Dr. Thornton's figures, and those very well executed, are printed in colours. The German figures are usually altogether deficient in picturesque beauty, or colouring, properly so called, but are expressive, and tolerably cheap, so as to be useful to the science. This however can only be said of their best works, some, the second-rate, though popular, ones, being coloured not much unlike the varnished Dutch toys seen at a fair. On the other hand, Germany has produced some exquisitely delicate botanical works in colours, as the *Planta Lichenose* of Hoffmann, and the cryptogamic works of Schrader and others.

It is much to be wished that the public were not burthened with repetitions of the same plant over and over again, at least by authors who publicly profess to publish new ones only. In books destined to exhibit the entire plants of any one country, or exclusively the exotic plants of any particular garden or gardens, such a scheme being avowed, there is no imposition. But still the most valuable and respectable are such as figure only entirely new plants, or at most what are badly or erroneously figured before. If this were attended to, the representations of all known plants might in time be accessible somewhere or other. However perfect the science of botanical definition may have become, few writers are competent to keep it up to its highest standard, who yet may be able to speak to the eyes by a picture. No painting indeed, however excellent, ought to supersede, or be unaccompanied by, descriptions and definitions, which alone render botany a science; for who can argue from a picture? Language is the current coin of rational beings. Nevertheless, the two modes of instruction may advantageously go hand in hand. If every known plant were to be found delineated in some work or other, the study of botany would be much facilitated, and even such an attempt as that of Schkuhr of Wittenberg, to furnish an universal set of botanical figures in as compendious a form as possible, merits great praise, though it may be doubted whether the rude colouring of such a work adds any thing to its value, though unfortunately too much to its price. It has often been remarked that the uncoloured wooden outlines of

FIGURE.

Brumfelsius, Fuchsius, and a few here and there in other authors, express the plants intended better than many finished plates. Hence outlines of Plumier and other botanists have been published in imitation, but none come near the merit of their prototypes. The truth is, that to make one of those admirable outlines, requires the skill of a first-rate painter, if not a spark of the genius of a Grecian statuary. Hence they are likely to remain unrivalled, as they have hitherto been. Of exquisite precision, without that sublime degree of art, Leers's figures of grasses in his *Flora Herborenfis* are matchless examples.

Some persons have attempted, and even published, figures made by an impression taken from the dried plant with printer's ink on paper. These might be supposed likely to prove peculiarly accurate, but they generally fail in execution. They may indeed give the unnatural stiff outline of a dried specimen, but the prominent parts of the surface being necessarily what give the darkest impression, they of course totally mislead the eye, and all but the most slender and expanded subjects produce a mass of confusion and deformity.

As we are on the subject of figures of plants, we beg leave to correct an error in our account of *DORÆNA japonica*. A plate of that shrub is extant in Thunberg's *Icones Pl. Japonicarum*, dec. 3, a work which however indifferently executed, ranks very high for the originality and rarity of its contents. S.

FIGURE, in *Dancing*, denotes the several steps which the dancers make in order and cadence; considered as they mark certain figures on the floor.

FIGURES, in *Fencing*, are the divers guards, postures, attitudes, or dispositions, of the body, arm, or sword. See FENCING.

FIGURE, in *Fortification*, is the plan of any fortified place; or the interior polygon, &c.

When the side and angles are equal, it is called a *regular*; when unequal, an *irregular figure*.

FIGURE, in *Geometry*, is applied to the extremes of points, lines, or numbers, thrown or cast at random: on the combinations or variations whereof the sages of this art found their fantastical divinations.

FIGURE, in *Geometry*, denotes a surface inclosed, or circumscribed with one or more lines.

Such are triangles, squares, polygons, circles, ellipses, &c.

Wolfius defines figure a continuum terminated by a perimeter. In which sense figure is applicable both to superficies and solids. In the former case, the perimeter is of lines; in the second, of surfaces.

Figures are either rectilinear, curvilinear, or mixt, according as the perimeter consists of right lines, curve lines, or both.

The superficial parts of a figure are called its *sides*; the lowest side, its *base*; and the angle opposite to the base, the *vertex*.

The height of a figure is the distance of the vertex from the base.

FIGURE, in *Grammar*, is an expression that deviates from the common and natural rules of grammar; either for the sake of elegance or brevity.

The best grammarians only reckon four figures; the ellipsis, pleonasm, syllepsis, and hyperbaton. Others add two more; *viz.* antiptosis, and enallage.

FIGURE, in *Heraldry*, a bearing in a shield. Of these figures there is almost an infinite variety: some are natural; such as the celestial figures of the sun, moon, stars, &c. and their parts; the effigies of men, women, &c. and their

parts: animals, as lions, stags, foxes, boars, &c. and their parts; birds, as eagles, swans, storks, pelicans, &c. and their parts; fishes, as dolphins, whales, sturgeons, trouts, &c. and their parts; reptiles, and insects, as tortoises, serpents, grasshoppers, &c. and their parts; vegetables, as trees, plants, flowers, herbs, &c. and their parts; and stones, as diamonds, rubies, pebbles, rocks, &c. These charges, as well as ordinaries, have divers attributes or epithets, which express their qualities, positions, and disposition. Thus, the sun is said to be *in his glory, eclipsed*, &c. the moon *in the complement, in crescent*, &c. Animals are said to be *rampant, passive*, &c. Birds have also their denominations; fishes are described to be *auriant, naiant*, &c. Besides these natural figures, there are also artificial figures; the principal of which are warlike instruments, as swords, arrows, battering rams, gauntlets, helmets, spears, pole-axes; ornaments used in royal and religious ceremonies, as crowns, coronets, mitres, wreaths, croziers; towers, castles, arches, columns, plummets, battlements, churches, portcullis, borrowed from architecture and fortification; and ships, anchors, rudders, pendants, sails, oars, masts, flags, gallies, lighters, &c. derived from navigation; all these bearings have different epithets denoting their position, structure, &c.

There are likewise chimerical or imaginary figures used in heraldry, that are the result of fancy and caprice; such as centaurs, hydras, phoenixes, griffons, dragons, &c. Pory's *Elem. Herald.* p. 132, &c. 172, &c.

FIGURE, in *Logic*, denotes a certain disposition of the terms of a syllogism; particularly of the medium, with regard to the extremes.

Hence it follows, that there are as many figures of syllogisms, as there are different connections of the extremes with the medium; so that, though the schoolmen ordinarily only reckon three, yet a fourth might be admitted.

In the *first* figure the medium or middle term is the subject of the major proposition, and the predicate of the minor. This contains four moods, and applies to the proof of all sorts of questions, whether universal or particular, affirmative or negative. In the *second* figure the middle term is the predicate of both the premisses, and this contains four moods, admitting only of negative conclusions. The *third* figure requires that the middle term be the subject of both the premisses, and has six moods, admitting only of particular conclusions. The special rules of these three figures are the following: in the first, the major proposition must always be universal, and the minor affirmative; in the second also the major must be universal; and one of the premisses, together with the conclusion, must be negative; in the third figure the minor must be affirmative, and the conclusion always particular.

In the *fourth* figure, called by the Peripatetics the *indirecte*, and by others the *Galenic* figure, as varying too much from the natural form, the middle term is predicated in the major proposition, and subjected in the minor. Some logicians will allow this to be nothing else but a mere inversion of the *first* figure. It has five moods. Watts's *Logic*, part iii. chap. 2. § 3.

FIGURE, in the *Manufactures*, is applied to the various designs represented or wrought on velvets, damasks, taffeties, sattins, and other stuffs and cloths.

The most usual figures for such designs are flowers, imitated from the life; or grotesques, and compartments of pure fancy. Representations of men, beasts, birds, and landscapes, have only been introduced since the taste for the

Chinese

FIGURE.

Chinese stuffs, particularly those called *furces*, began to prevail among us.

It is the woof of the stuff that forms the figures; the warp only serves for the ground. In working figured stuffs, there is required a person to shew the workman how far he must raise the threads of the warp, to represent the figure of the design with the woof, which is to be passed across the threads thus raised. This some call *reading the design*, which see.

For the figures on *tapestry, brocade, &c.* See TAPESTRY, &c.

For those given by the *calenders, printers, &c.* See CALENDER, &c.

FIGURE, in *Music*. In general, figure includes all the characters used in music to express sounds, their place in the scale, with their duration and equivalent rests: whence *contrappunto figurato*, to distinguish it from *contrappunto semplice*, plain counterpoint, which Zarlino defines common chords of note against note, all of the same length, and without discords. Figurative harmony, sometimes called florid counterpoint, is that in which the chords are broken into melody, and expressed by figures or notes of different lengths. See TIME-TABLE.

FIGURE, *Mute*; mute figures, in Italian music, imply rests, or characters denoting silence.

FIGURE, *Apparent*, in *Optics*, that figure, or shape, which an object appears under when viewed at a distance, being often very different from the true figure; for a straight line viewed at a distance may appear but as a point; a surface as a line; and a solid as a surface: and each of these of different magnitudes, and the two last of different figures, according to their situation with regard to the eye. Thus an arch of a circle may appear a straight line; a square or oblong, a trapezium, or even a triangle; a circle, an ellipsis; angular magnitudes, round; a sphere, a circle, &c.

Also any small light, as a candle seen at a distance in the dark, will appear magnified, and farther off than really it is. Add to this, that if several objects are seen at a distance, under angles that are so small as to be insensible, as well as each of the angles subtended by any one of them, and that next to it; then all these objects will appear not only to be contiguous, but to constitute and seem but one continued magnitude.

FIGURE, in *Painting and Sculpture*, is used to signify the form, the contour, or outline of the surface of bodies of whatever kind they may be. In conformity with this, we speak of a drawing, as representing the figure of a tree, a house, a book, a horse, &c. &c. And in sculpture we speak of figures of bronze, of marble, of plaster, &c. As however man is the principal subject on which artists who pursue the study of the higher branches of these arts are called to exert their talents, the *human form* is therefore by way of pre-eminence called the *figure*.

A picture wherein the representation is given of a great number of men, women, or children, is said to be full of figures. On the contrary, a landscape wherein there is only the representation of mountains, trees, &c. and not of human beings, is said to be without figures. For further illustration see HUMAN figure.

FIGURE, is also applied to representations, or images of things in prints, &c.

Some readers chuse to have the figures, especially the mathematical ones, in wood, for the convenience of having them immediately annexed to the matter they refer to: others rather chuse to be at the pains of turning over, and having recourse to another part of the book, that they may have the figures more neat and accurate on copper.

The author of a collection of dissertations, printed at Paris in 1715, shews, in the first dissertation on the Hebrew medals, p. 66, that the Jews were allowed to make any kind of figures, or images of trees, plants, buildings, flowers, &c. but not those of animals, or of the sun, moon, and stars.

FIGURES, *Brimstone*. See BRIMSTONE.

FIGURES, *Casting of*. See CASTING.

FIGURE *Circumscribed*, and *Inscribed*. See CIRCUMSCRIBING, and INSCRIBED.

FIGURES, *Equal*. See EQUAL.

FIGURE, *Equilateral*. See EQUILATERAL.

FIGURES, *Plain*. See PLAIN.

FIGURE, *Regular*, and *Irregular*. See REGULAR and IRREGULAR.

FIGURE, *Similar*. See SIMILAR.

FIGURE, in *Rhetoric*, is a phrase, or turn of speech or discourse, more beautiful and emphatical than what is used in common or ordinary speaking. Accordingly it implies some departure from simplicity of expression; but at the same time this deviation from what may be reckoned the most simple form of speech, by no means supposes any thing uncommon or unnatural; the case is so far otherwise, that, on many occasions, figures are the most natural, and the most common method of uttering our sentiments. Nor should it be imagined that every alteration from the common manner ought to be esteemed a figure, or deserving of that character. It must contain some beauty, or express some passion, to merit a place among rhetorical figures, and be marked out for imitation.

Figures, by the Greeks called *σχηματα*, *schemata*, are the enrichments of discourse, and we only use them when raised and moved with the consideration of something extraordinary.

The term *figure*, as Dr. Ward observes, seems to have been borrowed from the stage, where the different habits and gestures of the actors, suitable to the several characters they sustained, were by the Greeks called *σχηματα*, and by the Latins *figure*. Nor is it unusual with us to say of a person, both with respect to his dress and actions, that he makes a very bad, or a very graceful figure. And as language is the dress, as it were, of our thoughts, in which they appear and are represented to others; so any particular manner of speaking may, in a larger sense of the word, be called its figure, in which latitude orators sometimes use it (see Cic. De Orat. l. iii. c. 52.); but rhetoricians have restrained the sense of the word to such forms of speech, as differ from the more common and ordinary ways of expression; as the theatrical habits of actors, and their deportment on the stage, are different from their usual garb and behaviour at other times. Or, as the figure or shape of one body distinguishes it from another, so figures are forms of speech, having, each of them, a cast or turn peculiar to itself, which both distinguishes it from the rest, and distinguishes it from simple expression. Simple expression just makes our ideas known to others; but figurative language, more than this, bestows a particular dress upon that idea; a dress which both makes it to be remarked, and adorns it.

Some have erroneously imagined, that figures of speech should be classed among its chief ornaments not invented till language had advanced to its later period, and mankind were brought into a polished state; and that, then, they were devised by orators and rhetoricians. Whereas the contrary to this is the truth. Mankind never employed so many figures of speech, as when they had hardly any words for expressing their meaning. For, first, the want of proper names for every object, obliged them to use one name for many; and, of course, to express themselves by comparisons, metaphors, allusions, and all those substituted forms of
speech

FIGURE.

speech which render language figurative. Next, as the objects with which they were most conversant were the sensible, material objects around them, names would be given to those objects long before words were invented for signifying the dispositions of the mind, or any sort of moral and intellectual ideas. Hence, the early language of men being entirely made up of words descriptive of sensible objects, it became, of necessity, extremely metaphorical. For to signify any desire or passion, or any act or feeling of the mind, they had no precise expression which was appropriated to that purpose; but were under a necessity of pairing the emotion or passion which they felt by allusion to those sensible objects which had most relation to it, and which could render it, in some sort, visible to others. Other circumstances, also, besides necessity, contributed to the use of this figured style at the commencement of language. In the infancy of all societies, men are much under the dominion of imagination and passion; every thing will appear new and strange to them; fear and surprise will be their prevalent passions; and their language will necessarily partake of this character of their minds; they will incline to exaggeration and hyperbole; and they will be apt to describe every thing with the strongest colours and most vehement expressions. Besides, wherever strong exclamations, tones, and gestures blend themselves much with conversation, the imagination is always more exercised, and a greater effort of fancy or passion is excited, consequently the fancy kept awake, and rendered more sprightly by this mode of utterance, operates upon style and enlivens it more. Facts might be easily cited in confirmation of these reasonings.

Figures, in general, may be described to be that language which is prompted either by the imagination or the passions. Rhetoricians have commonly divided them into two great classes; *viz.* figures of words, and figures of thought. The former are generally called tropes, and consist in a word's being employed to signify something that is different from its original and primitive meaning; so that if you alter the word, you destroy the figure. Some writers, however, have distinguished between figures and tropes. (See *TROPE.*) Figures of thought suppose the words to be used in their proper and literal meaning, and the figure to consist in the turn of the thought; as is the case in exclamations, interrogations, apostrophes, and comparisons: with respect to which, though you vary the words that are used, or translate them from one language into another, you may, nevertheless, still preserve the same figure in the thought. Other rhetoricians have distributed figures into the following two kinds, differing less in sense than expression from the former; the one of *sentences*, and maintained in the sense itself, without any immediate dependance on any particular words; the other are only in the words themselves. As to *FIGURES of sentences*, some are principally adapted for reasoning and instruction, and others to move the passions, and hence figures have been called the "language of the passions."

Among the ancients, Demosthenes is most celebrated for expressing the force and energy of these figures, and Isocrates excelled in the beauties and delicacies of verbal figures.

Cicero lays so great stress on these figures, that he represents them as the brightest parts of oratory; and makes the power and efficacy of the art to depend in a great measure on a thorough knowledge and application of them.

Of the first kind, and of those that are principally adapted for reasoning, the most considerable are six; *viz.* PROLEPSIS, or *anticipation*; HYPOBOLE, or *subjection*; ANACONOSIS, or *communication*; EPITROPE, or *CONCESSION*; PARABOLE, or *SMILITUDE*; and ANTITHESIS, or *opposition*.

Those of the second kind, or such as are fitted for moving and influencing the passions, are EPANORRHOSIS, or *correction*; PARALEPSIS, or *omission*; PARRHESIA, or *reprehension*; APARITHNESIS, or *enumeration*; ENERGASIA, or *expansion*; HYPOTYPOSIS, or *imagery*; APORIA, or *doubt*; APOSIOPESIS, or *concealment*; EROTESIS, or *INTERROGATION*; ECPHONESIS, or *EXCLAMATION*; EPIPHONEMA, or *acclamation*; APOSTROPHE, or *address*; PRONOMOPEIA, or *the fiction of a person*. See each under its proper head.

Of *FIGURES of words*, some are tropes, i. e. translations of words from their proper signification, to some more remote and extraordinary one. See *TROPE*.

Others are *figures of words*, more properly so called, and not tropes; being so inherent in the words, that upon changing of the words, or sometimes only their situation, the figure is destroyed: as in *amantes jam amant*, where the figure would be lost, if instead of *amantes* you should put *liberi*.

Thus also, *to lose all rests of life, is in effect to lose life*; the figure is lost by changing the order of the words; as, *to lose all rests of life, is to lose life in effect*.

The principal of these verbal figures may be arranged into three classes; such as consist in a deficiency of words, in a redundancy, or a repetition. To the first class belong the ELLIPSIS and ASYNDTON. Under the second division are comprehended the PLEONASMUS and POLYSYNDETON. The third kind of verbal figures includes those by which the same word in sound, or sense, is repeated; or one of a like sound or signification, or both. Of the first sort in this division there are ten, called ANIACLASIS, PLOCI, EPIZEUXIS, CLIMAX, ANAPHORA, EPISTROPHE, SYMPOLOS, EPANALYSIS, ANADIPLOSIS, and EPANODOS. To the second class belong the PARONOMASIA, the HOMOIOPHONON, the SYNONYMIA, and DERIVATIO; the two first of which respect words that are similar in sound only, the third in sense, and the last in both.

With regard to the proper use of figures, we may observe, that they should always be accommodated to the sentiments, and rise in proportion to the images designed to be conveyed by them; it is also better, in general, to be nervous than copious, that the images, by their closer union, may impress the mind with greater energy, though in such figures as are designed for ornament or illustration, a more diffusive way of painting is sometimes agreeable. The too frequent use of figures should be avoided; and they should be so interwoven in a discourse as not to render the style rough and uneven, sometimes high and at other times low; now dry and jejune, then pompous and florid. In every case they should seem to rise more from nature than art, to offer themselves rather than to be the effect of study. Finally, it should be duly considered, that neither all the beauties, nor even the chief beauties of composition, depend upon tropes and figures. For a further account of the use and effects of figures on language, see *STYLE*. See also *METAPHOR*, and each of the articles above noted. Ward's *Orat. Lect.* 30, 31, 32, 33, 34. Blair's *Lect.* vol. i. ii.

FIGURES of Prose comprehend the SYNALEPHA, ECTHIPSIS, CRASIS, SYNÆRESIS, DIÆRESIS, SYSTOLE, and DIASTOLE. See each article.

FIGURE is used, in *Theology*, for the mysteries represented or delivered obscurely to us under certain types or actions in the Old Testament.

Thus, manna is held by some to be a figure or type of the eucharist; and the death of Abel a figure of the suffering of Christ.

Many divines and critics contend, that all the actions, historical,

ories, ceremonies, &c. of the Old Testament, are only figures, types, and prophecies, of what was to happen under the New. The Jews are supposed to have had the figures or shadows, whilst we possess the substance.

FIGURE is also applied in a like sense to prophane matters; as the emblems, enigmas, fables, symbols, and hieroglyphics of the ancients.

FIGURED, in *Heraldry*, is an epithet applied to those bearings which are depicted with a human face.

FIGURED, in the *Manufactures*. A figured camlet, stuff, tabby, &c. is that whereon there are divers designs of flowers, figure, branches, &c. impressed by means of hot irons. Figured ribbands first came into fashion about the year 1680. The method of performance was by successively applying steel plates engraven with divers ornaments, as flowers, birds, grotesques, &c.

But one Chandelier, a ribband-maker of Paris, invented a much better and readier way of doing it, by a machine not unlike the flatter used in coining, to flatten the pieces of metal, only much simpler.

The principal parts thereof were two steel cylinders, engraven with the figures intended to be represented. These cylinders were placed over each other like the rolls of a rolling-press, having each of them, at one of its extremes, a little dented wheel, one of which catching into the other, the whole was put in motion by means of a winch or handle fastened to the first.

The machine thus prepared, the workman heats the cylinders, and places the ribband in the little place remaining between the two, which he contracts yet farther by a screw that presses the upper part down upon the lower; the turning the rolls by the handle, a whole piece of ribband was figured in less time than a single yard could be done in the ordinary way.

FIGURED Velvet. See VELVET.

FIGURED, in *Music*, is an adj. in thorough base, when the harmony of a composition is expressed by figures over the base to denote such sounds as differ from common chords. See CHORDS, THOROUGH Base, and ACCOMPANIMENT.

FIJOGA, in *Geography*, a town of Japan, in the island of Nippon; 45 miles S.W. of Meaco.

FIJIASAKI, or FIROSAKI, a town of Japan, in the island of Nippon; 50 miles N.E. of Achita.

FILABRES, a stupendous mountain of Spain, in Granada, between Moxacer and Guadix, which is a solid block of white marble, without any mixture of stones or earth, about a league in circuit and 2000 feet high; it is flat on the summit, and its front towards the N.W. is about 1000 feet high, and nearly perpendicular.

FILAGO, in *Botany*, from *filum*, thread, and *ago*, to produce, or have to do with, in allusion to the cottony web connected with every part of the plant. Cud-weed.—Linn. Gen. 450. Schreb. 587. Willd. Sp. Pl. v. 3. 2387. Mart. Mill. Dict. v. 2. Juss. 179. (Evax; Gært. t. 165.) Class and order, *Syngenesia Polygamia-necessaria*. Nat. Ord. *Compositae nucamentaceae*, Linn. *Corymbifera*, Juss.

Gen. Ch. Common calyx of numerous, chaffy, imbricated scales, containing several perfect florets in the disk, and numerous female ones in the circumference, among the scales of the calyx. Cor. in the perfect florets funnel-shaped, with a four-cleft upright border; in the female ones, hardly discernible, extremely narrow, cleft at the top. Stam. Filaments in the perfect florets four, capillary, small; anther cylindrical, four-toothed at the top. Pist. Germen most perfect in the female florets, ovate, depressed, rather large; style thread-shaped, stigma acute, cleft. Peric. none, except the permanent calyx. Seeds to the female florets only,

obovate, compressed, small, smooth; down none. Recept. cylindrical, naked, except the permanent scales of the calyx, which separate the seeds.

Fl. Ch. Receptacle cylindrical, clothed with the calyx-scales. Seed-down none. Female florets among the calyx-scales; perfect ones four-cleft, in the disk.

1. *F. pygmaea*. Linn. Sp. Pl. 1311. Cav. Ic. t. 36. (*Gnaphalium umbellatum minus*; Bauh. Hist. v. 3. p. 1. 162. *Evax umbellata*; Gært. v. 2. 393.) Found in the south of Europe, in waste sandy ground, particularly in places occasionally inundated. The root is annual. Stems either entirely wanting, or more or less elevated, solitary or numerous, simple or branched, at most three or four inches high. Whole plant clothed with a white cottony tenacious web. Leaves scattered, obovate or spatulate, entire, many of them surrounding the little heads of flowers in a radiating manner, and making an elegant rosaceous appearance.

Professor Willdenow rightly retains this as the only species of *Filago*, the rest being best referred to *Gnaphalium*. It is also the original one.

FILAMENT, FILAMENTUM, a word though not of classical authority, yet well supported by analogy, is technically applied to the usually slender thread-like part which sustains the anther of a flower; see ANTHEÆ. This part, however, is not essential to all species of flowers, though the anther itself, being the male organ, is so. But the latter in some cases is immediately affixed to the corolla, receptacle, or pistil, on which it is sessile, without any filament.

The filaments differ in number, from one to several hundreds, in different genera, or even species of the same genus, though the latter case is rare. They, however, vary in this respect occasionally, in the same species or individual. They differ also, but vary less, in their insertion, or origin, with respect to other parts of the flower, proceeding either from the receptacle, as in the Poppy; the calyx, as in the Rose; or the corolla, as in the Jasmine. Their form is usually simple, each filament bearing one anther; but in the Orange and St. John's Wort many filaments are united into one, and in most of the Papilionaceous family one filament only is separate, nine others being united from their base almost to the summit. In the natural order of *Rutaceae*, see DIOSMA and ERIOSTEMON, the filaments are more elaborate in structure than usual, being tuberculated and glandular, and sometimes bearing their anthers on a sort of appendage, or pedicle. Indeed the extremity of each filament, in many instances, tapers into a fine flexible point, like an additional stalk, allowing of a free or rotatory motion in the anther; witness the Passion flower, and White Lily. Such flowers are said to have versatile anthers. Filaments are extremely different in proportion, some being prominent far beyond the verge of the blossom, exposing their anthers to the wind and weather, while others lie concealed in the bottom or tube of a flower, carefully protected from wet. Some are long and capillary; others short, broad, or thick.

A very curious circumstance respecting filaments is, that in some instances they appear endued with a spontaneous motion, as in *Ruta* (Rut.) *Saxifraga* and *Parnassia*. In these flowers the filaments bend in their turn over the stigma, that the anthers may more certainly drop their pollen upon it, and subsequently retire. In the Barbary blossom the same thing is accomplished by an exquisite irritability in the inner side of each filament at the bottom, in consequence of which it contracts when touched, scattering the pollen over the stigma, and after a while, resuming its original position, makes way for others. Some filaments are very sensible hygrometers, as in the Cock's-comb, *Cel. fist.* contracting in dry weather and so approaching the stigma, and re-

tiring for shelter under the corolla in wet. See Fecundation of Plants.

The word *filamenta* is also used for the fronds of the genus *Conserva*, which see; these being of a fine thread-like, or rather capillary, form and size. Roth contends that, to avoid ambiguity, *fila* should be used in the latter case, which expresses the same thing still more correctly. This is certainly an improvement, though it is scarcely possible that the ambiguity in question should cause any confusion. S.

FILAMENT, in *Medicine, Anatomy, Natural History, &c.* a term used in the same sense with fibre for those fine threads whereof flesh, nerves, skins, plants, roots, &c. are composed.

FILANA, in *Geography*, a river of Benin, which runs into the Atlantic; N. lat. 4° 40'. E. long. 5° 22'.

FILANDERS, in *Falconry*, a disease in hawks, &c. consisting of filaments or strings of blood coagulated and dried, occasioned by a violent rupture of some vein, by which the blood extravasating hardens into the figures above-mentioned, to the great annoyance of the reins, hips, &c.

The word is French, *filandres*, formed from *fil*, thread.

FILANDERS are also a sort of fine small worms which greatly incommode the hawk in the gorge, and about the heart, liver, and lungs; but which, on some occasions, are supposed to be of service, and to feed on the superfluities of certain parts. See BLACK WORM.

There are four kinds of these filanders or vermiculi. The first, in the gorge or throat; the second, in the belly; the third, in the reins; the fourth are called needles, on account of their exceeding fineness. The symptoms that discover the disease are the bird's gaping frequently, straining the fist or perch with her pounces, croaking in the night, ruffling her train, rubbing her eyes, wings, nostrils, &c. As the worms are very restless, the bird is frequently endeavouring to cast them up; and in opening its mouth you will readily discover them. From the throat, &c. they will ascend to the larynx, brain, &c. and finally over the whole body.

The ordinary cause is bad food. The proper remedy, they say, is not by killing them, for fear of imposthumes from their corruptions; but chiefly by stupefying them, that they may be offensive but seldom.

This is best effected by making the bird swallow a clove of garlic, after which she will feel nothing of the filanders for forty days. Others use rue, worm-seed, aloes, vervain, saffron, &c.

FILANGERI, GAETANO, in *Biography*, a celebrated political writer, was born at Naples on the 18th of August 1752. His parents intended him for the army, but his own genius pointed out to him the sciences as most adapted to his future pursuits. Politics, moral philosophy, and legislation engaged his mind, and seemed to absorb all his attention. He soon discovered the defects of the existing laws by which most of the European nations were governed. In 1771, he drew up the plan of a treatise on private and public education, which, however, he never completed. In 1774 he published a small work, in which he defended a new law against the arbitrary decision of a judge, with great judgment and the noblest enthusiasm. After this he determined to retire from public life, in order that he might prepare himself for important duties, by diligent and uninterrupted study. But in 1777 he entered into the service of the court, and was appointed a gentleman of the bed-chamber, and an officer of the manue. These avocations did not prevent him from devoting many of his days, and frequently whole nights, in philosophical research. In 1780

he published the first part of his work "On Legislation," which was intended to consist of seven books; but of which only four, and a part of the fifth, made their appearance during the author's life. The early parts of this work were received with the warmest approbation; and the celebrity of the author continued to increase; but as he had indulged in liberties which were new in Italy, he was open to the attack of venal and bigoted writers. His work was opposed by professor Joseph Grippa, who published a letter under the title of "Scienza della Legislazione Vindicata," with observations against Filangeri's proposal respecting feudal and criminal laws. Soon after a decree was issued by which the treatise "On Legislation" was declared among the number of prohibited works, on account of the advice given in the second book, to abolish ecclesiastical property, and the proposal promised in the fifth for reforming abuses in the power of the church. Filangeri was, however, protected by the court, and various distinguished marks of favor were conferred upon him. In 1783 he married an Hungarian lady sent to Naples by the empress Mary Theresa, as governess to the second of the princesses. With the permission of his sovereign, he retired from civil and military employment, that he might devote his whole time to the completion of his work at his country house near the town de la Cava, a few miles from Naples, where he resided till March 1787, when he was appointed to a place in the royal college of finance. In this situation he appeared with great advantage as a statesman, and many wise and very useful establishments were formed in consequence of hints which he suggested. Scarcely had he arranged his plans of economy and reform, when he was arrested by the hand of death. He died in July 1787, in the 37th year of his age. His death was lamented by the monarch, who settled a pension on his infant family, to be employed in their education. The demand for his great work on legislation was so great, that it went rapidly through ten editions in his own country, and was translated into the German and French languages. Gen. Biog.

FILARIA, in *Zoology*, a genus of intestinal worms, which have the body round, filiform, equal, and quite smooth; the mouth dilated, and furnished with a roundish concave lip.

The genus filaria, as now established, unites some few of the Vermes, formerly referred to the genus *Ascaris*, and according to its more extensive application in the Gmelinian edition, some of the *Gordius* tribe may be included also in the same genus. The vermes, which are truly of the filaria genus, seem to be abundant throughout all animated nature; they are not found in man, nor has their presence been hitherto determined in the higher class of domestic animals, the horse excepted; but there are few of the undomesticated quadrupeds, and scarcely any of the bird tribe that have been attentively examined, in which they have not been discovered; they are observed in the fish and reptile race, and insects are infested with them in inconceivable numbers. As these are the most simple of intestinal worms, the different species may not perhaps have hitherto been discriminated with sufficient accuracy; they do not seem to afford any very decisive characters by which the species may be readily distinguished; and it is no doubt for this reason that systematic writers describe and class them merely according to the respective animals in which they are observed. Gmelin inserts that highly dangerous creature, the hair-worm of the Indies, at the head of this genus, because it infests man: in this instance he deviates from the example of Linnæus, who considered that kind of vermes as a species of *gordius*, and not without reason. The two genera,

genera, filaria and gordius, are indeed analogous, and correspond in every essential particular, except the structure of the mouth, and the difference in this respect is not expressed with due precision either by Linnæus or Gmelin; the filaria genus have the mouth terminal, and more or less perceptibly dilated, of a simple form, and furnished with a rounded lip; to the Gmelinian character of the gordius we should add that the mouth consists only of a dent or incision, and is so very minute as to be imperceptible to the naked eye.

Species.

* *Infesting the Mammalia.*

EQUI. Body tapering behind, tail finely pointed, and incurved. Abildgaard.

Found in the cellular membrane of horses.

LEONIS. In the lion. Redi.

MARTES. In the martin. Redi.

LEPORES. In the cellular membrane of hares. Pallas.

** *Infesting Birds.*

FALCONIS. In the cellular membrane about the abdomen and thighs of hawks. Redi.

STRIGIS. In the cellular membrane about the head and ears of owls. Pallas.

CORNICIS. In the crop and lungs of crows. Pallas.

CICONIA. In the cellular membrane of the stork. Redi.

GALLINÆ. In the smaller intestines of poultry. Goeze. The body is capillary, and about two inches long.

*** *Infesting Insects in their perfect State.*

SCARABÆI. In the scarabæus finetarius. Phil. Trans.

SILPHÆ. In the silpha obscura. Goeze.

CARABI. In the carabus. Lister.

GRYLLI. In the gryllus. Roefel.

MONOCULI. In the monoculus apus. Walch.

**** *Infesting the Larvæ of Insects.*

LEPIDOPTERORUM. Tail hooked. Schrauck.

PAPILIONUM. In butterflies. Werner.

POLYCHLORI. White. In papilio polychloros. Werner.

URTICÆ. Body yellowish-grey. In papilio urticæ. Werner.

BETULÆ. Body white. In papilio betula. Werner.

QUERCUS. Body white. In papilio quercus. Werner.

SPHINGUM. In the sphinx euphorbiæ. Roefel.

PHALÆNARUM. In the phalæna. Mannigf.

QUERCUS. White. In phalæna quercus. Werner.

CAJÆ. Chestnut. In phalæna caja. Werner.

ZICZAC. In phalæna ziczac. Degeer.

NUPTÆ. In phalæna nupta. Goeze.

PSI. In phalæna psi. Roefel.

PELLIONELLA. In phalæna pellionella. Goeze.

These creatures are found under the skin of the larvæ, sometimes solitary, from four to seven inches long, and very destructive.

TENTHREDINIS. Found in the larvæ of the tentredo. Act. Stockh.

PHRYGANÆ. Found in the larvæ of the phryganea. Degeer.

FILAWS, among the modern Egyptians, villages inhabited by the original natives of the country.

FILAZER, FILACER, *Filizer*, an officer in the court of common pleas, so called because he *files* the writs whereon he makes out process.

Of these there are nine in the several divisions and counties

of England. They make out all writs and processes upon original writs, issuing out of chancery, as well real as personal and mixed, returnable in that court. In actions merely personal, where the defendants are returned summoned, they make out pones or attachments, which being returned and executed, if the defendant appears not, they make out a *distingas*, and so *ad infinitum*, or till he does appear.

If he be returned *nilhil*, then process of *capias* infinite, if the plaintiff will, or after the third *capias* the plaintiff may proceed to outlawry in the county where his original is grounded, and may have an exigent with proclamation.

The filazers likewise make out all writs of view in real actions where the view is prayed; and upon *replevins* and *recordaris*, writs of *retorno habendo*, *second deliverance*, and writ of *withernam*. In real actions they make out writs of *grand and petite cape* before appearance.

They enter all appearances and special bails upon any process made by them. They make the first *seire facias* upon special bails, writs of *habeas corpus*, *distingas nuper vicecomitem vel ballivum*, and *duces tecum*; and all *superseadeses*, upon special bail or appearance, &c. writs of *habeas corpus cum causa* upon the sheriff's return that the defendant is detained with other actions, and writs of adjournment of a term, in case of pestilence, war, or public disturbance.

Till an order of court made 14 Jac. I. which limited the filazers to all matters and proceedings before appearance, and the prothonotaries to all after, they also entered declarations, imparlances, judgments, and pleas, whereto a serjeant's hand was not requisite, and made out writs of execution, and divers other judicial writs after appearance. The filazers of the common pleas have been officers of that court before the stat. 10 Hen. VI. c. 4. in which they are mentioned; and in the king's bench, of later times, there have been filazers who made out process upon original writs returnable in that court on actions in general.

FILBERT, a common name frequently applied to the best sort of the hazel-nut. It is often written *filberd*, and sometimes *filbud*.

FILBERT-tree, the name of the tree from which the filbert nut is obtained. It is the low, shrubby tree usually planted out in gardens, orchards, and other places. See CORYLUS.

These trees may be raised by planting the nuts, by layers, by suckers from the roots, and by grafting upon *hazel stocks*; but the best methods are those of layering, and planting the off-sets or suckers. The layers should be laid down in the early autumnal season, and when they are become fully rooted, be taken off, and planted out in rows at the distance of two feet and twelve inches apart, in the rows. After they have attained sufficient growth in these rows, they may be carefully taken up and planted where they are to remain.

The off-sets or suckers may be taken off with good radical fibres, and be immediately planted out where they are to remain.

They answer best where the soil is of the light, mellow, friable kind, but will succeed in moist, when well protected from cold winds.

They may be planted in the standard method, in rows, at ten, fifteen, or twenty feet distance, by twelve feet in the lines; or be trained to single stems, to the height of four, five, or six feet, with full branches, spreading heads, and in the hedge manner, either in single or double rows, ten or twelve feet between; but the standard mode is most probably the best, as producing the finest nuts.

In Kent they never suffer these trees to rise higher than

fix feet, regularly pruning them in the manner of the gooseberry bush.

There are two sub-varieties of this tree, namely, the white-skinned, and the red-skinned, the former being in general the most esteemed.

FILBERTS, *Petrified*, in *Natural History*, and filbert-trees also, have been described by different authors, as found in the strata of the earth. Mr. John Ray mentions such as being found under the city of Modena and its neighbourhood, at twenty-six feet beneath its surface; but Mr. Whitehurst, who quotes this passage at length, in his Enquiry concerning the Earth (1st ed. p. 172.) observes, that these are not original strata, but modern accumulations of alluvial soil, which have buried the briars, corn, filberts, &c. in the alterations which the superficial parts of the ground about Modena have undergone; and similar remarks might, we believe, be applied to every other instance of real filbert-trees or nuts being found beneath the surface of the earth, or in accumulations of calcareous tufa, (see NUTS;) and the same will be found to belong to the class of *recent* fossils, mentioned in our article COAL.

FILE, an instrument used for reducing, and for giving shape and smoothness to a number of articles made of wood or metal.

It is divided into two varieties from the form of their teeth, namely, files and rasps. The former are cut upon the surface with a sharp-edged chisel. In the latter, the tooth is raised with a triangular punch. The file is adapted for working metals, but the rasp is more fitted for wood, bone and horn. Files again are distinguished by being single or double cut. The single cut file is simply cut once over, and is employed for filing brass, and the softer metals. A second course of teeth is cut to form the double cut file, crossing the first diagonally. This kind is best suited to iron and steel.

Files are also called by different names, from the various degrees of fineness of their teeth, as smooth, second cut, bastard cut, and rough files.

And again, from their shape, they are called flat, half-round, square, three square, round, and some having two round sides.

The steel employed for files requires to be very hard, and in consequence undergoes a longer process in the conversion: it is said to be double converted.

The very heavy files, such as smiths' rubbers, are made of the inferior marks of blistered steel: the more delicate kind, such as watch-makers' files, being made of cast steel. The steel is previously drawn at the tilt, into rods of suitable size.

Forging of Files.—The flat and the square files are made wholly with the hammer, and the plain anvil. Two workmen, one called the maker, and the other striker, are required in the forging of heavy files; the smaller being forged by one person only.

The anvil is provided with a gate, or groove, for the reception of certain bosses, or dies, which are used for the purpose of forging the half-round and three-angled files. The half-round boss contains a hollow which is the segment of a sphere, much less than half a circle. That used for the triangular files has a gate or hollow, consisting of two sides, terminating in an angle at the bottom.

In forging the half-round file, the steel is first drawn out, as if intended to make a flat file. It is then laid in the boss, and hammered, till the underside becomes round. The steel for the triangular file is tilted into square rods. The part to form the file is first drawn out with the hammer, as if intended to form a square file. It is then placed in the boss

with one of the angles downwards, and by striking upon the opposite angle, two sides of the square are formed into one, and consequently a three-sided figure produced. By successively presenting the different sides to the action of the hammer, the figure is rendered still more complete.

In forming the tangs of most files, it is necessary to make the shoulders perfectly square and sharp. This is performed by cutting into the file a little on each side with a sharp fate or aggron, and afterwards drawing out the part so marked off, to form the tang.

After forging, and previous to being ground and cut, the files require to be annealed. This process is generally performed by piling up a great quantity together, in a furnace for the purpose, and heating them red hot; suffering them afterwards to cool slowly. This method of annealing files, or indeed any other articles, in which great hardness is requisite, is very objectionable, since the surface of steel, when heated red hot in the open air, is so liable to oxydation. Two evils result from this circumstance, besides the loss by waste. First, the scaly oxyd is very hard, and difficult to remove; and secondly the steel, particularly on the surface, is deprived of a portion of its carbon, and thereby rendered less susceptible of hardening.

A superior method of annealing is practised by some file makers, and since hardness in a file is so essential a property, the process ought to be generally adopted.

This method consists in placing the files in an oven or trough, having a close cover, and filling up the interstices with sand. The fire is made to play on every side of this vessel, as gradually, and as uniformly as possible, till the whole mass becomes heated red hot. The fire is then discontinued, and the whole suffered to cool, before the cover is removed from the trough. Another evil may however arise from keeping steel red hot even in a close vessel, for too great a length of time. It assumes a kind of crystallization under which its tenacity is much impaired. Hence, it will be proper not to anneal too many at once, and not to heat them too hot. Steel, annealed in this way, is perfectly free from that scaly surface acquired in the open air; and if each article be perfectly surrounded with the sand, and the cover not removed before the steel is cold, the surface will appear of a silvery white colour.

If the steel be suspected to be too kind, from containing too little carbon, powdered charcoal may be employed instead of sand, or sand mixed with charcoal. In this case the files should be stratified alternately with the charcoal, in order that the extra-conversion may be uniform.

The next thing is to prepare the files for cutting, by making the surface, to contain the teeth, as level as possible. This was formerly effected by means of files; and the process is called stripping. The same is still practised by the Lancashire file makers, and by others not having convenience for grinding. The greatest quantity of files, however, are ground to prepare them for cutting. The stone employed for the purpose is of the sandstone kind, the texture of which is compact and sharp, but rather rough. They are of as great diameter as can be used with convenience; and about eight inches broad over the face. When used, the surface is kept immersed in water. The grinder sits in such a position as to lean over the stone, while its motion is directly from him. Its surface moves at about the same speed with those used in grinding cutlery. Since the object in grinding files is to make the surface as even and flat as possible, and as this cannot be done so completely upon a small stone, the stones of the file-grinder are laid aside when they are reduced to a certain size, and are employed for grinding

grinding other articles. Though grinding is by far the most expeditious method, it does not give that truth to the surface which can be effected by filing. If the price of the articles would admit, however, it would be well to render the surface more even by the file after grinding. If the surface be not flat, it is obvious, that when the file is used for filing a large surface, those teeth in the hollow parts of the file will not be brought into action. It is from attention to this circumstance, and to the care in annealing and hardening, that the Lancashire file-makers have generally excelled. They are, however, confined chiefly to the small articles, since the larger files would not pay for the process of stripping.

Cutting of Files.—If the vast number of teeth contained in a file, and their requisite uniformity are considered, a machine capable of effecting a business so apparently mechanical, may be considered a desideratum.

Though many attempts have been made to accomplish this object by machinery, and several varieties of machines have been constructed for the purpose, no one has yet been sufficiently general in its application, to render the prosecution of such an object very desirable. Among those who have distinguished themselves in this enquiry, Mr. Nicholson, the publisher of the Philosophical Journal, we believe, invented the most likely machine for file cutting, for which he took out a patent. We do not know, however, that either Mr. Nicholson's, or any other machine, is at present used for the purpose. A file, which is of the same breadth and thickness throughout, of any form, may be cut by the machine, because the same magnitude of stroke is required for every tooth; but if the file be conical, it is obvious that a machine, capable of giving all the varieties of strokes required in cutting even one side of a file, would be too complicated to be of any great utility. Again, the chissel employed for cutting a file is frequently liable to snip, or be otherwise out of order. This the workman, in the common way of cutting, can easily feel, and immediately stops to repair it. A very great evil would arise from this source, in cutting with the machine; and this evil would be greater in proportion to the number of chissels which one person had to overlook. It has also been said, but we cannot affirm the fact, that the teeth raised by machinery are not so full and sharp as those formed by hand. Till the above inconveniences can be obviated, in all probability the common method will be continued; the different apparatus and mode of performance of which we will endeavour to describe.

The tools of the file-cutter consist of an anvil placed upon a block of such a height, that the man sits to his work. He has also a piece of lead, or lead alloyed with tin, on which he lays the files when one side is cut. The chissel and hammer are of such size, as the size and cut of the file require. He is also provided with a leather strap, which goes over each end of the file, and passes round his feet, which are introduced into the strap on each side, in the same manner as stirrups are used. The file-cutter, therefore, sits as if he were on horseback, holding his chissel with one hand, his hammer in the other, at the same time he secures the file in its place by the pressure of his feet in the stirrups. *A, fig. 1. (Plate XIII. Miscellany.)* is the block; *B*, the anvil; *a b*, the file, laid upon the piece of lead; *C, C*, the stirrups passing over the ends of the file; *D*, the seat on which the workman sits. *Fig. 2.* is the form of one of the chissels for cutting the files. *Fig. 3.* represents the chissel or punch for raising the tooth of the rasp. *Fig. 4.* the hammer used to strike the head of the chissel. These people have found by experience that there is an advantage in having the head of the hammer hooked inwards. This is easily accounted for,

when we observe that the stroke will be made pretty near the centre of percussion. Great pains ought to be taken in preparing the edge of the chissel. It is, in the first place, hardened and tempered by heating it gradually till it appears of a yellowish brown. It is next ground very true to form the edge, which is afterwards finished upon a Turkey stone, with oil. It is not required to be very sharp, the bottom of the tooth requiring to be rather open, to prevent the file from clogging with the substance to be filed. The edge is also required to be very smooth, in order that it may slip easily upon the surface of the files: this is also facilitated by slightly greasing the surface. From this advantage, the worker, after making one tooth, is enabled, by feeling only, to form, at its proper distance, the succeeding tooth, by sliding the chissel close up against the back of the preceding one. All these motions are performed with astonishing rapidity, first the chissel and then the hammer. We observed a boy, in cutting three-sided files of five inches long, bastard cut, make 225 strokes, which produced as many teeth, in one minute. And the whole file being double-cut, contained 1350 teeth, or six times the above quantity. The second cut file, of the same size, contains 2025 teeth, and the smooth file 2700, consequently, the difference in labour between the bastard-cut and the smooth files is about as two to one. Larger files, from the greater surface, require a much greater stroke to raise the tooth, and consequently fewer strokes will be made in the same time.

In the double-cut files, the first set of teeth, which the workmen call *up-cutting*, are, previous to cutting the second course, filed slightly upon the face, in order to allow the chissel to slide freely.

The single-cut file is more durable than the double-cut, and ought to be preferred for all purposes, excepting for iron and steel.

The same method is employed in cutting the rasp. The workman is however guided completely by his eye, in regulating the distance of the teeth from each other. The rasp ought to be cut in such a manner that no one of the teeth may stand opposite to another. This not only allows the rasp to cut faster, but makes the surface, either of wood or other substance, much smoother.

Hardening of Files.—This is the last and most important part of file-making. Whatever may be the quality of the steel, or however excellent the workmanship, if it is not well hardened, all the labour is lost.

Three things are strictly to be observed in hardening; first, to prepare the file on the surface, so as to prevent it from being oxydated by the atmosphere, when the file is red hot, which effect would not only take off the sharpness of the tooth, but render the whole surface so rough, that the file would, in a little time, become clogged with the substance it had to work. Secondly, the heat ought to be very uniformly red throughout, and the water in which it is quenched fresh and cold, for the purpose of giving it the proper degree of hardness. Lastly, the manner of immersion is of great importance, to prevent the files from warping, which in long thin files is very difficult.

The first object is accomplished by laying a substance upon the surface, which, when it fuses, forms as it were a varnish upon the surface, defending the metal from the action of the oxygen of the air. Formerly, the process consisted in first coating the surface of the file with ale grounds, and then covering it over with pulverized common salt, (muriat of soda.) After this coating became dry, the files are heated red hot, and hardened; after this, the surface is lightly brushed over with the dust of coals, when it appears white and metallic, as if it had not been heated. This process has

lately been improved, at least so far as relates to the economy of the salt, which, from the quantity used, and the increase of duty, had become a serious object. Those who use the improved method are now confounding about one-fourth the quantity of salt used in the old method. The process consists in dissolving the salt in water to saturation, which is about three pounds to the gallon, and stiffening it with ale grounds, or with the cheapest kind of flour, such as that of beans, to about the consistence of thick cream. The files only require to be dipped into this substance, and immediately heated and hardened. The grounds, or the flour are of no other use, than to give the mass consistence, and by that means, allowing a larger quantity of salt to be laid upon the surface. In this method, the salt forms immediately a firm coating. As soon as the water is evaporated, the whole of it becomes fused upon the file. In the old method the dry salt was so loosely attached to the file, that the greatest part of it was rubbed off into the fire, and was sublimed up the chimney, without producing any effect.

The carbonaceous matter of the ale-grounds is supposed to have some effect, in giving hardness to the file, by combining with the steel, and rendering it more highly carbonated. It will be found, however, upon experiment, that vegetable carbon does not combine with iron, with sufficient facility, to produce any effect, in the short space of time a file is heating, for the purpose of hardening. Some file makers are in the habit of using the coal of burnt leather, which doubtless produces some effect; but the carbon is generally so ill prepared for the purpose, and the time of its operation so short, as to render the effect very little. Animal carbon, when properly prepared and mixed, with the above hardening composition, is capable of giving hardness to the surface even of an iron file.

The carbonaceous matter may be readily obtained from any of the soft parts of animals, or from blood. For this purpose, however, the refuse of shoe-makers and carriers, is the most convenient. After the volatile parts have been distilled over, from an iron still, a bright shining coal is left behind, which, when reduced to powder, is fit to mix with the salt. Let about equal parts, by bulk, of this powder, and muriat of soda, be mixed together, and brought to the consistence of cream, by the addition of water. Or mix the powdered carbon with a saturated solution of the salt, till it become of the above consistence. Files which are intended to be very hard, should be covered with this composition, previous to hardening. All files intended to file iron or steel, particularly saw files, should be hardened with this composition in preference to that with the flour or grounds. Indeed, we are of opinion, that the carbonaceous powder might be used, altogether, in point of economy, since the ammonia or hartshorn, obtained by distillation, would be of such value as to render the coal of no expence. By means of this method the files made of iron, which in itself is insusceptible of hardening, acquires a supererogatory hardness, sufficient for any file whatever. Such files may at the same time be bent into any form, and, in consequence, are particularly useful for sculptors and die sinkers.

The next point to be considered is the best method of heating the file for hardening. For this purpose a fire, similar to the common smiths' fire, is generally employed. The file is held in a pair of tongs, by the tang, and introduced into the fire, consisting of very small coals; pushing it more or less into the fire for the purpose of heating it regularly. It must frequently be withdrawn for the purpose of observing, that it is not too hot in any part. When it is uniformly heated, from the tang to the point,

of a cherry red colour, it is fit to quench in the water. At present an oven, formed of fire bricks, is used for the larger files, into which the blast of the bellows is directed, being open at one end, for the purpose of introducing the files and the fuel. Near to the top of the oven are placed two cross bars, on which a few files are placed, to be partially heating. In the hardening of heavy files, this contrivance affords a considerable saving, in point of time, in addition to which they are more uniformly and thoroughly heated.

After the file is properly heated for the purpose of hardening, in order to produce the greatest possible hardness, it should be cooled as soon as possible. The most common method of effecting this is by quenching it in the coldest water. Some file makers have been in the habit of putting different substances in their water, with a view to increase its hardening property. The addition of the sulphuric acid to the water was long held a great secret in the hardening of saw files. After all, however, it will be found, that clear spring water, free from animal and vegetable matter, and as cold as possible, is the best calculated for hardening files of every description.

In quenching the files in water some caution must be observed. All files, except the half round, should be immersed, perpendicularly, as slowly as possible, so that the upper part shall not cool. This management prevents the file from warping. The half round file must be quenched in the same steady manner, but at the same time it is kept perpendicular to the surface of the water, it must be moved a little horizontally, in the direction of the round side, otherwise it will become crooked backwards.

When the files are hardened, they are brushed over with water and powdered coals, when the surface becomes perfectly clean and metallic. They ought, also, to be washed well, in two or three clean waters, for the purpose of carrying off all the salt, which, if remaining, will be liable to rust the file. In addition to this, they should be dipped into lime water, and rapidly dried before the fire, after being oiled, with olive oil, containing a little oil of turpentine, while still warm, and they are deemed finished.

FILE is also a thread of wire whereon writs or other exhibits in courts or offices are fastened or filed, for the more safe keeping and ready turning to the same.

A file is a record of the count, and the filing of the process of a court makes it a record of it. 1 Lil. 112.

FILE, or *Label*, in *Heraldry*, a bearing, sometimes of more, and sometimes of fewer points, being the difference or distinction of the eldest son.

It is sometimes also borne as a charge in a coat armour, of which Gwillim gives many instances; but it is oftener the difference or mark of distinction which the elder brother bears in his coat during his father's life.

Some distinguish *file* and *label*, calling the file the upper horizontal line, and the label the points which issue from it.

FILE of *three*, or more labels. See LABEL.

FILE, in a *Military Sense*, is a row of men standing one behind another; as a rank, on the other hand, includes any number drawn up beside each other: whether, in either respect, they be in close or open order.

Or, file is a line or series of soldiers, placed one before another, and thus composing the *depth* of a battalion; and it is thus distinguished from the rank, which is a line of soldiers, drawn up side by side, forming the *length* of the battalion. A file is two or three deep; hence, a battalion or regiment drawn up consists of two or three ranks, and of as many files as there are men in a rank. Files of cavalry

are generally two deep. A file on horse-back occupies in the ranks about two feet eight inches; a file on foot occupies in the ranks twenty-two inches.

Close files in cavalry are at the distance which was taken before dismounting, when each man's boot-top touches, without pressing, that of his neighbour.

Loose files, in cavalry movements, are six inches distant from boot-top to boot-top, being calculated for the gallop as well as the walk of a squadron.

Open files, in cavalry, are the full breadth of a horse from boot-top to boot-top. Recruits and horses must be frequently exercised at this distance.

Flank file denotes the extreme file on the right or left of a squadron or troop, battalion or company, &c. *Forming* from file, is when the front file halts, and the rest ride up at a very smart gallop, taking care to halt in time, and not to over-run the ground. If the formation is by doubling round the front file, (e. g. when a formation is made to the rear of the march, or to the right, when marched from the right) the files must double round as closely and expeditiously as possible. In all formations from file the leaders of ranks instantly cover each other, take the ordered front, and halt. The files which bind the right and left are called the flanks.

In the covering of files on horseback, the same directions hold good as on foot. Besides, it must be scrupulously observed, that every man's horse stands exactly straight to the same front as that of the man before him. Both in the horse and foot drill the men should be often practised in covering. The former are thus taught to place their horses straight under them.

Close files of infantry are soldiers standing in rank, contiguous to one another, upon any given depth of line or column. Whenever a regiment marches in front, every man should feel his next man in whatever way he dresses; but he must not lean upon him, nor must he move his arms from his body to feel him: so that *arm close* files mean merely that soldiers in the ranks should lightly touch each other, without crowding or pressing. *Open* files are soldiers standing in rank at given distances without touching one another. The formation at open files is only practised as a preparatory drill for forming at close files (which is the order for action) in order that every man may be taught to stand and move in a proper position, without getting a habit of leaning upon his neighbour. On this account every intelligent officer who has the management of recruits, will form them sometimes at open files, and march in that order. Soldiers that have been regularly drilled should likewise be occasionally practised in advancing by open files. *Double* files are formed by the left files in each rank stepping to the rear of the right files. *Indian* files denote a line of men advancing or retreating from either of the flanks, from the centre, or from any proportion of a line in succession to one another. They are sometimes called "goose-files," a term vulgarly used among soldiers, and derived from a flock of geese, which generally follow a leader one by one. We say, *close* the files; that is, bring the men nearer each other. *Double* the files; that is, double the depth of the battalion, and diminish its breadth or front by one half. The last or hindermost person is said to *bring up* the file. *To file*, that is, to advance to, or from, any given point by files; as to file to the front, to file to the rear, to file from the right or left flank, or to file from any given company. *To file off*, is to wheel from marching in a spacious front, and to march in length by files. See DE FILE.

File-Leader is the soldier placed in the front of any file, or the man who is to cover all those that stand directly in

the rear of him, and by whom they are to be guided in all their movements. File-leaders should be very careful to preserve their proper distances, from which ever hand they are to dress to, and the followers of each file must only be attentive to cover, and be regulated by their proper file-leaders. In file the rear rank invariably dresses by, and is regulated by the front rank.

File marching on foot. According to the printed regulations, all recruits must first face, and then be instructed to cover each other exactly in file, so that the head of the man immediately before may conceal the heads of all the others in front. The men should move with the lock-step. The front-rank men should cover exactly, and the rear-rank men keep close and dressed to the front rank. File-marching may be performed to the front, to the rear, and to either flank; in all which cases the men must be taught to cover well. When recruits are at drill, on the word *march*, all are to step off together, gaining at the first step thirty inches, and so continuing each step, without increasing the distance between each recruit, every man locking or placing his advanced foot on the ground, before the spot whence the man who precedes him had taken up his. *Marching by ranks in front, open files*, is when any body of men advance by ranks at open order, and dress to some given object without touching one another. The flank-man of the flank to whom the soldiers dress, must be a non-commissioned officer, and he must take care that his head be kept quite straight to the front, and his body erect, and that he advances without deviating in any the least degree to the right or the left. In order to execute this essential part of the drill accurately, two persons should be present, one in the front, and the other on the flank, to observe the dressing. *Marching by ranks in front, close files*, is when any number of men advance by ranks at close order, and dress to some given object, each man lightly touching his next man, without crowding or pressing. The march in front at close files is much more easy than that at open files, because every man feels his next man, which ever way the rank dresses, and into whatever direction the rank or column moves.

FILIELFO, FRANCIS, in *Biography*, a distinguished Italian writer, was born at Tolentino in the year 1398. He studied at Padua with so much success, that he was invited to open a school of eloquence at Venice in his 20th year. In 1420 he went to Athens, where, under the direction of John Chrysoloras, son of Manuel, he applied himself so vigorously to the study of the Greek language, as to be sent ambassador to sultan Amurath II., and also the emperor Sigismund. In this latter embassy he received an invitation from Ladislaus IV. king of Poland, to assist at his nuptials, and on that occasion he recited an oration at Cracow, in the presence of the emperor and princes. Returning to Constantinople, he occupied himself in literary concerns, and in 1427 he revisited Venice on the express invitation of many of the nobles. From Venice he removed, in 1428, to Bologna, where he was received with extraordinary honours, and appointed professor of eloquence and moral philosophy, with an ample stipend. Civil discord obliged him in a few months to quit Bologna, and from thence he went to Florence, where he soon collected four hundred scholars, and was admitted to the rank of citizen by a public decree. Here his life was sometimes in danger from his enemies, among whom he reckoned the chief to be Cosmo de Medici. In 1435 he accepted of a professorship at Siena, where he was attacked by the same assassin from whose malice he had formerly escaped at Florence. The villain was detected, and punished with the loss of a hand. The reputation of Filelfo was now so high, that he was invited,

invited, at the same time, to the performance of important duties by the pope, the Greek emperor, the duke of Milan, and the universities of Perugia and Bologna. He accepted the latter, where he re-opened his school for a few months only, when, repairing to the court of the duke of Milan, he was retained by him in his service, and treated with great favour. The death of the duke, in 1447, deprived him of a powerful patron, but he was, after a considerable interval, received by the successor to the dukedom, Francis Sforza, who assigned him an honourable stipend. He next went to Rome, where he experienced the liberality of pope Nicholas V. Proceeding to Capua, he was treated with extraordinary regard by Alphonso king of Naples, who conferred upon him the honour of knighthood, allowed him the privilege of using the royal arms, and placed on his head the poetical crown of laurel. Upon his return to Milan, he learnt that his mother-in-law, the widow of Chrysoloras, and her two daughters, were made slaves in the capture of Constantinople by the Turks: at the earnest request of Filelfo the duke dispatched two messengers to Constantinople, with a letter and an ode addressed to Mahomet II., who restored the female captives without a ransom. At the same period Filelfo became reconciled to Cosmo de Medici, and ever after remained in friendship with that illustrious family. On the election of pope Pius II. in 1458, he settled a pension on Filelfo, which being paid only one year, gave him an occasion to declaim against the court of Rome and the pontiff, a liberty which was punished with imprisonment. In 1469 he presented pope Paul II. with his translation of the Cyropædia, for which he received a present of four hundred ducats. This donation was handsome, and perhaps unexpected, and he felt it his duty to go to Rome and return thanks in person. In the course of his journey he was honourably received and treated at Florence, by Peter and Lorenzo de Medici. He continued to reside at Milan till 1474, when he obtained leave, on the invitation of pope Sixtus IV., to become professor of moral philosophy at Rome. After this he removed three times to Milan, and back again to Rome, till at length, in the eighty-third year of his age, he accepted an invitation from Lorenzo de Medici to a Greek professorship at Florence. In the performance of the duties of this office he died, in 1481, a very short time after his arrival. He left behind many books, which consist of orations, moral discourses, poems, and familiar epistles, that afford much curious anecdote relative to the times. As a man of letters, he is more to be admired for his industry, and the great compass of his attainments, than for peculiar excellence in any one branch. Nevertheless he was a good historian, well skilled in classical learning, and a profound grammarian. Morevi.

FILER UN SON, *Fr.* in *Mus.* implies the conduct of the voice in singing, in such a manner as to be able to prolong, swell, or run rapid divisions of many bars, without taking breath. The French verb *filer*, literally means to string, thread, or wire-draw any substance: and, applied to the voice, it means almost every perfection of a great singer. Millæo used to say that the voice, by practice, should be rendered as ductile as wax when worked by the hand till it will receive any impression. Rousseau says there are two ways of managing the voice which come under the term *filer les sons*: the first is what we have been describing; the second, that of sustaining a tone steadily, and perfectly in tune, in a long note, while the accompaniments are busily employed. When the Gabrielli was here, during the time that the Agujari sang at the Pantheon, after she had finished one of her bravura airs, with long and difficult divisions, and such high notes as had never been heard in England be-

fore, the Gabrielli said to a gentleman in our hearing "mais in sieurs, ce n'est pas filer les sons;" one singer is never to praise another. Agujari was however a very great singer in a different style from that of the Gabrielli; who, when at her best, had very singular vocal abilities. We have just now recollected that Agujari was forgotten in the alphabetical order where she ought to have had a niche, for which we beg pardon of her manes, and shall try to deserve it, by doing her justice here.

LUCRETIA AGUJARI was a truly wonderful vocal performer. The lower part of her voice was full, round, of an excellent quality, and its compass, after she quitted its natural register, which it was to be wished she had never done, beyond any one we had then heard. She had two octaves of fair natural voice, from A on the fifth line in the base, to A on the sixth line in the treble, and beyond that, in alt, she had in early youth more than another octave; as Sacchini told me (says Burney) he had heard her go up to Bb in altissimo. Her shake was open and perfect, her intonation true, her execution marked and rapid, and her style of singing, in the natural compass of her voice, grand and majestic; though the pathetic and tender were not what her manner or figure promised, yet she had expressions sometimes that were truly touching, and she would have been as capable of exciting universal pleasure, as admiration, if she had been a little less violent in the delivery of her passages, and her looks had been more tempered by female softness and timidity. She sang hardly any other music while she was here than her husband's, Signor Colla, which, though often good, was not of that original and varied cast which could supply the place of every other master, ancient and modern.

At this time there was no male singer in England with irresistible attractions: Rauzzini indeed was here, who more frequently pleased than surprized his audience; but it was during this period that the proprietors of the Pantheon ventured to engage the Agujari at the enormous salary of 100*l.* a night, for singing two songs only! And yet, however exorbitant the demand, or imprudent the compliance with it may seem, the managers of this most elegant and superb building, which would have done honour to Greece at its most splendid period of taste and magnificence, have, since that period, by going a more economical way to work, involved the proprietors in disgrace and ruin. Indeed, in subsequent undertakings, previous to the fatal destruction of the building by fire, they have more frequently had money to pay than receive; for, notwithstanding so much was disbursed to the Agujari, much was likewise cleared, and the dividend was more considerable than it has ever been since that memorable era. The admirable Agujari, as Sacchini told us, was in her youth called "la Bastardella;" and being lame it was said, that, as soon as born, she had been abandoned on a dunghill by an unnatural mother, where a pig was beginning to devour her, when she was unexpectedly discovered, and humanely protected, adopted, and so well educated in music, as to become the wonder of her age and country. This admirable singer died at Parma in 1783.

FILEY, in *Geography*, a small fishing town of England, on the E. coast of the county of York, in a bay on the German sea, to which it gives name; near it is a ledge of rocks, called "Filey Brigg." In 1801 the inhabitants were 505.

FILIAL, something belonging to the relation of a son, *filius*.

The divines usually distinguish between a servile and a filial fear. The most abandoned have a servile fear of God,

such as that of a slave to his master; but not a filial fear, *i. e.* a fear resulting from love and respect.

FILIAL Portion. See CUSTOM of London.

FILICAIA, VINCENZO DA, in *Biography*, an elegant Italian poet, was born at Florence in 1642. He studied and took his degrees at the university of Pisa. He married at the age of thirty-one: he was fond of retirement, occupying himself in poetical composition, and in the duties of domestic life. He was first brought to public notice by his fine canzoni composed on the raising of the siege of Vienna. For this he received the most flattering and complimentary letters from several crowned heads; from the emperor Leopold, the king of Poland, the duke of Lorraine, and the queen of Sweden. By the latter he was adopted into her own academy, and she took upon herself the charge of maintaining his children; at the same time commanding him to conceal her bounty, as being inadequate to the merits of so great a man. He was created a senator by the grand duke, and employed in some important duties by that prince, which he performed with so much credit, as to gain the esteem of the prince, and affection of the people. He died universally lamented at Florence, in the year 1707, at the age of sixty-five. "He was," says his biographer, "one of the principal ornaments of modern Italian poetry, displaying, as well in his canzoni as his sonnets, great sublimity, animation and dignity, and scarcely surpassed by any in vigour of sentiment and energy of style. He also wrote Latin verse with elegance, and some of his orations and epistles are inserted in the "Prose Fiorentina." He was member of the academies of La Crusca, and the Arcadi. His son Scipio gave a complete edition of his Italian poems, under the title of "Poesie Toscane di Vincenzo da Filicaia, Senatore Fiorentino," 1707, 4to." Moreri.

FILICES, in *Botany*, Ferns, a very distinct and natural order of the class *Cryptogamia* of Linnæus. The name is supposed to be derived from *filum*, a thread, in allusion to the slender segments, or rather stalks, of these plants, whence also they are termed capillary plants, and some of them have the name of Maiden-hair. They constitute the fifth natural order in the first class of the system of Jussieu, and the first order of the twenty-fourth class of the Linnæan artificial system.

Their herbage is a frond, or leaf bearing fructification, rarely arborescent, involute when young, the stalk more or less scaly; the root perennial, and generally very long-lived. *Fructification* most commonly on the back of the leaf; sometimes at the edge; sometimes, (by a transformation, as it were, of a leaf or its lobes,) spiked and terminal, or solitary and axillary. *Capsules* usually of two valves and one cell, mostly stalked, and bound with a contrary elastic ring; sometimes sessile and aggregate; very rarely of many cells. *Seeds* extremely minute and copious.

The flowers of ferns are as yet altogether unknown, except what Hedwig has described in *Equisetum*; see that article. The same admirable investigator thought he discovered anthers dispersed about the rib of the leaf in some common ferns, and pistils under the cover of their young fruit, see his *Theoria Generationis et Fructificationis Plantarum Cryptogamicarum*, 43, &c. t. 5, 6, 7; but others have not assented to this theory. Bernhardt has suggested another, equally hypothetical, that impregnation is performed on the upper side of the leaf, the pollen being secreted by small membranous anthers situated near the margin, and the stigmas placed directly over the point of attachment of each dot or mass of capsules. See Sims and König's *Annals of Botany*, v. 1. 107; but this is not better supported by facts than the doctrine of Hedwig. Some have imagined the

ring which embraces the capsule in most doriferous ferns, might perform the office of an anther; but such a theory will not account for the impregnation in genera where no such part is to be found.

The seeds of ferns, independent of poetic fancies, were early known to naturalists. Giseke points out a passage in Cordus, denying them seeds indeed, but asserting that all ferns are propagated by the dust at the back of their leaves. Morison tells us he raised from seed the Harts-tongue and the Osmund-royal; see his *Historia*, v. 3. 555 and 593. Microscopic observers, about the same time, readily ascertained the structure of the capsules, and appearance of the seeds. Ehrhart observed the germination of *Aspidium spinulosum*; and Mr. Lindsay of Jamaica raised many ferns of that island from seed, as recorded in the *Transactions of the Linn. Soc.* v. 2. 93, carefully attending to, and delineating the progress of their growth. Mr. Fox of Norwich first raised a *Lycopodium* from seed; see *Tr. of L. Soc.* v. 3. 314. Similar experiments have been repeated by various other persons, and in hot-houses, where the larger kinds of *filices* are cultivated, young seedlings, of a scaly pellicud appearance, like an infant *Marchantia*, may often be seen scattered over the moist earth, or rotten bark. Sprengel well observes, in his letters on Cryptogamous plants, translated by Mr. König, and published at London in 1807, that the cotyledons of these plants are not always simple, and this raises another difficulty respecting a natural classification by those parts. See COTYLEDONES and DICOTYLEDONES.

The possible increase of ferns, if we consider the abundance of their seeds, is beyond computation. A single leaf will often bear one hundred millions of seeds. Yet we have no reason to think the countless numbers, that turn to no account as to propagating the species, afford food for animalcula of any kind, or serve any other secondary purpose.

Besides the seminal mode of increase, a few ferns produce gemmæ, or buds, on their stalks or leaves, as *Woodwardia radicans*; and some take root at their points, as *Asplenium rhizophyllum*.

To the botanical arrangement of ferns, much attention has been paid of late years, and with considerable success. The systematic writers of the 17th century touched this subject but slightly. Ray, in his *Methodus Plantarum* distinguishes the spiked from the doriferous ferns, and proposes to divide the latter according to the situation of the seeds on the edge or middle of the leaf, and according to the round or linear shape of the masses which those seeds compose. He then distinguishes them further into larger and smaller, owing, at the same time, that he was not well satisfied with such a principle of arrangement; and finally subdivides them into such as have simple leaves, and such as have them simply, doubly, or triply pinnate. What concerns the situation of the seeds, or capsules, in this system is excellent, and is justly claimed by Ray as original. It forms, indeed, the basis of the Linnæan arrangement hereafter mentioned. But the shape or structure of the frond leads to no true generic distinctions, and yet Ray, losing sight of his original principles, distributes ferns according to these faulty ones, scarcely observing how inconsistent they are, and retaining old names, without attempting to new-model them, or the genera which they had hitherto so imperfectly designed.

Tournefort, so studious of the genera of plants, attempted to distribute ferns according to the forms of their fronds, but even this he performed in a most superficial and imperfect way. His genus *Filix* indeed is tolerably characterized, after his principles, as having a pinnate leaf, and pinnatifid leaflets; his *Lonchitis* has auricled leaflets; and his *Tricomanes* "generally roundish ones;" while his

Polyodon

Polypodium has a simple pinnatifid leaf. But his *Ruta muraria* is strangely defined "with leaves somewhat resembling garden rue;" his *Filicula* "with leaves somewhat resembling those of *Filix*;" and his *Adiantum* "with leaves known from other plants by their peculiar appearance," without indicating what that appearance is. Such a loose mode of definition indicates a truly barbarous state of science. He paid no attention to the situation of the fructification in these plants. Plumier, a very famous collector and delineator of the species of ferns, followed his countryman Tournefort implicitly in their generic arrangement, if it deserves to be so called, nor were any improvements in this line attempted till the time of Linnæus.

The system of the learned Swede would of course have been imperfect, had he not undertaken to characterize all the genera, even of his class *Cryptogamia*, as much as possible by their parts of fructification alone, as far as such could be detected. Unfortunately, however, not only the essential organs of impregnation of ferns were then, as they still are, undiscovered, and the accessory parts of their flowers nearly as obscure; while the structure of the fruit in dorsiferous ferns was so much the same, in all known to Linnæus, that it was useless for the purposes of generic distinction. He was therefore obliged to have recourse to other principles, which, in the arrangement of plants with evident flowers and variously-formed fruits, he had rejected as unphilosophical; these were deduced from the situation of the fructifications, and their aggregate figure, according to the scheme indicated by Ray, but first carried into execution by Linnæus.

Thus six genera appear discriminated in the first edition of his *Genera Plantarum*.

Pteris. Fructifications disposed in a line, running along the margin of the leaf on its under side.

Lonchitis. Fructif. in little crescent-shaped lines, under the sinuses of the leaf.

Adiantum. Fructif. in oval spots, collected under the reflexed summits of the leaves.

Asplenium. Fructif. in straight lines, arranged on the under side of the leaf.

Polypodium. Fructif. in roundish spots, or dots, dispersed over the back of the leaf.

Acrostichum. Fructif. accumulated into one mass, entirely covering the back of the leaf.

In the second edition of the same work two other genera are added.

Hemionitis. Fructif. in lines running into or intersecting each other, or branched.

Trichomanes. Calyx turbinated, solitary, erect, from the margin of the leaf itself. Style bristle-shaped, terminating the capsule.—This last definition is incorrect in terms, there being no authority for the use of the words style and capsule in this case, and the former being indeed merely a column, or elongated receptacle, to whose lower part several capsules are indeed attached, but whose summit we are not warranted, by any analogy, to suppose a style, however appearances may be in favour of such a supposition.

In the 5th edition of *Gen. Pl.* a ninth genus is added, while the arrangement of the former is a little altered.

Blechnum. Fructif. disposed in lines, parallel with, and near to, the rib of the leaf.

Nothing new on this subject occurs in the 6th edition of the same work, the last to which its author himself lent any assistance, nor did he leave any thing relative to it in manuscript.

Schreber, in his edition of the *Gen. Pl.* had added three

new genera, *Marattia* of Swartz, *Canopteris* of Bergius, and *Meniscium* one of his own.

It is proper to notice what has been done by some contemporaries of Linnæus towards obtaining satisfactory generic characters of *filices*.

Adanson, in his *Familles des Plantes*, published at Paris in 1763, has noticed the membranous involucre which covers the fructification of most ferns; as has Gleditsch in his *Systema Plantarum*, published at Berlin in 1764; but they have detected this part in very few genera, and have erred in several of their remarks concerning it. Thus in the common brake, *Pteris* of Linnæus (*Thelypteris* of Adanson, *Cincinnatiis* of Gleditsch) whose involucre is manifest to the most careless observer, the former properly describes that part as of one valve, in the shape of a pent-house, while Gleditsch absolutely denies its existence. They both justly observe that the involucre of *Asplenium Scolopendrium* of Linnæus consists of two valves, but do not say a word of its form in *Blechnum*, *Hemionitis*, or *Lonchitis*. "They have totally deranged the Linnæan genera, but being ignorant of any true principles, have made every thing worse than they found it; and as to nomenclature, they have gone counter to every maxim and all sorts of authority. Both these writers have observed the elastic ring, which binds together the capsular valves of ferns, but they have alike both equally erred, in denying the existence of any such part in *Polypodium vulgare*." It appears that both these authors, who profess great originality, are not original even in this error, for the slightest inspection of this very common fern would have prevented it, none having a more evident ring; they therefore could only have adopted it from Tournefort, whom they do not quote, but who in his figure and description has fallen into this unaccountable mistake. Scopoli in his *Flora Carniolica* has made use of the remarks of Adanson and Gleditsch, without correcting the above faulty particulars, which he adopts on their authority, though so very easy to be ascertained or refuted. Haller and most other writers have made use of the Linnæan characters, with some occasional variations of no great moment, either with respect to nomenclature, or the disposition of the species.

Indeed those who were conversant with European ferns, or a few well-known exotic ones, only, would scarcely find any necessity of looking further than the Linnæan generic distinctions. But the writer of the present article was indispensably led to consider the subject with attention, in consequence of the vast collection of unsettled ferns of which he became possessed in the Linnæan herbarium, and which were subsequently much increased by the unbounded liberality of his friend sir Joseph Banks. Many of these could not be reduced to any known genus, and others, though by their technical characters possibly referable to some, were yet so novel in habit as to require to be kept generically separate. Many of these novelties were sent to the celebrated Hedwig in 1786, in hopes of his assistance; but nothing has transpired from him respecting any generic reformations, though he or his son have since published a few of the species.

The result of a general review of all the known as well as nondescript ferns that could be got together, was a Latin essay, communicated to the Royal Academy at Turin, and printed in the fifth volume of their *Memoires* in 1793, under the title of *Tentamen botanicum de filicum generibus dorsiferarum, auctore J. E. Smith*. In this the involucre, or membranous cover of the masses of capsules, was first brought into use for generic discrimination, and particularly the direction in which it opens, whether out-

wards,

wards, that is, towards the margin or extremity of the frond, or inwards, towards the rib, nerve, or base, of the frond or its segment. This easy principle is found to lead to the most natural and distinct genera, without any exception. It does not overturn nor change one of those established by Linnæus, but more clearly defines them, while it affords means of ascertaining new ones. The part in question is found in almost every fern, covering the fructification before the latter comes to maturity. It originates sometimes from the margin of the leaf, but more commonly from some nerve or vein, in which last case it is either lateral and parallel, or terminal and vertical. The involucrem adheres firmly to the frond on one side, whence its nourishment while growing is derived, and on the other is more or less closely pressed to, or sunk into a cavity in, its surface, without being really united with its cuticle, at least as far as can be observed. Not but that even on this side also the air is altogether excluded, so that in whatever mode the impregnation of the germens is accomplished, that operation must go on in secret under this covering, without any external communication, except through the stalks by which the capsules themselves are attached, as the theory of Bernhardt supposes; while Hedwig's implies an occasional elevation of the margin of the young involucrem, which we can find no reason to believe. When indeed the feed-vessels and feeds are arrived at maturity, the neighbouring parts, and especially the involucrem, dry up, the latter separating at the edge, and becoming crisped or reflexed, to allow of the discharge of the feeds.

In the Essay in question the Linnæan genera of doriferous ferns were thus distinguished by characters taken from the involucrem, in addition to those by which they were previously known.

Acrostichum. Involucrem none, except little scales, or hairs, interspersed among the capsules.

Polypodium. Invol. umbilicated, separating nearly all round.—Such species as have no involucrem were still retained here for further examination, they being then supposed very few.

Asplenium. Invol. originating laterally from a vein, and separating inwards;—that is, towards the nerve or rib.

Hemionitis. Invol. in pairs, originating from the vein (which runs between the lines of capsules) and each separating outwards.

Blechnum. Invol. originating from the surface, continued, separating towards the nerve.

Pteris. Invol. from the inflexed margin of the frond, uninterrupted, separating on the inner side.

Lonchitis. Invol. from the inflexed margin of the frond at each sinus, in pairs, crescent-shaped.

Adiantum. Invol. like scales, from the inflexed margin of the frond, distinct, separating inwards.

Trichomanes. Invol. marginal, urn-shaped, undivided, opening outwards, shorter than the column bearing the capsules.

To these the following new genera were added.

Darea, distinguished from *Asplenium* by the involucrem separating outwardly, or towards the margin of the leaf.

Scolopendrium, distinguished from *Hemionitis* by its double involucrem separating inwards, the valves folding over each other.

Woodwardia, differing from *Blechnum* in having separate, short, or interrupted, vaulted involucrems.

Lindsea, published by Mr. Dryander in Tr. of Linn. Soc. v. 3, differing from *Pteris* in its continued nearly marginal involucrem separating outwards.

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Vittaria, having a double involucrem covering its long line of capsules, one valve from the margin, torced in, the other from the surface, separating outwards; its character combining those of *Pteris* and *Lindsea*.

Davallia, having a small scale-like involucrem to each round mass of capsules, terminating a vein or nerve, near the margin, or separating outwards.

Dicksonia of L'Heritier, having a double involucrem to each round mass of capsules, one from the surface, separating outwards, the other from the inflexed margin of the frond, embracing the former, and separating inwards.

Cyathea, bearing its capsules in scattered hemispherical cups opening at the top without any lid.

Hymenophyllum, having an involucrem of two flattish straight valves at the edge of the leaf, opening outwards, longer than the column to which the capsules are attached.

Schizæa, having a double uninterrupted involucrem, formed of the inflexed edges of each linear appendage to the fronds, which bears the fructification.

All these genera have, or at least were supposed to have, a ring embracing each capsule; but it has since been observed that in some, as *Schizæa*, there is only an appearance of such a ring, as will be mentioned hereafter. Another section was subjoined, consisting of three genera unknown to Linnæus, whose capsules are not only decidedly destitute of a ring, but remarkably different in appearance and structure from the former, being sessile, naked, opening by pores. These the author termed *thecate*, as the former are *annulate*.

Gleichenia. Capsules with three cells and three valves; partitions originating from the middle of each valve.

Marattia of Swartz's Prodrômus. Fl. Ind Occ. Capsules oval, bursting longitudinally on their upper side, with several cells in each division.

Danaea. Capsules of one cell, opening by a pore at their summit, and accumulated together in two parallel rows.

See in their proper places CYATHEA, DANÆA, DAREA, DAVALLIA, and DICKSONIA.

This essay being reprinted in Germany, called the attention of the learned cryptogamic botanists of that country to the subject. Hence various treatises on the genera and species of ferns have appeared in different periodical publications, from the pens of Bernhardt, Willdenow, Mohr, and others. It was also published in English in 1798, in a volume of Tracts by the author.

Several new observations were made, and mistakes corrected, by the writers just named. Mohr observed that the capsule of some ferns is only corrugated, so as to resemble a ring, but not really furnished with one, as in *Schizæa*. The same discovery was long ago made, but never published, by Mr. R. Brown. *Onoclea*, hitherto thought destitute of a ring, was proved to have one, and to be a true doriferous fern. Several new genera were defined, but not in every case justly. Thus, the *Spheropteris* of Bernhardt is precisely a *Cyathea*, he having conceived a wrong idea of the latter genus, from some of the European less certain species. His *Wibelia* is a *Davallia*, and his *Ripidium* a *Schizæa*. The good genera established by this and other writers will be mentioned hereafter.

At length the whole that had been done was revised and improved by the able Dr. Swartz, professor of botany at Stockholm, who published, in Schrader's Journal at Göttingen in 1800, the Genera and Species of Ferns arranged in systematic order, which work appeared in a still more perfect form, with a preface, descriptions of new or rare species, and several figures at Kiel in 1806, under the title of Synopsis Filicum. The family of *Lycopodium* and its allies are subjoined, as

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distinct natural order; a distinction to which we cannot assent.

We shall enumerate the genera of ferns according to Dr. Swartz's work.

Section 1. Ferns whose capsules are surrounded with an elastic ring; called by him *Filices Gyrate*.

* Involucrum none.

1. *Acrostichum*. Capsules forming an indeterminate spot or assemblage, over the back of the leaf.

2. *Moussicum*. Schreb. Gen. 757. (*Polypodium reticulatum*; Linn.) Spots crescent-shaped, nearly parallel, between the veins of the leaf.

3. *Hemionitis*. Spots linear, forked and reticulated. Dr. Swartz separates from this genus such species as have an involucrum, by the name of *Diplazium*.

4. *Grammitis*. Spots linear, straight, scattered.

5. *Tanitis*. Spots linear, longitudinal, continued, solitary between the rib and margin on each side, parallel.

6. *Polypodium*. Spots roundish, scattered.

* * Spots veiled with an involucrum.

7. *Aspidium*. Spots roundish, scattered, covered with an umbilicated, more or less circular, involucrum.

This consists of the vast tribe of Linnæan species of *Polypodium*, which differ from the *vulgare* and a few others in having an involucrum, and of which we have already spoken. It is by far the largest and most troublesome genus of the whole order.

8. *Asplenium*. Spots linear, straight, scattered. Involucrum lateral, separating inwards.

9. *Darea*. (Called by Swartz *Ceropteris*, after Bergius.) Spots linear, near the margin. Involucrum lateral, separating outwards.

10. *Scolopendrium*. Spots linear, in pairs, scattered. Involucrum of two opposite superficial valves, folding over each other.

11. *Diplazium*. (*Hemionitis*; Smith.) Spots linear, scattered, in pairs, simple or branched, at each side of a vein. Involucrum of two valves, originating from the vein, separating outwards.

12. *Lonchitis*. Spots crescent-shaped, at the sinuses of the leaf. Involucrum from the inflexed margin of the leaf, separating inwards.

13. *Pteris*. Spots linear, continued, marginal. Involucrum from the inflexed margin of the leaf, uninterrupted, separating inwards.

14. *Vittaria*. Spots linear, continued, longitudinal along the disk or near the edge of the leaf. Involucrum double, uninterrupted; one separating outwards, the other inwards.

15. *Onoclea*. Spots indeterminate, entirely covering the backs of some leaves. Involucrum from the membranous, revolute margin of the leaf, either continued or interrupted, separating inwards.

16. *Blechnum*. Spots linear, longitudinal, continued, parallel, one on each side of the rib. Involucrum superficial, continued, separating inwards.

17. *Woodwardia*. Spots oblong, distinct, lying near the rib. Involucrum superficial, vaulted, separating inwards.

The term superficial involucrum, *involucrum superficialium*, expresses one that originates from the surface, not from the margin nor rib.

18. *Lindsæa*. Spots linear, continued, near the margin. Involucrum superficial, continued, separating outwards.

19. *Adiantum*. Spots roundish or linear, distinct, mar-

ginal, growing upon the inner side of the membranous involucrum, which are formed out of the reflexed edge of the leaf, and separate inwards.

20. *Cheilanthes*. Spots roundish, distinct, marginal, each covered with a distinct membranous involucrum, formed of the reflexed crenate edge of the leaf, and separating inwards.

This genus, established by Dr. Swartz, and named from *Χηλαίαι*, the *brim* or *margin*, and *ανθος*, a *flower*, comprehends 12 species in his work, some of which had previously been referred to *Adiantum*, others to *Pteris*, and some even to *Polypodium*; which diversity of opinion among authors affords a strong presumption of their not agreeing well with any known genus, and consequently of the necessity of founding a new one to receive them. Accordingly the above character sufficiently distinguishes them from *Adiantum*, the only genus with which they could, in the present state of the science, be confounded, by the fructification being seated on the leaf itself, and not on the scales which form the involucrum.—*Polypodium fragrans*, Linn. Mant. 307; and a distinct species so called by Desfontaines, Fl. Atlant. t. 257; also *Adiantum capense* of Thunberg, arc. according to Swartz, species of *Cheilanthes*.

21. *Davallia*. Spots roundish, separate, near the margin. Involucrum superficial, scale-like, distinct, terminating a vein, and separating outwards.

22. *Dicksonia*. Spots roundish, separate, marginal. Involucrum double; one superficial, separating outwards, the other from the inflexed margin of the frond, separating inwards.

23. *Cyathea*. Spots roundish, scattered. Receptacle of the capsules central, within a cup-shaped involucrum, opening at the top.

The proper character of this genus consists in the involucrum going under the insertion of the capsules, either in the form of a membranous undivided cup, as in *C. arborea*; (*Polypodium arboreum*; Linn.) and several others; or of a similar cup composed of numerous scales, as in *C. horrida*; (*Polypodium horridum*; Linn.). Whether some European species, as *C. fragilis* Fl. Brit., whose involucrum is a membrane enfolding the capsules while young, properly belong to the same, botanists are not agreed, nor have some who have decided on this subject been furnished with proper materials for the purpose.

24. *Trichomanes*. Spots marginal, prominent. Receptacle of the capsules brittle-shaped, longer than the undivided, pitcher-shaped, direct involucrum.

25. *Hymenophyllum*. Spots marginal, prominent. Receptacle of the capsules brittle-shaped, shorter than the two-valved, direct involucrum.

Section 2. Capsules of one cell, destitute of a distinct ring, opening by a longitudinal fissure on one side.—These are called by Swartz *Filices spurie gyrate*, because they have a wrinkled capsule, imitating the ring in the former section; or *rimate*, alluding to the fissure by which the said capsule discharges its seeds.

26. *Schizæa*. Capsules crowded, sessile, on the backs of several appendages to the leaf. Involucrum from the inflexed margin of each appendage, uninterrupted.

27. *Lygodium*. Capsules solitary, sessile, within the imbricated two-ranked scales, of terminal or lateral spiced appendages to the leaf.

The name, derived from *λυγος*: a *twig* or *wand*, alludes to the slender flexible habit. This elegant genus, which comprizes the *Ophioglossum scandens* and *flexuosum* of Linnæus, has been indicated by several writers. Willdenow

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has named it *Hydroglossum*; Cavanilles *Ugena*; and Mirbel *Ranondia*. None can be more distinct.

28. *Mobria*. Capsules separate, sessile, at the edge of the leaf. Involucrum from the inflexed crenate margin.

A genus founded by Swartz in honour of his able cryptogamic friend *Mobr*, upon the *Polypodium cafferorum* Linn. by some referred improperly to *Osmunda*.

29. *Anemia*. Capsules crowded, sessile, naked, on the branches of a compound spike.

This genus is separated by Swartz from the following, chiefly because its capsules are sessile on a branched receptacle, not stalked and situated on the back of a leaf, neither are they so much divided into two valves. The difference is rather difficult to define, but may be founded in nature. Both genera are quite destitute of all involucrum.—The present consists of 17 species, amongst which are *Osmunda phyllitidis*, *hirta*, *hirsuta*, *adiantifolia*, *bipinnata*, *verticillata* and *filiculifolia* of Linnaeus, all fine West Indian ferns figured in Plumier.

30. *Osmunda*. Capsules crowded, stalked, naked, on the metamorphosed leaflets of the frond.

31. *Todea* of Willdenow. Capsules nearly sessile, on the transverse, almost parallel, veins of the leaf, naked.—The only species is *T. africana*. (*Acrostichum barbarum* Linn.)

32. *Mertensia* of Willdenow. Capsules sessile, in roundish, superficial, scattered, naked spots.

Consists of seven species, one of which, *M. furcata*, is *Acrostichum furcatum* Linn. figured in Plumier, t. 28. This genus is scarcely distinct from the following.

33. *Gleichenia* of Smith. Capsules three or four together, sessile in a little hemispherical depression of the leaf.

It appears from this character that Swartz considers as separate capsules, what the author took for cells of one capsule, and analogy confirms the opinion of the former.

34. *Angioperis* of Hoffmann. Capsules sessile, naked, placed in a double series, in little parallel neighbouring spots, all together forming a longitudinal line near the margin.

The only species is *A. exalta*, a most elegant large fern, found in the South sea and Philippine islands.

Section 3. Capsules destitute of all traces of a ring.

* Capsules of many cells.

35. *Marattia* of Swartz. Capsules oval, scattered, at first closed, then separating into two parts, and disclosing two rows of cells, opening at the top.

36. *Danea* of Smith. Capsules oblong-linear, transverse, parallel, immersed in the frond, with two rows of cells, opening at the top.

* Capsules of one cell, with two valves.

37. *Botrychium* of Swartz. Capsules distinct, sessile, crowded into a cluster, bursting transversely. Separated by Swartz from *Osmunda*, and containing our *O. lunaria*, &c.

38. *Ophioglossum*. Capsules united into a two-ranked, somewhat jointed spike, bursting transversely.

The *Lycopodinea* of Dr. Swartz we consider as no less genuine *filices* than the foregoing. They have an herbaceous, or shrubby, leafy stem, with axillary fructifications, and may be defined as follows.

Section 4. Capsules axillary, naked, of one, two, or three cells.

39. *Lycopodium*. Capsules of one cell.

This is a large and beautiful genus, comprehended amongst Mosses by Dillenius and Linnaeus, from which its fruit totally differs. Nothing is known respecting the flower or impregnation.

40. *Imseipteris* of Bernhardt. Capsules of two cells, with a transverse structure.

T. tannensis, a New Holland plant, is the only known species.

41. *Pflotum* of Swartz. Capsules of three lobes and three cells.

Consists of *Lycopodium nudum* of Linn. and one more species. They have leaves, though small ones, analogous to those of *Lycopodium*, and the capsules are really axillary.

Cavanilles, in his Lectures on Botany in Spanish, published in 2 vols. 8vo. at Madrid in 1802, has adopted the same principles of arrangement, candidly acknowledging whence he has derived them, and describing many new ferns from the East and West Indies. Swartz refers to this work, which is the more necessary, as their generic names often differ.

One of the latest writers on the subject is Professor Sprengel of Halle, who in his Letters on the Study of Cryptogamous Plants, already mentioned, treats copiously of ferns, both physiologically and systematically. The author does not seem to be aware of the person to whom he is obliged for his leading principles and generic characters, having apparently never seen the above-mentioned Essay, though he properly mentions "the excellent Swartz," whose treatise, as it stands in Schrader, he might very well take to be original; neither has the translator corrected this omission, which we are well assured is an accidental, not designed, injustice.

Sprengel establishes the following genus upon the European *Cyathea*.

Athyrium. Capsules in small, scattered, round spots, on the whole lower surface of the frond. Involucrum fixed on one, mostly the inner, side, and commonly opening towards the margin.

This definition is not sufficient to give a clear idea of the supposed genus, which, as far as concerns the species that we have all along referred to *Cyathea*, ought to be characterized as having a lacerated involucrum, enclosing the mass of capsules, and inserted beneath them. The reformers of *Cyathea* have not had access to the whole series of species which appear to us to connect these with the primary ones.

But however this may be, we are persuaded several of Sprengel's *Athyria* belong rather to other genera, from whence he has removed them.

We cannot take leave of Professor Sprengel's work, which is full of excellent compiled matter, without giving our readers against a position in his 6th letter, p. 73. "The only character," says he, "that can be derived from the shape of the fruit, in the classification of ferns, is the presence or want of the annulated ring of the seed-vessels. From this therefore they may be divided," (he ought rather to have said they *have been* divided), into *annulate*, with a ring, and *exannulate*, without a ring: but this is an artificial, not a natural character; for the genus *Ondelia*, whose seed-vessels are annulated, approaches very near to *Osmunda*, whose capsules are without a ring; and *Polypodium* is closely related to *Marattia*, *Pteris* to *Angioperis*, *Asplenium* to *Danea*." This is so extraordinary an assertion, as to shake our confidence in the author's judgment and observation to the very foundations. No ferns, no plants of one natural order, are more distinct, unlike, and essentially different from each other than these, inasmuch that we cannot account for, nor trace, the chain of ideas which caused them even to be compared. We must repeat that nothing is more natural or absolute than the distinction between annulated and exannulated ferns, nor between either of these, and such as have a wrinkled, or sparsely annulated, capsule. The writer of the present article honestly confesses that the discovery of the latter tribe at first made him doubt the solidity of the distinction as far as

ferns with single capsules were concerned; nor had he leisure to resume the subject, before Dr. Swartz's publication removed every scruple, and set the matter at rest. About the *thecata* (*Marattia* and *Danaea*) there could never be any uncertainty. Their fruit is so unlike the annulated ferns, that to term them *exannulata* seemed to imply a sort of affinity or resemblance, (independent of the ring,) for which there was no foundation; another term was therefore contrived, but it has not been adopted. The author is the more ready to resign it, as he has ever found the necessity of keeping a watchful eye upon the invention of new terms, in this and other branches of natural history, which are often but a substitute for a deficiency of new ideas.

Thus the German writers are pleased to call, after Hedwig, the seed-vessel *sporangium*, though *pericarpium* is of precisely the same meaning, and has long been established. Professor Swartz rightly uses *capsula*, which moreover expresses what sort of seed-vessel is intended. Yet the latter prefers *gyrus*, a new botanical word, to *annulus*, because, it seems, *annulus* is used in *fungi*; as if there could be any ambiguity or confusion! Willdenow and Swartz call the involucre *indusium*, (a cover,) which we think needless, because the part correctly answers to the Linnæan idea, as well as to the true meaning of the word *involucrum*, and has long been so called. Cavanilles names it *tegumentum*, and Hedwig *perisporangium*. So the latter calls the ring *symplokiun*, and Palisot Beauvois names it *anelus*. There is no end to such futile and reprehensible changes. *Seri* of Swartz may be advantageously admitted for the spots of fructification, which cannot always be called *puncta* or dots, being sometimes linear, and sometimes broad and unlimited, so that the terms *lineæ* and *maculæ* have been resorted to; whereas the word *fori*, spots, comprehends every different shape.

We have in another place, Introduction to Botany, p. 388, put in a protest against a corruption of the generic nomenclature of ferns, on which subject we shall here be very brief. Several of the new names are compounded of *Pteris*, a fern, and some other word. Now if these are allowed to remain, some such distinctive syllables might be prefixed to the old genus *Pteris* of Linnæus, to get rid of the latter; else a very sound Linnæan law is needlessly infringed, which forbids forming new generic names of already established ones, combined with another word to give them a new meaning. All writers, before they publish, should study and observe these matters, that science may remain uncorrupted and unobscured.

In the above general synopsis of ferns we have said nothing of *Pilularia*, *Isoetes*, *Marsilea*, *Salsvinia*, and *Equisetum*, which have generally been considered as belonging to this natural order, but they ought rather to compose a new one. It is hinted in the Flora Britannica that the two first might perhaps be removed to *Monoclea* in the artificial system, and if the last should remain among the *Filices spicate*, see *Equisetum*, it can only be on artificial principles. *Marsilea* and *Salsvinia* we have never critically examined, but they seem near akin to *Pilularia*, and are likewise perhaps monocleous.

Of the Books containing figures of ferns, Plumier's splendid volume of Outlines is the most valuable. Peltier has copied it on a diminished scale. There are many East Indian species in Rheede and Rumphius; some from all quarters in Plukenet. The younger Hedwig, now alas! no longer surviving his father, has published several coloured plates of this tribe; but no plants less require this additional illustration, being all so much alike in colour. Many Euro-

pean ferns are delineated in the Flora Danica, and English Botany, and a few in Bulliard's Herbar de la France. Lamarek has given several of the new genera, with the old ones, in his general plates.—Ferns are easily dried and preserved in a herbarium, no other plants being so little attacked by insects.

Propagation and Culture—Of the propagation of ferns by seed we have already spoken. Shade and moisture are requisite for the success of the experiment; and the seedlings are of extremely slow growth. Ferns of cold countries are in our gardens hardly perennials, generally requiring a moist and shady situation, and slowly increasing by root. Those of hot climates are many of them beautiful trees, and when not too large, well worthy of culture in our stoves. The *Dicksonia arborea* from Madeira is so preserved in a few curious collections, but does not succeed very well. *Polypodium aureum*, *Davallia canariensis*, and *Woodwardia radicans*, are easily kept in a green-house, and increase slowly by means of their creeping roots. We have seen growing in the stove of Mr. Evans at Stepney in 1806, the *Todea africana*, Willd. Rare Ferns, t. 3, in full fructification. It was said to have been brought from New South Wales, but possibly that might be a mistake, as we have often detected such in the reports of those who bring plants from remote countries. It is not however impossible that this fern may grow in New Holland as well as Africa, in which case it will only afford a fresh instance of the impropriety of names of countries for specific appellations. S.

FILICULA, a little fern, was by Tournefort applied as a generic name to some of the smaller kinds of ferns, which he separated from others merely on account of their size. They belong to various genera, and have no good natural nor artificial characters.

FILIGRANE, FILLIGREE, or *Filagree-work*, a kind of enrichment on gold or silver, wrought delicately, in manner of little threads or grains, or both intermixed.

The word is compounded of *fil* or *filum*, thread, and *granum*, grain. In Latin it is called *filatim elaboratum opus*, *argentum*, *aurum*: but this is to be understood as alluding to the latest Latin writers, for *filatim* occurs only once in Lucretius, who applies it only to woollen thread. In this kind of work fine gold and silver wire, often curled or twilled in a serpentine form, and sometimes plaited, were wrought through each other, and soldered together so as to form festoons, flowers, and various ornaments; and they were also sometimes melted together by the blowpipe into little balls, by which means the threads became so entwisted as to have a very beautiful and agreeable effect. It was formerly much more employed than at present, in the manufacture of small articles, which served more for show than for use; such as vases, needle-cases, caskets to hold jewels, small boxes, particularly shrines, decorations for the images of saints, and other church furniture. This art, however, is of great antiquity; and seems to have been brought into Europe from the East. Among church furniture we meet with filligree work of the middle ages. The Turks, Armenians, and Indians make at present some master-pieces of this sort, and with tools that are exceedingly coarse and imperfect. Articles of this nature, which are very pretty and elegant, are manufactured in the Deccan, and also in China, where the filligree work is mostly wrought of silver; but this is much inferior in delicacy of workmanship to that of the Malays, described by Marsden, in his "History of Sumatra," p. 140, &c. In this island it is universally used and worn; and the goldsmiths who are employed in it are settled every where along the coast. The surprising delicacy of the work is the more extraordinary, as the tools

tools employed in it are very rudely and inartificially formed by the goldsmith, from any old iron which he can pick up. The gold is melted in an earthen rice pot, in a crucible of ordinary clay. In general they use no bellows, but blow the fire with their mouths, through a joint of bamboo; and when the quantity of metal to be melted is considerable, three or four persons sit round their furnace, which is an old broken iron pot, and blow together. At Padang alone, where the manufacture is more extensive, they have adopted the Chinese bellows. When they have drawn the wire to a sufficient fineness, much in the European manner, they flatten it, by beating it on their anvil, and then give it a twist, like that in the whale bone handle of a punch ladle, by rubbing it on a block of wood with a flat stick. After twisting they again beat it on the anvil; and thus form a leaf or element of a flower in their work, which is cut off. The end is again folded and cut off, till they have got a sufficient number of leaves, which are all laid on singly. Patterns of the flowers or foliage, in which there is not much variety, are prepared on paper, of the size of the gold plate on which the slagree is to be laid. They then begin to dispose on the plate the larger compartments of the foliage, for which they use plain wire of a larger size, and fill them up with the leaves before mentioned. To fix their work they use a glutinous substance, made of a red berry called *booa sago*, ground to a pulp, on a rough stone. This pulp they place on a young cocoa-nut, about the size of a wall-nut: the top and bottom being cut off. The juice of the cocoa-nut serves probably to keep the pulp moist, which would otherwise speedily dry and become unfit for the work. After the leaves have been all placed in order, and stuck on, bit by bit, a folder is prepared of gold filings and borax, moistened with water, which they strew over the plate, and then putting it on the fire for a short time, the whole becomes united. In executing the open work the foliage is laid out on a card, or soft kind of wood, and stuck on with the sago berry: and the work, when finished, being strewed over with their folder, is put into the fire, when the card or soft wood burning away, the gold remains connected. If the piece be large, they folder it at several times. When the slagree is finished, they cleanse it by boiling it in water, with common salt and alum, or sometimes lime-juice; and in order to give it a fine purple colour, they boil it in water with brimstone. In making little balls, with which their works are sometimes ornamented, they take a piece of charcoal, and having cut it flat and smooth, they make a small hole in it, which they fill with gold dust, and this, melted in the fire, becomes a little ball. They are very inexpert at finishing and polishing the plain parts, hinges, screws, and the like, being in this as much excelled by the European artists, as these fall short of them in the fineness and minuteness of the foliage. The price of the workmanship depends upon the difficulty or uncommonness of the pattern. In some articles of usual demand, it does not exceed one-third of the value of the gold; but in matters of fancy it is generally equal to it. This art is now neglected and little esteemed in Europe. Augsborg, however, a few years ago, had a female artist, Maria Euphros. Reinhard, celebrated for works of this kind, who died in 1779. In 1765 she ornamented with this work some silver basons, which were sent to Russia for the use of the church, and which gained her great honour.

The term has been lately applied to ornamental works, formed, as fancy directs, of strips of paper, differently coloured, rolled into various figures, and artfully combined.

FILING, in *Mechanics*, is the operation of using a file in cutting away and reducing various substances into any re-

quired form. The file is chiefly confined to the working of metal, though it is occasionally applied to wood, ivory, bone, &c. The art of filing is an essential to every workman in metal, and it requires great practice and skill to perform it well: the principal difficulty consists in filing a truly plane and even surface to any piece of metal. To do this, the work must be held firmly in a vice, so that the surface to be filed be truly horizontal; the workman then files it over with a file, adapted in its cut, or size of its teeth, to the magnitude of his work: in doing this, if it is large, he takes one end of the file in each hand, holding it firmly, as he moves it backwards and forwards, in a horizontal plane, taking care not to lean heavier upon one end of the file than the other. The file only cuts in going forwards; he must therefore press harder upon it, that it may take hold of the metal: in drawing it back it is unnecessary to lean on the file, because it is not then adapted to act; it is usual, in filing a piece of flat work, to begin at one side, and every time the file is drawn back, to move it sideways at the same time about the breadth of the file: the next stroke proceeds straight forwards, as before, but in a fresh place, unless some sudden eminence is to be reduced; then two or more strokes should be made in one place, or the pressure on the file increased till all is brought to a flat or even surface. When the whole of the work has been done over in one direction, it is then filed in the same manner at right angles thereto, and afterwards diagonally, till it is finished, trying it occasionally by a straight edged ruler. Some workmen, by long practice and experience, are able to make the work flat by filing in one direction only, and without any trial; so that if two surfaces of metal thus filed are placed one upon the other, they will adhere together for an instant if the upper one be suddenly lifted up. The height of the vice, in which the work is held, is a matter of some importance in filing; if the work is large, it should be about forty inches above the floor on which the workman stands; for small work it may be higher, because the workman does not need to bear so heavily on the work. In filing articles which are to be fitted together, the workman makes use of bevils, gauges, rulers, compasses, &c. to mark out and try the work. Round pins, &c. are held in a hand vice, and supported on a piece of wood while they are filed, and the workman turns them round while he files, in order that they may be truly round and have no angles.

The file-makers in Lancashire, for cutting the teeth of their small files, sometimes make use of a knife, *fig. 5. Plate XIII. Miscellany*, which has a beveled edge; the workman uses it in the same manner as the chisel, except that no hammer is employed. The finest files used by watch-makers have sometimes as many as 350 teeth *per* inch, which are frequently cut by the knife; other watch-makers' files are cut in the manner above described, by the chisel, *fig. 6*, which is struck on the head by a small hammer. The smallest chisels used are not a vast deal larger than the figure, and the hammer, *fig. 7*, is the full size, though the handle in reality is somewhat longer; some of very fine watchmakers' files are not larger than needles, and are called needle-files.

FILIPENDULA, in *Botany*, so called because the knobs of the roots are pendulous on threads from the main stock. *Tourn. Inst. 293. t. 150. See SPIRÆA.*

FILIPPOLI, PHILIPPOPEL, or *Filide*, in *Geography*, a town of European Turkey, in Romania, on the Maritz, where it becomes navigable; founded by Philip, father of Alexander the Great. In the year 250 it was taken by the Goths, who are reported to have massacred 100,000 persons in the sack of this city; and in 1360 it was taken by Amurath I. emperor of the Turks; 90 miles W.N.W.

of Adrianople, and 124 W.N.W. of Constantinople. This town is meanly built, without fortifications, or one good street. Its situation is so low and moist, that the mud is sometimes two feet deep, and stones, like posts, are set up to facilitate the progress of foot-passengers. Nevertheless it is a place of considerable size. N. lat. 42° 22'. E. long. 24° 44'.

FILITZ, a town of Germany, in the principality of Culmbach; six miles S. of Kirch Lamitz.

FILIUS ANTE PATREM, *q. d.* the son before the father; a denomination applied by botanists and florists to plants whose flowers come out before their leaves. Such are the several species of colchicum, or meadow-saffron, the colt's foot, butterbur, &c.

FILIX, in *Botany*. See *FILICES* and *FERN*.

FILL, *To*, in the *Sea Language*, is to brace the sails in such a manner, that the wind entering their cavities from behind, dilates them, so as to advance the ship in her course, after the sails had been for some time shivering or braced back.

FILLEK, in *Geography*, a town of Hungary, taken by the Turks in 1554, but soon after recovered. Its fortifications are destroyed; 40 miles S.E. of Crennitz.

FILLER, a term often provincially used to signify the horse which supports, and is placed between the shafts of carts or other carriages. It is commonly written thiller. See *THILLER*.

FILLET, in *Anatomy*. See *FRÆNUM*.

The word is French, *filet*, formed of *fil*, thread.

FILLET, or *Filet*, in *Architecture*, denotes a little square member or ornament used in divers places and on divers occasions, but generally as a sort of corona over a greater moulding.

The fillet is the same with what the French call *reglet*, *bande*, and *bandelette*; the Italians, *listra*, or *listella*.

FILLET, in *Botany*. See *THREAD*.

FILLET, *Teniola*, in *Heraldry*, a kind of orle or bordure, containing only a third or fourth part of the breadth of the common bordure. See *BORDURE*.

It is supposed to be withdrawn inwards, and is of a different colour from the field. It runs quite round near the edge, as a lace over a cloak.

FILLET is also used for an ordinary drawn like the bar from the sinister point of the chief across the shield, in manner of a scarf; though it is sometimes also seen in the situation of a bend, fesse, cross, &c.

According to Guillim, the fillet is a fourth part of the chief, and is placed in the chief point of the escutcheon.

FILLET, in *Midwifery*, a contrivance for the purpose of extracting the child, in difficult births, when the head is too large to pass readily through the pelvis. The invention is probably very ancient, as it is mentioned by Avicenna, as well known in his time; that is, towards the end of the tenth century. The simplest, and probably the first contrivance of the kind, was made by cutting, in a strong slip of cloth, a slit, sufficiently large to embrace, and take into it, the head of the child. This was carried up into the vagina, upon the hand of the accoucheur, and passed over the face of the child, and lodged under the chin, or over the hind-head, and pressed close to the nape of the neck; the hand was then withdrawn, and the child extracted by pulling down the other end of the cloth. But as it was difficult to keep the noose open, so as to make it embrace the head of the child; this defect was attempted to be remedied, by making a sheath, with a slip of strong cloth, two feet or more in length, through which a thin piece of whalebone was passed. The noose being carried over the head,

and fixed under the chin, or close to the nape of the neck, the whalebone was then withdrawn, and the child extracted by pulling down the two ends of the sheath. Various other improvements, or alterations, in the form of the fillet, have been devised, all with the view of facilitating the passing of the noose over the head of the child, or of fixing it when passed, but with so little success, that it has long been given up as useless, and the *forceps*, or the *lever*, (see those articles) are invariably used in all the cases for which the fillet was formerly recommended. This may be a proper place to mention a kind of net invented by Peter Amand, (see the article *AMAND*, *Pierre*) an accoucheur of some credit, who flourished the latter end of the 17th century, with which he brought away, or proposed bringing away, the head of the child, when it happened to be left in the womb separated from the body. The accident, which is far from being of frequent occurrence, can scarcely ever happen but when the brim of the pelvis, in the woman, is too narrow to suffer the head of the child to pass entire or unmutilated; consequently, too narrow to admit the hand of the accoucheur, encumbered with the net, to pass into the uterus. The contrivance, therefore, sunk as soon almost as it was invented; and the crotchet, which is much more manageable, is constantly used in these unpleasant cases. See the article *CROTCHET*.

FILLET is also used among *Painters*, *Gilders*, &c. for a little rule and reglet of leaf-gold, drawn over certain mouldings; or on the edges of frames, pannels, &c. especially when painted white, by way of enrichment.

FILLETS, in the *Manège*, are the loins of a horse, which begin at the place where the hinder-part of the saddle rests.

FILLING up of *Chasms*, in *Geology*. It was a favourite opinion of the late ingenious Mr. Whitehurst, that most, or all of the rocky vallies in Derbyshire, were formerly immense and almost fathomless chasms, hiati, or gaping fissures, which were subsequently filled up with the fragments or ruins of the adjoining strata, to the level of the present rivers or brooks; the vale of Matlock-Bath he particularly describes as such a filled-up chasm, in the second plate of his "Enquiry concerning the Earth;" but which opinion the miners of the district shortly afterwards proved to be unfounded, by driving across, in solid and undisturbed strata, under the bed of the river, see *Philosophical Magazine*, vol. xxxi, plate 2.

The instances are doubtless numerous, of the filling up of chasms or faults with alluvial and extraneous matters; indeed it is a common occurrence; but it is to be observed, that such are in general quite filled up, and not partially, so as to leave a valley between the sides of the fault; for faults are but rarely visible on the surface of the ground (see that article); and as rarely, or more so, do they traverse the bottoms of vallies, with which they seem to have little connection, but to have happened prior to the EXCAVATION of Vallies; see that article. It is the opinion, founded on the experience of most miners, that the strata or measures under vallies are as regular and undisturbed as in any other places, and that faults are scarcely so much to be apprehended there, as in some other situations; if, however, a change of the dip takes place, and a real dislocation of the measures on the two sides of a valley, as Mr. Whitehurst supposes in his section across Matlock-Bath vale, above referred to, then a fault may confidently be looked for in the valley, the same as would be expected in any other situation, where the same circumstances occur.

FILLY, in *Rural Economy*, a term signifying a mare, or young female of the horse kind of animals. See *HORSE*.

FILLY Foal, a term implying a mare or female foal. See FOAL.

FILM, a thick skin or pellicle.

In plants it is often used for that thin woody skin which separates the seeds in the pods, and keeps them apart.

FILM, *White, on the eye of a horse*, may be removed by lifting up the eye-lid, after the eye has been washed with wine, and stroking it gently with the thumb with wheat-flour: common salt and salt of lead, beaten fine, and put into the eye, are proper to consume a film; or the horse's eye may be washed with the spittle in the morning, fasting, having first put a little salt into your mouth; but there is nothing so effectual as sal ammoniac, beaten and put into the eye, and repeated every day till the film is gone.

FILMER, EDWARD, gent. in *Biography*, in 1629, collected, translated, and published, "French Court Ayres, with their ditties, Englished, of four and five parts, dedicated to the Queen," folio. These ayres were chiefly composed by Pierre Guedron, with two by Anthoine Boiffet. There is very little musical merit discoverable in these songs: which are, however, highly extolled in several copies of verses prefixed to the book; and, among the rest, in one by Ben Jonson. The editor seems to have taken great pains in translating the words, "totidem syllabis," in order to accommodate them to the original melodies.

FILOPONSKAJA, in *Geography*, a town of European Turkey, in Dobruzzic Tartary; 18 miles S.S.E. of Ismail.

FILOQUIA, ANFILOQUIA, or *Jerovilia*, a town of European Turkey, in Livadia, on a river which runs into the gulf of Arta. It was anciently called Amphilochia, or Argos Amphilochium, and, although once a celebrated town, it was ruined by the war between the Venetians and Turks; 44 miles N.N.W. of Lepanto.

FILTER, or **FILTRE**, in *Chemistry*, &c. a piece of woollen cloth, linen, paper, or other matter, some of which are in the form of hollow inverted cones, used to filtrate or strain liquors through. The filtre has the same use and effect with regard to liquids that the sieve or searce has in dry matters. Filtrés are of two sorts: the first are simple pieces of paper or cloth, through which the liquid is passed without farther trouble. The second are twined up like a skin or wick, and first wetted, then squeezed, and one end put in the vessel that contains the liquor to be filtrated: the other end is to be out, and hang down below the surface of the liquor; by means of this the purest part of the liquor distils drop by drop out of the vessel, leaving the coarser part behind. The filter or philter acts as a siphon.

FILTER is also an apparatus used to separate water or other fluids from any foreign mixture it may contain; this is effected by causing the water to percolate through an infinite number of apertures, which are too minute to allow the passage of any substances mixed in the water; by this means, the most foul water, after passing through such a filter becomes perfectly transparent and sweet, though at the same time it is not deprived of any of its qualities which depend upon matter entering into combination with it; only such as depend upon mechanical mixture being arrested in its progress through the filter.

The great utility of filters for domestic use must be evident, as a fluid fit for culinary purposes can be obtained from any putrid and muddy water; on this account the construction of apparatus, which will at the same time be cheap and efficacious, is a desirable object; and a vast variety have been contrived, many possessing great advantages.

The filter in most general use is a basin formed of some

porous kind of stone, and supported over any convenient vessel to receive the filtered fluid. The foul water being poured into the basin, insinuates itself by slow degrees through the minute pores of the stone, and is collected, drop by drop, into the receptacle placed beneath. This apparatus answers its purpose perfectly well for a time, but has its defects: the constant accumulation of the impurities in the basin, in time chokes up the pores of the stone; this may be removed by washing many times, but the more minute particles of matter are, by insensible degrees, carried down into the stone, fill up the pores, and at length no water will pass through. A trifling error is also committed in the form of the vessel, which is in general a hemisphere; in this figure the pressure of the fluid is greatest in the lowest point, and gradually diminishes in every other part, so that unless the pressure is greater in the centre than it ought to be, scarcely any water will pass through the other parts. A more eligible form would be that of a cylinder, formed either of earthenware or metal, with a circular plate of the filtering stone cemented into it at the middle; by this means, the pressure on all parts will be equal, and it would have another advantage, that when the water began to pass slowly through the stone, by inverting the cylinder, the water would be filtered in a contrary direction, and act to remove the matter deposited in the pores of the stone by the preceding process. The stone proper for conducting filters, is by no means scarce; in London a very porous limestone containing innumerable fragments of broken shells is employed; it bears strong resemblance to the rag-stone found at Barnack near Stamford, Northampton; a grit-stone, procured at Birchover and Stanton Moor near Winster in Derbyshire, is found to be well adapted for filters, which are carried all over the country. The expence of stone filters, and their liability to be clogged up by long use, have given rise to many others more simple; sand finely washed, pulverised glats, pottery or charcoal, are frequently employed, being placed in a proper situation for the water to percolate through them. The latter, from its well-known antiseptic quality, is peculiarly adapted to correct putrid water, at the same time that it separates its impurities. Mr. John Isaac Hawkins, Titch-eld street, has established a manufacture of charcoal filters for the supply of the metropolis where the water in general requires such preparation.

Figs. 8 and 9, Plate XIII. Miscellaneous, represent two constructions. The latter is on a large scale, and constructed in a cask A B C D, divided into two compartments by a vertical partition, E F, which does not reach within two inches of the bottom of the cask; the space a B D B C b is filled with charcoal, at first a stratum of coarsely powdered charcoal four inches deep, and this is covered with another stratum of four inches, in pieces about the size of walnuts; in each division of the cask the charcoal is covered with a perforated cover, the foul water is poured in on the side, A B E F, and is forced by its pressure down on *s* side, and up on the other, through the charcoal, in which it deposits its extraneous mixtures, and rises in the side, I E F, perfectly transparent and sweet: it is drawn off for use by the cock *d*; at *e* is a cover to prevent the foul water being accidentally thrown in on the wrong side; the cask is of wood, and charred within-side, to still farther sweeten the water.

The filter represented in *fig. 8*, is on a smaller construction; here A is the vessel for the foul water, furnished with a cock *a*, delivering the water in the spout *b*, of a second vessel B, containing the filter; it is filled with charcoal as high as the cover *c*, which prevents the small charcoal being disturbed by the entrance of the foul water, which, after percolating through the filter, escapes at the tube *d* into the inferior reservoir, where it is retained until wanted, when it

is drawn off at the cock *g*. The cask filter is two feet eight inches in height, twenty-two inches diameter at the bottom, and sixteen inches at top; if constantly supplied with foul water it will purify one hundred gallons per day; its inventor strongly recommends it for the use of ships; the other filter, which is made of earthenware, and a much smaller scale, will do a proportionate quantity; when the charcoal becomes foul it may be taken out and replaced, at an inconsiderable expence; sand, pounded glass or pottery, and other substances, have at times been recommended. Professor Parrot constructed a filter with sand; its form is an inverted siphon, the curve of which is filled with sand washed exceedingly clean, a constant stream of the foul water enters at one side of the siphon, and passing down through the sand in one leg, rises through the other, escaping on a level rather lower than it entered. Great stress is laid by the inventor upon the filtration by ascent, as well as descent, as he supposes the more weighty particles will subside; though from their exceedingly small size, they might escape through the interstices of the sand. It will be easily seen that the ship filter by Hawkins is the same in effect, though on a better construction.

Mr. James Peacock took out a patent in 1791 for filtration by ascent through any of the above-mentioned substances; but he does not describe any thing material which we have not mentioned above.

The filter delineated in *fig. 10.* is a contrivance of Mr. Collier, and described in the Philosophical Magazine; A B C is an ordinary cask divided into three parts by three horizontal partitions; the upper division A B *ab* is to contain the reservoir of foul water; the partition *ab* is perforated, and allows the water to pass slowly down into the middle division filled with broken crockery ware, presenting innumerable surfaces upon which the water deposits any matters which will subside; the cask is perforated all round to admit air at *ab*; the water then passes into the inferior compartment which contains the filters; these are three cylinders, one of which is seen at D; they are formed of argil and silex baked together in a potter's kiln. The water percolates through this substance, and is received into a vessel E communicating with the filters, formed of metal, and furnished with a cock at *e* to draw off the fair water; F is a metal tube placed upon the top of the reservoir E, with which it communicates, and in which the water rises as it accumulates in the reservoir; a cock at *f* will draw off the foul water, and the tube F, being full, or nearly, of the filtered water, the pressure will be reversed, and the impurities lodged in the pores of the cylinders removed by the contrary action.

To the inhabitants of a large city the filtration of the water they make use of is a matter of considerable importance, but the practice is at present confined to apparatus on a small scale for the use of one family only; filters on a large scale might be simply constructed, and the expence of land for their formation would be amply repaid by the improvement of the water. The construction of the ship filter seems best adapted for this purpose, a large tank lined with brick-work, and divided into two by a wall which must have every other brick of the lower course omitted, so as to leave apertures at the bottom of the wall; this tank being filled two feet deep with pulverized charcoal would form an excellent filter, and several of these being arranged round the steam engine for pumping the water would alternately supply it. The expence of charcoal might be obviated by using the refuse or charm as it is termed, or saw-dust might be charred in an iron retort at a small charge. See FILTRATION.

FILTER, or *Philter*, is also a charm, supposed to have a virtue of inspiring love.

The word is derived from *φιλος*, which signifies the same thing, of *φιλεω*, *amo*, *I love*.

The Greeks, when their love was without success, had several arts to procure the affections of their beloved. The Thessalian women were famous for their skill in this, as well as other magical practices. The means whereby it was effected were of divers sorts; it was sometimes done by potions, called *φιλιζα*, which are frequently mentioned in authors of both languages. Juvenal speaks thus:

“Hic magicus assert cantus, hic Thessala vendit
Philtre, quibus valeat mentem vexare marit.”

Their operations are violent and dangerous, and commonly deprived such as drank them of their reason. Plutarch and Cornelius Nepos report, that Lucullus, the Roman general, first lost his reason, afterwards his life by one of them. Lucretius, the poet, ended his life by the same way; and Caius Caligula, as Suetonius reports, was driven into a fit of madness by a filtre given him by his wife Cæsonia, which story is mentioned by the same poet. Ovid likewise assures us, that this was the usual effect of such potions.

The ingredients they were made of were of divers sorts, several of which, applied by themselves, were thought effectual.

FILTJA, in *Geography*, a town of Sweden, in the province of Sudernania; 30 miles S.W. of Stockholm.

FILTRATION, the act of passing any liquor through a filtre, called also *colature*, *percolation*, and *transfolution*. See FILTRE.

The end of filtration is of two kinds; the one to free fluids from any solid bodies of a feculent nature with which they are mixed; and the other to separate any precipitated powder or other solid body from superfluous fluid; and the means must be varied accordingly. Such liquors as are incorporated with particles that adhere to them are rendered capable of filtration by coagulating and collecting the heterogeneous parts. This is effected either by boiling or by mixing whites of eggs and boiling them with the turbid liquors. See CLARIFICATION.

The most commodious way of filtrating is by whited-brown paper, or paper without size, fastened over the mouth or aperture of a funnel; the smallness of the pores of this paper admits only the finer parts through, and keeps the rest behind. There are also filtrations through sand, pulverized glass, &c. Spirits of vitriol, salt, and nitre, are filtrated through a quantity of beaten glass in the bottom of a funnel.

Filtration is also performed by a woollen or linen bag, called Hippocrates's sieve: the choice of these must be directed by the liquor to be filtered.

Dr. Papin contrived a method by which filtrations through cap-paper might be made suddenly, and with great quantities of liquor, by the help of the air-pump. For this purpose he made use of the following contrivance: A A (*Plate XIII. Miscellany, fig. 11.*) is a glass receiver; B B a cover fitted to it; C C C is a pipe forming the communication between the receiver A A and the air-pump; D D a shallow vessel full of little holes; E E E a pipe that makes the communication between the vessel D D and the receiver A A; F F a vessel to contain the liquor to be filtrated, and G G the plate of the pump. When this instrument is used, the shallow vessel D D ought to be tied about first with linen cloth, and then with cap-paper, so that no liquor may get into the holes of the said vessel but through the cap-paper, and linen cloth; this must be wholly placed

placed within the liquor to be filtrated: let the air be extracted by means of the air-pump out of the vessel A A. Then the liquor in the vessel F F must be drawn through the cap-paper, and the linen cloth into the vessel D D, and from thence through the pipe E E E into the vessel A A; and this operation must be quick, on account of the great pressure of the atmosphere that drives the liquor; besides, the sediment of the liquor subsiding at the bottom of the vessel F F will not be so apt to stop the pores of the cap-paper as in ordinary filtrations. Birch's Hist. of the Royal Society, vol. iv. p. 366, &c.

Filtering stones and filtering basons, either natural or artificial, for the purpose of purifying water, are not unfrequently used in this and in other countries. Rocky mountains, beds of sand, gravel, &c. are natural filters. The composition for making filtering basons, in order to purify water, consists of equal parts of tobacco-pipe clay, and coarse sea, river, drift, or pit-sand. The basons are formed and turned on a potter's wheel; and they should be about $\frac{3}{4}$ of an inch thick. When the vessels are of the usual degree of dryness, the whole outside and inside surface must be shaved or turned off on a potter's wheel; and, when perfectly dry, these basons are burnt or baked in a potter's kiln after the usual manner. Many patents have been obtained by different persons for filtering machines of their own invention. See FILTER.

The secretion of the divers juices in the body from the mass of blood seems to be little else but filtration. Pitcairn, and other late authors, hold that the diversity of filtration does not depend on the different configurations of pores, but on their different sizes or diameters.

Springs also seem to be raised from the ocean by the same principle of filtration.

FILTRATION, in *Pharmacy*, is chiefly concerned in tinctures; as when some portion is drawn from the ingredients or suspended in the tincture which is not necessary to it, but disturbs and renders the rest unpleasant both to the palate and sight. Besides this, there is a filtration which has much tortured the philosophy of some ages to account for; this is that performed by the ascent of the finer parts of a liquor up a cord or skein of cotton, or such like matter, which is contrived to drop over another vessel and leave the grosser behind.

After the same manner it is, without doubt, that the humidity of the earth is drawn up into the substance of the roots of vegetables, which we know consists of long and very minute fibres, so disposed as to form a great number of tubular interstices; these act in the nature of this sort of filtre, and attract the juices and moisture appointed for the nutriment and increase of the plant.

Some say, that the cause of this ascent is because the liquor swells those parts of the filter that touch it, by entering into the pores of the threads which compose it, whereby they rise up, touch, and wet those next above them; and these again the next threads; and so on to the brim of the vessel, when the liquor runs over, and descends in the other part of the filter which hangs down by its own natural gravity.

But this account is liable to many objections, especially as liquors rise after the like manner in glass tubes much above the surface of the liquor they are immersed in, where the glass cannot be imagined thus to swell.

Others account for it, by considering every filter as composed of a great number of long, small, solid bodies, which lie very close together; so that the air getting in between them loses much of its pressure, and cannot gravitate so strongly as it doth on the fluid without them; the conse-

quence is, that the parts of the water between the threads of the filter must be pressed upwards, and ascend till they come so high, as, by their weight, to counterbalance the general pressure on the other parts of the surface of the water.

Lastly, the retainers to Sir Isaac Newton's philosophy deduce the phenomenon from the principle of attraction. According to them, the cause of this filtration is, doubtless, the same with that whereby fluids ascend up heaps of ash s, sand, &c. the same with that whereby water is raised in form of vapour, the sap rises in vegetables, and the blood circulates through the capillary arteries, and the extremely minute glandular strainers. See ASCENT of fluids.

FILTRUM, in *Natural History*, the name of a stone much in use in the eastern parts of the world, and sometimes with us for the filtrating of water intended for drinking. The Japanese are extremely fond of this stone, and impute their uninterrupted health, and particularly their being always free from the stone and gravel, to their drinking the water thus cleared of all its heterogeneous and mischievous particles. The people of this, and many other places thereabouts, have a settled opinion, that most diseases arise from impurities of water, and are well assured, that these impurities are all lodged in the stone-filtre, and left behind by the water in its passage.

The manner of using the stone is this; they form a sort of mortars with very thick bottoms out of the largest pieces of it, and the water is poured into these, and the stone being of a very lax and spongy texture, it soon makes its way through, and is received into a vessel placed underneath for that purpose. It being found, therefore, an easy thing for us to have our water filtered in the same manner that the Japanese have, it remains to try whether it will have all those salutary effects which the people of that part of the world give it; and this seems not to be imagined from reason and analogy. We very well know that water is frequently impregnated with saline particles, and that it also frequently dissolves by this means earthy and other matters which it otherwise could not do. But we also know, that salts dissolved in water are not to be separated by filtration; and it is equally certain, that earthy, sparry, or other matter, that is suspended in water when clear, will in like manner pass through the filter with it.

Upon the whole, we are happy enough to have no occasion for filtering stones, since our springs and rivers afford us water already pure enough to our hands; and in places where this is not the case, it is always possible to save rain-water, which will keep a long time with proper management, and is much purer than all the art in the world can make such as has once been foul. Valentini Museum Musæorum, lib. i. cap. 22.

The only instance in which a filtering-stone can be of real use, is, when there is no water to be had but that of some muddy river; in this case, the mud being a foreign body not dissolved in, but only floating among the water, it will be left behind in its passing the close structure in the filtre; but this is always to be as well obtained by letting it stand a while to subside. Ephem. Germ. Cent. iii. p. 76.

Filtres, however, have been found useful to those who live near the metropolis, and who are supplied with water from the Thames, the New River, and the ponds from Hampstead; and many filtering machines have been contrived for this purpose. See FILTER and FILTRATION.

FILTZ, ANTON, in *Biography*, a performer on the violoncello in the Elector Palatine's band at Mannheim, in

1763, and an elegant composer. His pleasing productions for various instruments were soon noticed and admired; but alas! death stopped his career in the prime of life, before his genius and talents were well developed. In 1768 the musical world was robbed of this young artist, of whom, from the specimens he had already given of his abilities, the highest expectations were formed. In Paris and Amsterdam the following compositions appeared before his decease, six symphonies, six violin trios for the harpsichord, violin, and bafe. These were printed from the Paris copy, by Bremner, as were most of his symphonies. Nothing was ever so elegant, and at the same time so easy, as his harpsichord trios. He left behind him in MS. various concertos for the violoncello, the German flute, the hautbois, and the clarinet, which were sold singly in MS. at the music shops in Leipzig and Hambro', all much admired when executed by great performers. Besides these, some MS. duets and solos for the violoncello were long purchased and performed with great applause.

FILUM AQUÆ, the thread or middle of the stream where a river parts two lordships. "Et habebant istas buttas, usque ad filum aquæ prædictæ. File du mer, the high tide of the sea." Rot. Parl. 11 Hen. IV.

FILURINA, in *Geography*, a town of European Turkey, in Macedonia; 28 miles N. of Edeffa.

FIMARELLA, a river of Naples, which runs into the gulf of Tarento. N. lat. 39° 36'. E. long. 17° 12'.

FIMBLE HEMP, in *Rural Economy*, a term sometimes applied to early ripe hemp, or female hemp. See **FEMBLE Hemp**.

FIMBRIA, in *Anatomy*, the fringed border of the opening, by which the Fallopian tube communicates with the abdominal cavity. This part is named the fimbriated extremity of the tube. (See **GENERATION**.) There is also a part in the brain called corpus fimbriatum. See **BRAIN**.

FIMBRIA, in *Surgery*, was a term anciently employed to signify the outer tape, or fillet, which was put on to secure the rest of some bandage, or apparatus.

FIMBRIATED, a term in *Heraldry*, signifying that an ordinary is edged round with another of a different colour.

Thus, he beareth, or, a cross-pattee gules fimbriated sable.

FIMBRISTYLIS, in *Botany*, from *fimbria*, a fringe, and *stylus*, the style of the flower. Vahl. Enum. v. 2. 285. Class and order, *Triandria Monogynia*. Nat. Ord. *Calamaria*, Linn. *Cyperoidea*, Juss.

Gen. Ch. *Cal.* a single seale to each flower, concave, keeled, gradually deciduous, making part of a spike imbricated every way. *Cor.* none. *Stam.* Filaments usually three, rarely only one or two; anthers linear. *Pist.* Germen very small, superior; style with a half-globular bulb at the base, which falls off along with it; compressed and gradually dilated upward, fringed or ciliated at each edge; stigmas two, capillary, spreading, downy. *Peric.* none. *Seed* one, lenticular, convex at each side, pointed at the base, without any surrounding bristles. *Receptacle* gradually elongated and becoming naked from the base upward, very closely pitted, the pits or cells having each a membranous border.

Ess. Ch. Glumes chaffy, imbricated every way. Corolla none. Style cloven, bulbous at the bottom, compressed, fringed at each edge. Seed solitary, without any bristles at its base.

This genus is separated from *Scirpus* by Vahl, in consideration of the great extent of the latter, which has long

rendered some such division desirable. He defines its habit as follows.

Stems several, erect, without joints, leafy in the lower part. Leaves channelled, rough-edged upwards. Involucrum like the leaves. Rays of the umbel bearing each one spike, and having a central sessile spike at their base; sometimes each ray bears two spikes, one of which is sessile, the other stalked: all the spikes are gradually elongated as the seeds ripen. Keel of the scales green.

The author just named still seems to consider this as an artificial genus, which may perhaps be tenable as a section only of *Scirpus*. Yet he asserts it to be as distinct from the latter as *Pelargonium* and *Erodium* are from *Geranium*; three genera as distinct, if we be not greatly mistaken, as any that agree in natural order throughout the whole vegetable kingdom. See **ERODIUM**.

Vahl has 24 species of *Fimbristylis*. Among them are, *F. miliaceum*. "Spikes globose. Involucrums of about two leaves, shorter than the twice-compound umbels. Stem leafy at the base." (*Scirpus miliaceus*; Linn. Sp. Pl. 75. Willd. Sp. Pl. v. 1. 305. Rottb. Gram. 57. t. 77. f. 2. Burm. Ind. 22. t. 9. f. 2.)—Native of the East Indies. Perennial. Stems a foot high. Leaves flaccid, smooth. Umbels more compound than the above account of the habit of the genus implies. Spikes scarcely bigger than mustard-seed, rufly-brown.

F. dichotomum. "Spikes ovate-oblong. Involucrum of about three leaves, longer than the repeatedly compound umbel." (*Scirpus dichotomus*; Linn. Sp. Pl. 74. Willd. Sp. Pl. v. 1. 303. Sm. Fl. Græc. Sibth. v. 1. t. 50. Rottb. Gram. 57. t. 13. f. 1.)—Native of the East Indies and south of Europe, in moist sandy ground. Root annual, fibrous. Herbage glaucous-green. Stems from six to twelve inches high. Spikes more ovate and acute, as well as larger, than in the former. Stamens from one to three. Rottboll describes the style as rough, but does not represent it so, neither is that character, which makes the plant a *Fimbristylis*, exhibited by Mr. Bauer in the *Flora Græca*.

F. ferrugineum. "Spikes ovate-oblong. Scales somewhat downy or hoary in the middle. Involucrum of about two leaves, as long as the simple umbel." (*Scirpus ferrugineus*; Linn. Sp. Pl. 74. Gramen cyperoides majus, spicis ex oblongo rotundis compactis ferrugineis; Sloane Jam. v. 1. 118. t. 77. f. 2.)—Native of salt marshes in Jamaica. Stems a foot and half high, glaucous, ribbed, compressed. Umbel simple or compound, of from three to six rays. Spikes half an inch long, brown and hoary.—Vahl is much confused in his quotation of Sloane, as in many other similar cases, his book being carelessly executed in that respect. In this instance he errs by copying Linneus without turning to the book quoted.

F. spadicum. "Spikes oblong, cylindrical, acute. Involucrum rigid, of two leaves, as long as the doubly compound umbel." (*Scirpus spadicus*; Linn. Sp. Pl. 74. Gramen cyperoides majus aquaticum, paniculis plurimis juncis spartis, spicis ex oblongo rotundis spadicis; Sloane Jam. 118. t. 76. f. 2.)—Native of watery places in the West Indies. Stems two or three feet high, rigid and rushy. Spikes numerous, acute, an inch long, dark shining brown.

F. argenteum. "Spikes cylindrical, obtuse, sessile, clustered, in round heads."—(*Scirpus argenteus*; Rottb. Gram. 51. t. 17. f. 6. Mullen-pullu; Rheede H. Mal. v. 12. 101. t. 54.)—Native of moist places in the East Indies. Root apparently annual. Stems numerous, from three to six inches high, glaucous as well as the leaves. Spikes of a silvery grey, numerous, in dense heads. Vahl thinks *Scirpus*

Scirpus monander of Rottboll, 50. t. 14. f. 3, is not different from this.

We believe this genus will receive augmentation from several species hitherto considered as *Scirpi*, but not yet described. As far as we have observed, the progressively deaerated rachis of the spikes, from the deciduous glumes, is very characteristic of a *Fimbristylis*.

FIN, in *Geography*, a small river of the county of Monaghan, Ireland, which rises in the west of the county, and runs into Lough Erne.

FIN, *Pinna*, in *Natural History*, the name of that part of a fish which distinguishes it from other aquatic creatures, no animal but a fish having fins and wanting legs.

The fin is properly a part standing out or hanging from the body of the fish, and consisting of a membrane supported by several rays or oblong bones, which are in some hard and firm, and in others cartilaginous.

This definition of a fin properly excludes all those other parts of a fish which may be prominent from the body, and may be of a membranaceous structure, and even bear the appearance of a fin, though they have none of the rays or little bony substances within them, and therefore cannot serve the creature in the office of fins in swimming; for the cartilages or bones which support the membranes of the fins are what give them their due and necessary strength and firmness to bear against the water for the motion of the body of the fish; those other membranaceous appendages to the bodies of fishes cannot do this; for wanting the support of these rays, the simple and soft membrane has no more power of moving the water than the water has of moving it. Hence appears the use of the bones or rays supporting the fins, and the truth of the definition, that nothing is properly a fin which wants them.

The fins, by their differences, make very obvious distinctions among the several species of fish; and these differences are in regard to number, situation, figure, and proportion.

The number of the fins, including the tail, is very different in different fish. 1. In some there is only one fin to the whole fish: this is the case in the ophidium lumbriciforme, and in the muræna. 2. The fins are two in number in others, as in the petromyzæ, and the like. 3. There are many which have three fins, as the conger, the eel, the common ophidium, the Greenland whale, the sea-cow, and the like. 4. Many have four fins; of the number of which are the dolphin, the phocæna, and the second kind of the æcus Aristotelis. 5. Several have five fins, as the ammodytes or sand-eel, the sword-fish, the lupus marinus, the mola or fan-fish, and many others. 6. The lump fish gives us an instance of six fins; for the seeming first fin on the back of that fish is not a real fin, but only a cutaneous prominence. 7. Many fish have seven fins, as the gudgeon, the pleuronectes, the cyprinus, the clupea, the coregonus, the osineri, the salmons, the cobites, the efoees, the cernua flaviatilis, the gasterosteus, the spari, the labri, the silurus, the mugil alatus, the remora, the capriscus, the hippurus, the pompilus, and the accipenser. 8. Many fish also have eight fins each; of this number are some of the peraches, the clarea, the cottus, the mugil, the labrax, the fudis, the nulli, the ling, the trachurus, the scyæne, the trachinus, the uranoscopus, and that little fish called the anguella by the Venetians. 9. The scorpena of Rondeletius gives us an instance of the fins being nine in number; and finally, the scombri and thynni give us instances of eleven fins in the same fish.

The differences in situation are less numerous than these, as to number, but they are not less obvious and essential.

1. They are generally placed both on the back and belly, as we see in most of the species of fishes. 2. They are sometimes placed only on the back; this is the case in the petromyzæ, the æcus lumbriciformis, and some others. 3. Some have them, on the contrary, only on the belly; of this kind are the Greenland whale, the sea-cow, and the like: and to this it is to be added, that the back and belly fins differ greatly in the several fish, in their being placed more or less backward or forward.

The differences of shape or figure in the fins of fishes are also very obvious. 1. They are in some nearly triangular, as in the cyprini and salmons, &c. 2. Some few fish have them round. And, 3. Some have them of an oblong square or parallelogram square.

Finally, the difference in proportion is not to be omitted, for they are in some much shorter and smaller than the body, as in the case in the generality of fish; but in others they are of an equal length with the body. Of this kind are the pectoral fins in some of the legyræ, and the ventral fins in the mugil alatus of Rondeletius and other authors. Artedi, Ichthyol. p. 4. See *Anatomy of Fishes*.

FIN, Fr. *Fine*, Ital. *Finis*, Latia, the end of a work, or, in *Musick*, of a composition.

FINS of *Fish*, in *Natural History*, is the name by which some fossil relics have been denominated, owing to their resemblance to that member of the finny tribe, in the present race: Mr. W. Martin recommends the classing of all these detached parts of reliquia under temporary species; there to remain, until the whole, or a sufficient number of the parts of the same animal, shall be found united, to determine its place among the permanent species.

FIN, in *Rural Economy*, is a term frequently used to signify a sharp cutting plate of iron, fixed upon the coulter or sock of a plough, in order to render its operation or work more complete. It is mostly had recourse to in coarse, tough, peaty sorts of land.

FIN, a common name frequently applied to the troublesome weed termed *rest-karrozæ*.

FIN-fish, the *balena physalus* of Linnæus. See *PHYSALUS*.

FINS, *Whale*, are commonly taken for that part of the whale which the populace call *whale-bone*; but whence the mistake should arise is not easy to determine.

These whale-fins, as some have erroneously called them, are the most valuable part of the animal. See *Whale-FISHERY*, and *Whale-bone*.

FINAL, that which terminates or comes last in any thing, as a final judgment, final sentence, &c.

FINAL Cause, is the end for which the thing is done. The final cause is the first thing in the intention of a person who does a thing; and the last, in the execution. See *CAUSE*.

FINAL Decree. See *DECREE*.

FINAL Judgment. See *JUDGMENT*.

FINAL Letters are those which close words.

The Hebrews have five final letters, which, when at the end of a word, have a different figure from what they bear at the beginning or in the middle thereof. These are the \aleph , \beth , \daleth , \kaph , \mem , nun , pe . *qade*, which every where but at the end of words, are wrote \aleph , \beth , \daleth , \kaph , \mem , nun , pe .

FINALE, in *Geography*, a town of Italy, in the department of the Panaro, on an island in the river Panaro; 13 miles N.N.E. of Modena.

FINALE, a small marquisate, surrounded by the Ligurian republic, agreeable, fertile, and populous; which, after having frequently changed its possessors, at length became

subject to the Ligurian republic. Its capital is a sea-port town of the same name, having a good harbour on the coast of the Mediterranean; 31 miles S.W. of Genoa. N. lat. $44^{\circ} 10'$. E. long. $8^{\circ} 24'$.

FINALE, Ital. in *Music*, the last chorus, or movement at the end of an act of an opera; and in symphonies, concertos, quartettos, or sonatas, the last movement is called the *finale*. The finales of the Italian comic operas are the most ingenious, varied, pleasing, and masterly compositions which dramatic music can boast; particularly those of Piccini, Paisiello, Cimarosa, and Mozart. Such a variety of measure, such fire, grace, passion and pathos, by turns, that the hearer, at the end, is unable to say what movement or passage he likes best. They are extremely difficult to perform, yet the Italians, by dint of study and rehearsal, are no more embarrassed than if, instead of singing, they were only talking and squabbling the whole time.

FINALIS PAUSA, in old music, two Latin words. See **CORONA**.

FINANCES, in *Political Economy*, denote the revenues of the king and state; much the same with the *fiscus* of the Romans. The word is derived from the German, *finantz*, *scrapping*, *usury*; though Du-Cange chooses rather to deduce it from the barbarous Latin, *fnancia*, *praestatio pecuniaria*.

The French have a peculiar kind of figures or numeral characters, which they call *chiffre de finance*. See **CHARACTER**.

FINANCES, *British*. See **FUND** and **REVENUE**.

FINBO, in *Geography*, a mountain of the Lower Engadine; 8 miles N. of Trasp.

FINBY, a town of Sweden, on an island in the government of Abo; 28 miles S.S.E. of Abo. N. lat. $60^{\circ} 7'$. E. long. $23^{\circ} 43'$.

FINCASTLE, a post-town of America, in Virginia, and capital of Botetourt county, situated on the E. side of Catabaw creek, a small stream which falls into James river, on the W. side of the North mountain. It has about 56 houses, a court-house and gaol, and contains 426 free inhabitants, and 276 blacks. It lies on the post road from Richmond to Kentucky; 36 miles E. of Lexington.

FINCH, a township in the county of Stormont, in Upper Canada, W. of Onabruck.

FINCH, in *Ornithology*. See **FRINGILLA**.

FINCH-backed, streaked on the back with white. It is mostly used in respect to cattle.

FINCHED, in *Rural Economy*, a term which is often used to signify cattle streaked on the back or other parts with white spots or stripes.

FINCK, HERMAN, published at Wittemberg, in 1556, "Practica Musica," in Latin, with examples of various characters, proportions, and canons, with opinions of the ecclesiastical modes or tones, and a more pleasing and artificial method of singing. This may have been a useful tract when published, but it is dry, and little is to be learnt in it now, of material use.

FINDER, in *Optics*, a short telescope, generally affixed to the tube of a large one, for the purpose of expeditiously finding out any object. This finder does not magnify the object more than four, six, or eight times; but it has a large field of view, so that a great part of the heavens may be seen through it at once. In the inside of its tube, and exactly at the focus of the eye-glass, there are two slender wires, which cross each other in the axis of the telescope. The finder is adjusted by means of screws upon the tube of the large telescope, in such a manner, that, when an object, seen through the finder, appears to be near the crossing of

the above-mentioned wires, it is at the same time visible through the large telescope; hence, when the observer wishes to view a small distant object, as a star, a planet, &c. he moves the instrument to one side or the other, until, by looking through the finder, he brings the object nearly to coincide with the crossing of the wires. And when that takes place, he immediately looks through the large telescope.

FINDERS, in our *Old Statutes*, are supposed to be the same with those we now call searchers, who are employed for the discovery of goods imported or exported without paying custom. Stat. 18 Edw. III. 14 Ric. II. 17 Ric. II. &c.

FINDER, among *Sportsmen*. See *Water-Dog*.

FINDHORN, in *Geography*, a fishing-town of Scotland, on the N. coast of the county of Murray, at the mouth of the river Findhorn, near the firth of Murray, with a tolerable harbour, and a large convenient bay; 9 miles W. of Elgin. N. lat. $57^{\circ} 139'$. W. long. $3^{\circ} 29'$.

FINDING of a Bill of Indictment, in *Law*. See **INDICTMENT**.

FINE, ORONCE, in *Biography*, one of the most celebrated mathematicians of his time, was son of a physician at Briarçon, where he was born in the year 1494. His father dying while he was very young, he was sent to Paris, and, through the interest of Anthony Silveiler, obtained a place in the college of Navarre, where he went through a course of classical learning and philosophy. His attention to polite literature did not prevent him from applying much of his attention to mathematics, which he found most congenial to his taste and inclination. In these sciences he had no instructor, and the study of them had fallen into disrepute. Regardless of the prevailing fashion of the age, he determined to proceed, and by the force of his own genius, and a sedulous application, he made considerable progress in them. In 1519, he published an edition of "John Martin Siliceus's Arithmetic;" and afterwards, in 1523, he gave to the public a revised and improved edition of the "Margareta Philosophica," containing the principles of rational and moral philosophy. After this, for he was still a student at the college of Navarre, he gave private lectures in the mathematics, and then became a public teacher of them in the college of Gervais. In this capacity he obtained so high a reputation, that Francis I. who had founded a new college at Paris, and who was desirous of filling the professorships with men of the first rate abilities, recommended Fine as the most proper person to teach the mathematics. This excellent mathematician, like many others who flourished at the same period, was devoted to the art of judicial astrology, and, on one occasion, he suffered a long and severe imprisonment, for presuming to announce predictions that seemed to affect the court of France. Fine was likewise a good mechanic, and invented and constructed different instruments and pieces of mechanism, which added very much to his celebrity as a man of science. Notwithstanding his genius, assiduity, and extraordinary talents; and the esteem in which he was held by an almost indefinite number of persons, it was his hard lot never to receive an adequate reward for his great services. Through the whole of life he had to struggle with the evils of poverty, to the disgrace of many who affected to value him very highly, and who could not but be well acquainted with his wants, but who nevertheless had not the spirit nor the virtue to afford him any assistance. He died in the utmost distress in 1555, leaving behind him a wife and six children, involved with debt, and destitute of all means of support. Provision was, however, made for their decent maintenance, by those who had pretended

tended to patronize him while living. The works of Fine were published together in three volumes folio, which bear the dates of 1532, 1542, and 1546. Bayle. Moreri.

FINE, that which is pure, and without mixture. The term is particularly used in speaking of gold or silver. See GOLD and SILVER.

FINE, *finis*, or *finalis concordia*, in Law, denotes a solemn amicable agreement or composition of a suit (whether that suit be real or fictitious) made between the demandant and tenant, with the consent of the judges; and enrolled among the records of the court where the suit was commenced; by which agreement freehold property may be transferred, settled, and limited. (Cruise on Fines.) Sometimes, says Shepherd (Touchst. c. 3.) it is taken for "a final agreement or conveyance upon record for the settling and securing of lands and tenements;" and accordingly it is designated by some to be "an acknowledgment, in the king's court, of the land or other things to be his right that doth complain;" and by others "a covenant made between parties, and recorded by the justices;" and by others "a friendly, real, and final agreement amongst parties, concerning any land, rent, or other thing, whereof any suit or writ is hanging between them in any court;" and by others more fully "an instrument of record of an agreement concerning lands, tenements, or hereditaments; duly made by the king's licence, and acknowledged by the parties to the same, upon a writ of covenant, writ of right, or such like, before the justices of the Common Pleas, or others thereunto authorized, and enrolled of record in the same court: to end all controversies thereof, both between themselves, which be parties and privies to the same, and all strangers not suing or claiming in due time."

A fine is sometimes said to be a feoffment of record (Co. Litt. 50.); though it might be more accurately called an acknowledgment of a feoffment on record; by which is to be understood, that it has at least the same force and effect with a feoffment, in the conveying and assuring of lands; though it is one of those methods of transferring estates of freehold by the common law, in which livery of seisin is not necessary to be actually given; the supposition and acknowledgment thereof in a court of record, however fictitious, inducing an equal notoriety. But, more particularly, a fine may be described to be an amicable composition or agreement of a suit, either actual or fictitious, by leave of the king or his justices; whereby the lands in question become, or are acknowledged to be, the right of one of the parties. (Co. Litt. 120.) In its original it was founded on an actual suit, commenced at law for recovery of the possession of land or other hereditaments; and the possession thus gained by such composition was found to be so sure and so effectual, that fictitious actions were, and continue to be, every day commenced, for the sake of obtaining the same security. A fine is so called because it puts an *end, finis*, not only to the suit thus commenced, but also to all other suits and controversies concerning the same matter. Accordingly it is so expressed in an ancient record of parliament, 18 Edw. I. Fines, indeed, are of equal antiquity with the first rudiments of the law itself: they are spoken of by Glauvil and Bracton in the reigns of Henry II. and Henry III. as things then well known and long established; and instances of them have been produced even prior to the Norman invasion. (Plowd. 369.) So that the statute of 18 Edw. I. called "Modus levandi fines," did not give them original, but only declared and regulated the manner in which they should be levied, or carried on. This is as follows:

1. The party, to whom the land is to be conveyed or assured, commences an action or suit at law, against the

other, generally an action of covenant, by suing out a writ or "præcipe," called a writ of covenant; the foundation of which is a supposed agreement or covenant, that the one shall convey the lands to the other; on the breach of which agreement the action is brought. On this writ there is due to the king, by ancient prerogative, a "primer fine," or a noble for every five marks of land sued for; that is, one-tenth of the annual value. (2 Inst. 511.) The suit being thus commenced, there follows

2. The "licentia concordandi," or leave to agree the suit. For, as soon as the action is brought, the defendant, knowing himself to be in the wrong, is supposed to make overtures of peace and accommodation to the plaintiff; who accepting them, but having, upon suing out the writ, given pledges to prosecute his suit, which he endangers if he now deserts it without licence, he applies to the court for leave to make up the matter. This leave is readily granted; but for it there is also another fine due to the king, by his prerogative, which is an ancient revenue of the crown, and is called the "king's silver," or sometimes the "post-fine," with respect to the "primer-fine," before-mentioned. And this is as much as the "primer-fine," and half as much more, or 10 shillings for every mark of land; that is, three-twentieths of the supposed annual value. (5 Rep. 39. 2 Inst. 511. Stat. 32 Geo. II. c. 14.)

3. Next comes the "concord," or agreement itself, after leave obtained from the court; which is usually an acknowledgment from the deforciant (or those who keep the other out of possession,) that the lands in question are the right of the complainant. And from this acknowledgment, or recognition of right, the party levying the fine is called the "cognizor," and he to whom it is levied the "cognizee." This acknowledgment must be made either openly in the court of Common Pleas, or before the lord chief justice of that court; as also before one of the judges of that court, or two or more commissioners in the county, empowered by a special authority called a writ of "dedimus potestatem," which judges and commissioners are bound by statute 18 Edw. I. ff. 4. to take care that the cognizors be of full age, sound memory, and out of prison. If there be any feme-covert among the cognizors, she is privately examined whether she does it willingly and freely, or by compulsion of her husband.

By these acts all the essential parts of a fine are completed; and if the cognizor dies the next moment after the fine is acknowledged, provided it be subsequent to the day on which the writ is made returnable (Comb. 71.), still the fine shall be carried on in all its remaining parts; of which the next is

4. The "note" of the fine; which is only an abstract of the writ of covenant and the concord; naming the parties, the parcels of land, and the agreement. This must be enrolled of record in the proper office, by direction of the statute 5 Hen. IV. c. 14.

5. The fifth part is the "foot" of the fine, or conclusion of it; which includes the whole matter, reciting the parties, day, year, and place, and before whom it was acknowledged or levied. Of this there are indentures made, or executed, at the chirographer's office, and delivered to the cognizor and the cognizee; usually beginning thus, "Hæc est finalis concordia," or "this is the final agreement," and then reciting the whole proceeding at length. Thus the fine is completely levied at common law. By several statutes some additional solemnities are introduced, in order to render the fine more universally public, and less liable to be levied by fraud or covin. And still, by 27 Edw. I. c. 9. the note of the fine shall be openly read in the court of Common Pleas.

Pleas, at two several days in one week, and during such reading all pleas shall cease. By 5 Hen. IV. c. 14. and 23 Eliz. c. 3. all the proceedings on fines, either at the time of acknowledgment, or previous, or subsequent thereto, shall be enrolled of record in the court of Common Pleas. By 1 Ric. III. c. 7. confirmed and enforced by 4 Hen. VII. c. 24. the fine, after engrossment, shall be openly read and proclaimed in court (during which all pleas shall cease) sixteen times, *viz.* four times in the term in which it is made, and four times in each of the three succeeding terms; which is reduced to once in each term by 31 Eliz. c. 2; and these proclamations are endorsed on the back of the record. It is also enacted by 23 Eliz. c. 3. that the clerk or recorder of fines shall every term write out a table of the fines levied in each county in that term, and shall affix them in some open part of the court of Common Pleas all the next term; and shall also deliver the contents of such table to the sheriff of every county, who shall at the next assizes fix the same in some open place in the court, for the more public notoriety of the fine.

Fines, thus levied, are of four kinds: 1. What is in our law French called a fine "sur cognizance de droit, come ceo que il ad de son done," or a fine upon acknowledgment of the right of the cognizee, as that which he hath of the gift of the cognizor. This is the best and surest kind of fine; for thereby the deforciant, in order to keep his covenant with the plaintiff, of conveying to him the lands in question, and at the same time to avoid the formality of an actual feoffment and livery, acknowledges in court a former feoffment, or gift in possession, to have been made by him to the plaintiff. This fine is therefore said to be a feoffment of record; the livery thus acknowledged in court being equivalent to an actual livery; so that this assurance is rather a confession of a former conveyance than a conveyance now originally made; for the deforciant, or cognizor, acknowledges, "cognoscit," the right to be in the plaintiff, or cognizee, as that which he hath "de son done," of the proper gift of himself, the cognizor. 2. A fine "sur cognizance de droit tantum," or upon acknowledgment of the right merely; not with the circumstance of a preceding gift from the cognizor. This is commonly used to pass a *reversionary* interest, which is in the cognizor. For of such reversions there can be no feoffment, or donation with livery, supposed; as the possession during the particular estate belongs to a third person. (Moor. 629.) It is thus worded: "that the cognizor acknowledges the right to be in the cognizee; and grants for himself and his heirs, that the reversion, after the particular estate determines, shall go to the cognizee. (Weil. Symb. p. 2. § 95.) 3. A fine "sur concessit" is, where the cognizor, in order to make an end of disputes, though he acknowledges no precedent right, yet grants to the cognizee an estate "de novo," usually for life or years, by way of supposed composition. And this may be done reserving a rent, or the like; for it operates as a new grant. (Weil. p. 2. § 66.) 4. A fine "sur done, grant, et render" is a double fine, comprehending the fine "sur cognizance de droit come ceo, &c." and the fine "sur concessit:" and may be used to create particular limitations of estate; whereas the fine "sur cognizance de droit come ceo, &c." conveys nothing but an absolute estate, either by inheritance, or at least of freehold. (Salk. 340.) In this last species of fine, the cognizee, after the right is acknowledged to be in him, grants back again, or renders to the cognizor, or perhaps to a stranger, some other estate in the premises. But, in general, the first species of fine, "sur cognizance de droit come, &c." is the most used, as it conveys a clear and absolute freehold, and gives the cognizee a

feisin in law, without any actual livery; and is therefore called a "fine executed," whereas the others are but "executory."

The force and effect of a fine principally depend, at this day, on the common law; and the two statutes, 4 Hen. VII. c. 24. and 32 Hen. VIII. c. 36. The ancient common law, with respect to this point, is very forcibly declared by the statute 18 Edw. I.; which states that the fine is so high a bar, and of such force, that it precludes not only those which are parties and privies to the fine, and their heirs, but all other persons in the world, who are of full age, out of prison, of sound memory, and within the four seas, the day of the fine levied; unless they put in their claim on the foot of the fine within a year and a day. But this doctrine of barring the right by "non-claim" was abolished for a time by a statute made in 34 Edw. III. c. 16. which admitted persons to claim, and falsify a fine, at any indefinite distance (Liti. § 441.); whereby, as Sir Edward Coke observes, (2 Inst. 518.) great contention arose, and few men were sure of their possessions, till the parliament, held 4 Hen. VII. reformed that mischief, and excellently moderated between the latitude given by the statute and the rigour of the common law. By that statute the right of all strangers whatsoever is bound, unless they make claim, by way of action or lawful entry, not within *one* year and a day, as by the common law, but within *five* years after proclamations made: except feme-coverts, infants, prisoners, persons beyond the sea, and such as are not of able mind; who have five years allowed to them and their heirs, after the death of their husbands, their attaining full age, recovering their liberty, returning into England, or being restored to their right mind. Henry VII. seems by this statute to have covertly extended fines so as to have been a bar of estates-tail, in order to render them more open to alienations; but doubts having arisen whether they could, by mere implication, be adjudged a sufficient bar (which are expressly declared *not* to be by the statute "de donis"), the statute 32 Hen. VIII. c. 36. was thereupon made, which declares that a fine levied by any person of full age, to whom or to whose ancestors lands have been entailed, shall be a perpetual bar to them and their heirs, claiming by force of such entail; unless the fine be levied by a woman after the death of her husband, of lands which were, by the gift of him or his ancestor, assigned in tail to her for her jointure (stat. 11 Hen. VII. c. 0.); or unless it be of lands entailed by act of parliament or letters patent, and whereof the reversion belongs to the crown.

From the view now given of the common law, regulated by these statutes, it appears that a fine is a solemn conveyance on record from the cognizor to the cognizee; and that the persons bound by a fine are *parties*, *privies*, and *strangers*. The *parties* are either the cognizors or cognizees; and these are immediately concluded by the fine, and barred of any latent right they might have, though under the legal impediment of coverture. And, indeed, as this is almost the only act that a feme-covert or married woman is permitted by law to do, (and that because she is privately examined as to her voluntary consent, which removes the general suspicion of compulsion by her husband), it is therefore the usual and almost the only safe method whereby she can join in the sale, settlement, or incumbrance of any estate. *Privies* to a fine are such as are any way related to the parties who levy the fine, and claim under them by any right of blood, or other right of representation. Such as are the heirs-general of the cognizor, the issue in tail since the statute of Henry VIII., the vendee, the devisee, and all others who must make title by the persons who

who levied the fine. For the act of the ancestor shall bind the heir, and the act of the principal his substitute, or such as claim under any conveyance made by him subsequent to the fine so levied. (3 Rep. 87.) *Strangers* to a fine are all other persons, except parties and privies. These are also bound by a fine, unless, within five years after proclamation made, they interpose their claim, provided they are under no legal impediment, and have then a present interest in the estate. The impediments, as we have already mentioned, are coverture, infancy, imprisonment, insanity, and absence beyond sea: and persons, who are thus incapacitated to prosecute their rights, have five years allowed them to put in their claims after such impediments are removed. Persons also that have not a present, but a future interest only, as those in remainder or reversion, have five years allowed them to claim in, from the time that such right accrues. (Co. Litt. 372.) And if within that time they neglect to claim, or (by the statute 4 Ann. c. 16.) if they do not bring an action to try the right within one year after making such claim, and prosecute the same with effect, all persons whatsoever are barred of whatever right they may have, by force of the statute of non-claim. But, in order to make a fine of any avail at all, it is necessary that the parties should have some interest or estate in the lands to be affected by it. Else it were possible that two strangers, by a mere confederacy, might without any risk defraud the owners by levying fines of their lands; for if the attempt be discovered, they can be no sufferers, but must only remain in *statu quo*; whereas, if a tenant for life levies a fine, it is an absolute forfeiture of his estate to the remainder-man or reversioner (Co. Litt. 251.) if claimed in proper time. It is not therefore to be supposed that such tenants will frequently run so great a hazard; but if they do, and the claim is not duly made within five years after their respective terms expire (2 Lev. 52.), the estate is for ever barred by it. Yet where a stranger, whose presumption cannot be thus punished, officiously interferences in an estate which in no wise belongs to him, his fine is of no effect; and may at any time be set aside (unless by such as are parties or privies thereunto (Hob. 334.) by pleading that “partes suas nihil habuerunt.” And even if a tenant for years, who hath only a chattel interest, and no freehold in the land, levies a fine, it operates nothing, but is liable to be defeated by the same plea. (5 Rep. 123 Hardr. 401.) Wherefore, when a lessee for years is disposed to levy a fine, it is usual for him to make a feoffment first, to displace the estate of the reversioner (Hardr. 402. 2 Lev. 52.), and create a new freehold by disseisin. Blackl. Com. Book ii. See RECOVERY.

In order to punish criminally such as thus put the estate of another to the hazard as far as in them lies, the stat. 21 Jac. 1. c. 26. makes it felony without benefit of clergy to acknowledge, or procure to be acknowledged, any fine, recovery, or judgment, &c. in the name of any person not privy or consenting to the same.

Fines may be reversed for error, so as the writ of error be brought in 20 years, &c. and not afterwards by stat. 10 & 11 W. III. c. 11. which 20 years are to be computed from the time of the fine levied, and not from the time the title accrued (2 Stra. 1257.) No person can bring a writ of error to reverse a fine, or any judgment, that is not intitled to the land, of which the fine was levied. In order to avoid a fine there must be an actual entry, except where the fine is levied without proclamations; for the statute 4 H. VII. c. 24. does not extend to such a fine, and it may be avoided at any time within 20 years. (2 Will. 45.) The entry, when necessary, must be made by the person who has a right

to the lands, or by some one appointed by him. (1 Inst. 258 a.) Nothing can be assigned for error that contradicts the record. (1 Rol. Abr. 757.) Fines are not reversible for rasure, interlineation, misentry, or any want of form, but it is otherwise if of substance. (Stat. 23 Eliz. c. 3.) Fines may be avoided, where they are obtained by fraud, covin, or deceit, though there be no error in the process. (Cro. Eliz. 471.)

Fines are generally divided into those with, and those without proclamations; the former is termed a fine according to the statutes 1 R. III. c. 7. 4 H. VII. c. 24; and the latter is called a fine of the common law, being levied in such manner as was used before the statute 4 H. VII. c. 24; and is still of the like force by the common law, to discontinue the estate of the cognizor, if the fine be executed.

Fines are either *single* or *double*. *Single fine* is that by which nothing is granted or rendered back again by the cognizees to the cognizors, or any of them. *Double fine* contains a grant and render-back, either of some rent, common, or other thing out of the land, or of the land itself, to all or some of the recognizors for some estate, limiting thereby remainders to strangers not named in the writ of covenant.

In this kind of fine, called “*sur done, grant and render,*” both the fines “*sur cognizance, &c.*” and “*sur concessit,*” are formed into one; and it is partly executed and partly executory. See FINE above.

Sometimes also a *double fine* is when the lands lie in several counties.

Fines, with regard to their effect, are divided into *executed* and *executory*. *Fine executed*, is such as of its own force gives a present possession (at least in law) to a cognizee; so that he needs no writ of “*habere facias seisinam*” for execution of the same: of which sort is a fine “*sur cognizance de droit come ceo, &c.*” that is, upon acknowledgment, that the thing mentioned in the concord is “*ius ipsius cognitati, ut illa quæ idem habet de dono cognitoris.*” West. § 51. K.

The reason is, because the fine passeth by way of release of a thing which the cognizee hath already (at least by supposition) by virtue of a former gift to the cognizor, which is, in truth, the surest fine of all. See FINE, supra.

Fines *executory*, are such as of their own force do not execute or give the possession to the cognizee without entry or action, but require a writ of “*habere facias seisinam*,” as a fine “*sur cognizance de droit tantum,*” unless the party be in possession of the lands. This kind of fine is commonly made use of to pass a reversion. There is also another executory fine called “*sur concessit.*” See FINE, supra.

Fines in England are now levied in the court of Common Pleas at Westminster, in regard to the solemnity thereof, ordained by the statute of 18 Ed. I. stat. 4. before which time they were sometimes levied in the county-court, court-barrons, and in the exchequer, as may be seen in *Origines Juridicales*, &c.

Fines are also taken by commissioners in the country, empowered by *delimus potestatem*. 15 Ed. II. stat. 2. *fn.* Though by the common law all fines were levied in the court. Fines levied before the justices in Wales, or in the counties palatine of Cheller, Durham, &c. have the same effect as those that are levied before the justices of C. B.

FINE *advallando levato de tenemento quod fuit de antio domino*, a writ directed to the justices of C. B. for disavowing a fine levied of lands in ancient demesne to the prejudice of the lord. Reg. Orig. 15.

Fines for alienation, are fines formerly paid to the king by his tenants in chief, for licence to alienate their lands; according to the statute 1 Edw. III. c. 12. but taken away by statute 12 Car. II. cap. 24.

Fine capiendo pro terris, &c. a writ lying where a person upon conviction of any offence by jury hath his lands and goods taken into the king's hands, and his body is committed to prison; to be remitted his imprisonment, and have his lands and goods re-delivered him on obtaining favour for a sum of money. Reg. Orig. 142.

Fine foras, is an expression in stat. 35 Hen. VIII. cap. 12. denoting that a person is forced to do that which he can in no way avoid.

Fine levando de tenementis de rege in capite, &c. a writ directed to the justices of the Common Pleas to admit of a fine for the sale of land holden of the king *in capite*. Reg. Orig. 167.

Fine non capiendo pro pulchre placitando, a writ to inhibit officers of courts to take fines for fair pleading. Reg. Orig. 179.

Fine pro rediffessina capienda, &c. a writ lying for the release of one imprisoned for a rediffessin, on payment of a reasonable fine. Reg. Orig. 222.

Fines le roy, are all fines to the king. Under this head are included fines for original writs. Thus, for every writ of plea of land, if it be not of right patent, which is for the yearly value of five marks, and for all original writs in debt and trespass, where the debt or damage is 40*l.* a fine is due to the king of 6*s.* 8*d.* and more proportionably when the writ is for greater value.

Fine alio, according to Cowel, signifies a sum of money paid as an income for lands or tenements let by lease, anciently called *gerfama*.

Fine is also used to denote an amends, pecuniary punishment, or recompence, for an offence committed against the king and his laws, or against the lord of a manor. In which case a man is said, *facere finem de transgressione cum rege*, &c.

In all the diversities of the use of the word *fine*, it hath but one signification; and that is, a final conclusion, or end of differences between parties. In the last sense, where it denotes the ending and remission of an offence, it is used by Bracton, who speaks of a *common fine* that the country pays to the king for false judgments or other trespasses, which is to be assessed by the justices in eyre before their departure, by the oaths of knights and other good men, upon such as ought to pay it. There is also a common fine in courts leet.

The discretionary fines (and discretionary length of imprisonment) which our courts are enabled to impose, may seem an exception to the general rule, that the punishment of every offence is ascertained by the law. But the general nature of the punishment, *viz.* by fine or imprisonment, is fixed and determinate; though the duration and quantity of each must frequently vary, from the aggravations, or alleviations, of the offence, the quality and condition of the parties, and innumerable other circumstances. The *quantum*, in particular, of pecuniary fines neither can, nor ought to be, ascertained by any invariable law. The value of money is fluctuating; and what would be ruin to one man's fortune may be matter of indifference to another's. Thus the law of the twelve tables at Rome fined every person, that struck another, twenty-five denarii; and this, in the more opulent days of the empire, became a punishment of so little consideration, that Aulus Gellius tells a story of one Lucius Neratius, who diverted himself by giving a blow to any person at pleasure, and then tendering the legal forfeiture. Our statute law has not therefore often ascer-

tained the quantity of fines, nor the common law ever; merely directing such an offence to be punished by fine in general, without specifying the certain sum: and this will appear to be fully sufficient, when we consider that, however unlimited the power of the court may seem, it is far from being wholly arbitrary; but its discretion is regulated by law. For the bill of rights (stat. 1 W. and M. II. c. 2. c. 2.) has particularly declared, that excessive fines ought not to be imposed, nor cruel and unusual punishments inflicted (which had a retrospect to some unprecedented proceedings in the court of king's bench, in the reign of king James II.); and the same statute farther declares, that all grants and promises of fines and forfeitures of particular persons before conviction, are illegal and void. Now the bill of rights was only declaratory of the old constitutional law; and accordingly we find it expressly holden, long before (2 Hal. 48.) that all such previous grants are void; since thereby many times undue means, and more violent prosecution, would be used for private lucre, than the quiet and just proceeding of the law would permit.

The reasonableness of fines in criminal cases has also been usually regulated by the determination of "Magna Charta" (c. 14.) concerning amercedments for misbehaviour by the suitors in matters of civil right. See AMERCEMENT.

Courts of record may fine for an offence committed in court in their view, or by confession of the party recorded in court. (1 Lill. Abr. 621.) A man shall be fined and imprisoned for all contempts done to any court of record, against the commandment of the king's writ, &c. (9 Rep. 60.) See CONTEMPT. Some courts may imprison, and not fine, as the countables at the petit sessions; some courts cannot fine, or imprison, but amerce, as the county, hundred, &c.; but some courts can neither fine, imprison, nor amerce, as ecclesiastical courts held before the ordinary, archdeacon, &c, or their commissaries, and such who proceed according to the canon, or civil law. (11 Co. 43, 44.)

A fine may be mitigated the same term it was set, being under the power of the court during that time, but not afterwards. (T. Raym. 376.) And fines assessed in court by judgment upon an information, cannot be afterwards mitigated. (Cro. Car. 201.) If a fine certain is imposed by statute upon any conviction, the court cannot mitigate it; but if the party comes in before conviction, and submits to the court, they may assess a less fine; for he is not convicted, and perhaps never might. The court of exchequer may mitigate a fine certain, because it is a court of equity, and they have a privy-seal for it. (3 Salk. 33.) If an excessive fine is imposed at the sessions, it may be mitigated at the king's bench. (1 Vent. 336.)

All fines belong to the king, because the courts of justice are supported at his charge; and wherever the law puts the king to any charge for the support and protection of his people, it provides money for that purpose. (Bract. 129.)

Fine-drawing, or *rentering*, a very nice way of sewing up or rejoining the parts of any cloth, stuff, or the like, torn or rent in the dressing, wearing, &c.

It is prohibited to fine-draw pieces of foreign manufacture upon those of our own, as has formerly been practised. See RENTERING.

Fine Loch, in Geography, is one of the extensive inland waters of Argyleshire, in Scotland, connecting with the sea by means of the estuary of the Clyde rivers, and by Kylbranna found on the west of the isle of Arran; it has also another communication with Clyde river by means of the Kyles of Bute on the west of Bute island. The principal branch of Fine Loch extends a few miles to the N.E. of the town of Inverary; from the top of Gilp Loch, which is a branch of

this loch, the Crinan canal proceeds, for the passage of ships to the west into Crinan Loch, and the found of Jura. From East Tarbeth Loch, another short branch of Fine Loch, the Tarbeth canal was, in 1773, proposed by Mr. Watt to form another communication with the found of Jura, by means of West Tarbeth Loch. See CANAL.

FINE-stiller, in the *Distillery*; that branch of the art which is employed on the distilling the spirit from treacle or other preparations or recrements of sugar, is called *fine-stilling*, by way of distinction from malt-stilling; and the person who exercises this part of the trade is called a fine-stiller.

The operation in procuring the spirit from sugar is the same with that used in making the malt spirit; a wash of the saccharine matter being made with water from treacle, &c. and fermented with yeast. It is usual to add in this case, however, a considerable portion of malt, and sometimes powdered jalap, to the fermenting backs. The malt accelerates the fermentation, and makes the spirit come out the cheaper, and the jalap prevents the rise of any musty head on the surface of the fermenting liquor, so as to leave a greater opportunity for the free access of the air, and thus to shorten the work, by turning the foamy into a hissing fermentation. Shaw's Lect. p. 220.

FINECIOLARO, in *Geography*, a small island in the Mediterranean, near the N.E. coast of the island of Corsica; 7 miles N. of Bastia. N. lat. $42^{\circ} 58'$. E. long. $9^{\circ} 39'$.

FINEERING. See **VENEERING**.

FINERS of Gold and Silver, are those who purify and part those metals from other coarser ones by fire and acids.

They are also called *parters*, in our old law-books, and sometimes *deparTERS*.

FINERY, in the *Iron-works*, is one of the two forges at which they hammer the sow or pig iron. See **FORGE**.

Into the finery they first put the pigs of iron, placing three or four of them together behind the fire, with a little of one end thrust into it; where, softening by degrees, they stir and work them with long bars of iron, and expose at different times different parts to the blast of the bellows, in order to refine it as equally as possible, till the metal runs together with a round mass or lump, which they call a *half-bloom*. They then take this out, and give it a few strokes with their sledges; afterwards they carry it to a great heavy hammer, raised by the motion of a water-wheel; where, applying it dexterously to the blows, they presently beat it out into a thick short square. This they put into the finery again, and, heating it red-hot, they work it out under the same hammer till it comes to be in the shape of a bar in the middle, but with two square nobs at the ends, which they call an *acony*. It is then carried into the other forge, called the *chafery*. Phil. Trans. No. 137, or Abr. vol. ii. p. 559. See **IRON**.

FINESSE, a French term, of late current in English. Literally, it is of no farther import than our English *fineness*; but among us it is chiefly used to denote that peculiar delicacy or subtlety perceived in works of the mind, and the nicest and most secret and sublime parts of any science or art.

It is sometimes used to express that kind of subtlety made use of for the purposes of deception.

FINGAH, in *Ornithology*. See **LANIUS Carulefcens**.

FINGAL, in *Biography*, the distinguished hero whose exploits and character are so charmingly portrayed in the fascinating poems of Ossian, who, notwithstanding what has

been advanced against their existence in the Gaelic language, from which they were professedly translated; was a real personage, a famous warrior, and renowned prince. The controversy respecting the genuineness of the originals was at one time as long and as ably defended by the partizans on each side the question, as that on the subject respecting the authenticity of the Epistles of Pindarus by the critics of the day, under those able leaders in controversy, Boyle and Bentley. What was the family name of this supposed fictitious hero of romance, but really the gallant defender of his country from Roman subjugation, does not appear on the face of history; in that early period it not unfrequently happened, the real name was sunk in the official designation, or honorial title. He was the son of Comhal, the grandson of Truthal, and the great grandson of Trenmór, all Caledonian princes of great military reputation, during the severe struggles the Celtic tribes held with the invaders of Britain. He was king of Morven, a country to the north of the river Tay, supposed by some to have had for its southern boundary the Caledonian forest; and by others to have extended farther southward, into part of the Roman province of Valentia: it doubtless, from the best authorities, comprised the whole of the northern and western Highlands, inclusive of the Hebrides or Western isles. His principal residence was at Selma, in the vicinity of Glenco, county of Moray, supposed to be the Cona celebrated by Ossian. According to the Irish annals, he was born A.D. 282; but the poems of Ossian fix the date of his birth a few years later. The time of his death is uncertain.

After the Romans had overrun the country of the Picts, and given to that part of the island to the north of their province, Valentia, the name of Caledonia, as the country next to be subdued, and penetrated part of the Highlands with an army under Lollius; they were repulsed and beaten back behind the frontier wall, erected at the command of Severus, by the superior prowess and valour of the troops under Comhal. On this occasion, the exploits performed by the son of that prince evinced he was equally qualified by talents, as descent, to be the antagonist of a Roman emperor, and the hero of Ossian; when Severus determined to conduct the war in person through North Britain, to wipe off the disgrace of his defeated legions under Lollius, and revenge the severities inflicted on his troops by the outraged natives; he paid the two wails for these purposes, with the collected force of the empire in Britain; and entered with a spirit of vengeance, and reiterated menaces of extirpation, the district of Caledonia. At that period, the prince denominated Fingal was the head of the united British forces in the north, the Vind-galt of the combined army, a station or office similar to that of the Pendragon among the western Britons; which has likewise been confounded with the family names, and considered a personal appellation. The haughty and enraged emperor was met by the undaunted Fingal, whose troops, well acquainted with the dells and passes of the country, hung upon the invader's rear, harassed the imperial army in its march, selected advantageous ground, and made at every turn vigorous attacks, and frequently drew the enemy into insidious and fatal ambuscades. Thus wearied and reduced by the superior manœuvring of their bold and vigilant opponents, the Romans experienced the greatest distress, so as to be obliged to destroy their sick and wounded, lest they should fall alive into the hands of what they considered a barbarous enemy. In this expedition alone, according to Ammianus Marcellinus, they lost 50,000 men, and were constrained to cede to the victors that part of the country conquered by Lollius. And when the Romans, after being reinforced, again entered the country under the

command of Caracalla, who was commissioned to exterminate the natives, Fingal met the Roman general in that part, now the county of Stirling, the latter was defeated on the banks of the Carron, the contested dominions given up, and the Romans again obliged to retire to the south of the wall. Exclusive of these contests, in which, through a protracted warfare, he displayed a superior prowess, and undaunted intrepidity, he appears to have conducted also naval wars. He is stated to have made frequent voyages to Scandinavia, the Orkneys, and Ireland, designated by Ossian, as Locklin, Innislore, and Ullin.

“The character of Fingal,” Dr. Blair observes, “is perhaps the most perfect that was ever drawn by a poet, for we boldly defy all the writers of antiquity to shew us any hero equal to Fingal. Throughout the whole of Ossian’s works, he is presented to us in all that variety of lights which give the full display of a character. In him concur almost all the qualities that can ennoble human nature, that can make us admire the hero, or love the man. He is not only unconquerable in war, but he maketh his people happy by his wisdom in the days of peace. He is truly the father of his people.” Whitaker’s *History of Manchester*. Ossian’s Poems, with notes, &c.

FINGAMO, in *Geography*, a town of Japan, on the island of Nippon; 45 miles N. of Meaco.

FINGERS, in *Anatomy*, the last divisions of the upper extremity. For their names, see DIGITUS. The bones and joints of the fingers are described in the article EXTREMITIES. The structure of these organs, consisting of three bones moveable on each other, renders them particularly well suited for grasping, seizing, and holding external objects; for all those offices which come under the common name of prehension. By this arrangement any object of moderate size can be encircled by the fingers. The size of the bones, the firmness of the joints, and the strength of the muscles, bestow on them great powers in addition to their flexibility. The integuments at their extremities are highly organized, and receive a large supply of vessels and nerves, so as to constitute them the organs of touch, and the facility with which they can be applied to any body, of which we are desirous to learn the properties, makes them a very convenient situation for that organ.

FINGERS, *Amputation of*. See AMPUTATION.

FINGERS, *Carious*. In these cases the surgeon is to endeavour to extract the exfoliating portions of bone, immediately when they become loose. For this purpose, he is justified in making such incisions as may enable him to fulfil the object in view. Until the process of exfoliation is sufficiently advanced, he can do little more than apply simple dressings, and keep the part in a clean, quiet state.

When the separation of the dead pieces of bone will certainly destroy the utility of the finger, and convert the part into an inconvenient, stiff appendage to the hand; or, when the patient’s health is severely impaired by the irritation of the disease, the termination of which cannot be expected within a moderate space of time; amputation is proper. It is a truth, however, that many fingers are amputated which might be preserved, and surgeons ought to consider well, before presuming to remove parts which, when curable, may become of the greatest consequence, in regard to the perfection of the hand. The bread of many persons, it is well known, depends on the unmutated state of certain fingers. These remarks are offered, because we have seen several surgeons, who are fond of seizing every opportunity of cutting their fellow-creatures, remove fingers, which might have been usefully saved, either by allotting a little

more time to the exfoliation, or by making incisions, and cutting out the dead piece of bone.

FINGERS, *Dislocations of*. See LUXATION.

FINGERS, *Fractions of*. See FRACTURE.

FINGERS, *Supernumerary*. Children are sometimes born with more fingers than are natural, and since allowing the redundant number to remain would keep up deformity and create future inconvenience, the surgeon is called upon to amputate them. The redundant fingers are sometimes with, sometimes without, a nail; are seldom more numerous than one on each hand, are generally situated just on the outside of the little fingers, and, as far as our observation extends, are incapable of motion, in consequence of not being furnished, like the rest of the fingers, with muscles. The best plan is to cut off supernumerary fingers with a scalpel, at the place where they are united to the other part of the hand. The operation should be performed while the patient is in the infant state, that is to say, before the superfluous parts have acquired much size, and while the object can be accomplished with little pain. The incisions ought to be made so as to form a wound with edges, which can be brought into contact with strips of adhesive plaster. The hemorrhage will almost always cease, as soon as the dressings are applied, without any ligature.

FINGER, GODFREY, in *Biography*, who resided many years in England during the latter end of the 17th century, and the beginning of the last, was a good performer on the violin, and a voluminous composer for that instrument, and when he quitted England and returned to Germany, was, according to Teleman in Mattheson’s *Chrenpforte*, chamber musician to Sophia Charlotte, queen of Prussia, in 1702, and in 1717 chapel master to the court of Gotha. Finger was not a man of genius; but in science he was infinitely superior to the musicians with whom he had to contend.

FINGER’S *Breadth*, a measure of two barley-corns in length, or four laid side to side.

FINGER-*keys*, in *Music*, or clavier of the Germans, signify the arrangement of short levers of different colours, on which the fingers act in performing on organs, piano-fortes, and some other instruments with fixed tones; the arrangement of these within one octave, from C to C, is shewn in *Music*, Plate I.; the learning and recollection of which will be much facilitated, by considering the same divided (between E and F) into two parts, which Dr. Calcott, in his “Plain Statement of Earl Stanhope’s Temperament,” calls a *ditone* and a *tritone*, see those articles. It may be proper here just to add, that D is always the middle of the ditone or first division, and that G and A are the middle notes of the tritone or second division of the *septave*, or whole octave. In Mr. Hawke’s patent piano-fortes and organs, with 17 strings or pipes in each octave (sold by Mr. Bill, Rathbone Place, and Mr. Elliot, Tottenham Court), the whole clavier or range of finger-keys is shifted, by pedals, for occasioning either the five flat or the five sharp notes of each octave to be brought into play, as may be desired; without altering the pitch of the long keys or natural notes. See TEMPERAMENT for an account of this, and various other systems of musical intervals.

FINGER-*key Intervals*, is a term sometimes used for the *half-notes*, or *semi-tones*, between the 13 finger-keys of instruments; these, according to the common theory and notation used by all composers and copyists of music, are equal among themselves, and conform to the *equal temperament* of the scale, see that article, and *Philosophical Magazine*, vol. xxvii. p. 195; but, in strictness, these finger-key intervals, both the simple ones between the next adjoining as well

well as between the more distant finger-keys, differ very sensibly from each other, in most of the other different systems of temperament, and even in different parts of the scale of each of such systems themselves. The number of these finger-key intervals, which any interval, larger than the enharmonic diesis contains, appears on inspection, when it is expressed in the new notation of Mr. Farey, by the number of f 's, or lesser fractions which it contains; thus, his expression for the fifth $358 \Sigma + 7f + 31m$, (Phil. Mag. p. 35. vol. xxx.) shews that interval to contain seven half-notes or finger-key intervals, and by which the situation of its treble above any note on the clavier or range of keys on an instrument, or of its bass below any note, considered as the treble of a fifth, can with certainty be found. See FIFTH.

Finger-keyed Viol, a musical instrument, noticed under our article *CLAVIOLE*, which is another name for the same invention: at that time we had not had an opportunity of seeing this instrument, but have now the satisfaction of being able to present our readers with a drawing and description of it, having, for that purpose, obtained the permission of its inventor, Mr John Isaac Hawkins, proprietor of the useful and mechanical museum, No. 79, Great Titchfield street, London, where are many curious mechanical contrivances, the most striking of which we shall occasionally notice. *Plate XIV. Miscellany*, is devoted to the elucidation of this curious piece of mechanism: a general idea will be given by inspecting the first figure, which is a perspective view of the whole instrument, laid open, while the remaining figures explain the construction of the more minute parts. The instrument contains 68 gut strings, stretched in a vertical position, and arranged in four series: the first, A, corresponding to the double bass, with 17 large strings, 13 of which are covered with wire; the longest string is 38 inches, and the shortest 28 inches: the second series of 17 strings, B, producing the tones of the violoncello, from 28 to 15 inches in length: the third, C, is the viola, from 15 inches to seven long, and the fourth, the violin, are from seven to three inches long. The frame containing the strings is of equal height in all parts, though the effective lengths of the strings are only to be reckoned from their respective bridges, a, b, c , and d , to the keys; each string is provided with a finger-key, which keys are arranged in the same order as in the organ, &c. and each string is adjusted to sound the proper note for the key to which it belongs; the adjustment is made at the upper end of the string by a screw. To keep the instrument in tune, through all variations of the atmosphere, each string is stretched by a helical spring, attached to the lower part of the frame at one end, and to the string at the other; by this means the tension of the string is always equal, notwithstanding its variations of length from the state of moisture in the air, as the force of the spring will not be sensibly changed, by such minute alteration of length: these springs are seen beneath the keys of the instrument at $h i g k$, and several of the tuning screws are shewn separately in *fig. 2*. The end of the string, e , or of a wire to which it is tied, is hooked upon a pin projecting from the nut, a , of the screw, b , which is turned round by a small handle to produce the motion of the nut, and adjust the string.

The next parts to be spoken of are the refined horse-hair bows, which are the most ingenious parts of this invention; they are four in number, being situated at EFG and H in *fig. 1*. one to each series of strings. The horse-hairs are arranged within a circular ring of brass, $f f$, in *figs. 3* and 6 , where the method is shewn by which an approximation to a circle can be formed from a great number of similar and equal chords within a larger circle; it is in fact a polygon,

but with so many sides as to render its difference from a circle insensible in its effects: the brass ring containing the hairs is sustained by three wheels g, b , and i , within it, which admit of its rotative motion, and at the same time allow the strings to pass down through the ring at m ; and to be as near to the hairs as possible, without touching them: for this purpose each series of the strings is arranged in a circular form to correspond with the curvature of the bows at EFG and H in the principal figure. The circular bows are put in motion by a pulley on the axes of the wheel i , and a strap or band passing round this, communicates motion from a vertical axis, k , in *fig. 7*, which is common to the whole, and is put in motion by a wheel, on the axis of a crank, which is turned by the treadle I, and provided with a fly-wheel, K, *fig. 1*, to regulate the motion, and continue it, while the treadle is ascending: the communication between the horizontal axis l , *fig. 7*. of the crank and fly-wheel, and the vertical axis k , giving motion to the bows, is made by two conical wheels, m and n , covered with soft leather, touching each other in their circumferences: this is an excellent substitute for toothed wheels, both with respect to the freedom and silence of the motion, as the toothed wheels, being necessarily constructed of metal, could not be divested of an unpleasant sound, not to be endured in a musical instrument.

The keys are constructed, as shewn in *figs. 3* and 4 , moving on a fulcrum at o , and by that means, when pressed down by the fingers, the opposite end elevates one arm of the bent lever p ; at the same time the other arm is drawn back, and the wire, q , moves one arm of a second angular lever r ; the other arm ends in a hook, which is engaged with the string corresponding to the key: from this arrangement, when the key is forced down, the string is drawn in contact with the hairs of the bow situated at f , just above the lever $r r$, and the friction causes the string to vibrate in the same manner as the violin.

It is scarcely necessary, after this, to say any thing respecting the action of the instrument: the performer keeps the bows in continual motion by the treadle I, which moves with such ease as to be no impediment to the freedom of motion requisite for a performer on a keyed instrument: an increase of pressure on the keys causes that fulness of tone which is so much admired in the violin, and the delicate softness, produced by lightly touching the keys, is a principal advantage in this instrument; and it is a great recommendation, that by its assistance these excellencies of the violin are secured to every good performer on keyed instruments. The velocity of the bows is another circumstance to be attended to at the same time with the pressure: when moved slowly the tones will be soft and delicate; but when the velocity is increased the tones are full, and adapted for grandeur of effect; the alteration in velocity is easily made, Mr. Hawkins having adapted an ingenious balance weight to the treadle, which acts to turn the wheel while the treadle is ascending, so that by this assistance the wheel can be made to revolve exceedingly slow, without danger of *pitching*, or stopping at the highest or lowest points of the cranks: this ingenious contrivance is equally adapted to lathes, or other machines receiving motion from the foot, and will be explained under the article FOOT WHEEL.

In this manner the velocity of the bows is completely manageable by the greater or less pressure upon the treadle, and the performer may easily make a sudden transition from quick to slow, by resisting the ascent of the treadle when he wishes to retard it, or pressing the treadle while it is descending to accelerate the motion of the wheel: it is worthy of notice that each bow moves with a different velocity, as is

best adapted to produce the vibration of the strings it is applied to; this is effected by the different diameters of the four pulleys on the vertical axis *k*, *fig. 5*, which tunes the bows; these are in such proportion, that when the double bass bow revolves at the rate of 25 times *per* minute, the others make 35, 50, and 75 revolutions in the same period.

The instrument is provided with pedals, one of which, when pressed down, brings a piece of rosin in contact with the hairs of each bow, so as to cause no interruption for this necessary operation. Another pedal elevates the bows all together, and causes them to act nearer the bridge than when it is not in use, producing the effect well known to performers on the violin when they bow near the bridge; for this purpose the frame containing the three wheels *g*, *h*, *i*, *fig. 6*, of the bow, terminates in a stem *t*, which slides in a socket, and can be elevated or depressed by the pedal just mentioned. A third pedal brings a piece of leather lightly in contact with the middle of each string, which causes it to vibrate in two portions, and found the octave in a beautiful tone, similar to the musical glasses.

FINGERIN, in *Ichthyology*, a name given to the Samlet or Salmulus, called also Branlin and Salmoneta, which is the least of the trout kind, and supposed by several, without sufficient reason, as Pennant conceives, to be the fry of the salmon. It is frequent in the Wye, in the upper part of the Severn, and the rivers that run into it, in the north of England and in Wales. These fishes are also common in the rivers of Scotland, where they are called Pars. Those of the Wye are there known by the name of Skirlings, or Laffrings. This fish resembles the trout, but the head is narrower, and the mouth less than that of the trout; the body deeper; length seldom exceeding six or seven inches; the pectoral fins have generally one large black spot, sometimes attended by a single small one; the spurious or fat fin on the back is never tipped with red, nor is the edge of the anal fin white; the spots on the body are fewer than those of the trout, and not so bright, and it is marked from the back to the sides with six or seven large blueish bars, whence it has been called fingerin or fingery; the tail is much more forked than that of the trout. Some have erroneously supposed that there are no other but males of this species.

FINGERING on *Keyed Instruments*. This is a subject which, to treat amply, requires great knowledge, meditation, and experience; and so many examples and illustrations of the rules, as an entire volume could hardly contain, much less an article of a dictionary. We shall, however, give the principal elementary rules for the carriage of the hand, and economy of the fingers, in a few keys, which, by analogy, may be extended to the rest. Couperin (see DOUGHTER) was the first who treated the subject with intelligence, in the minority of Louis XV. 1717; and though his compositions, for which the rules were given, have long since been thrown aside and forgotten, most of his rules are still good for music of a very different kind. He advises parents to place their children under an intelligent master, at six or seven years old, and prescribes not only the manner of placing the hands on the keys, but the carriage of the person. The height of the seat, if allowed to sit at so early an age, should be such as would place the wrists on a level with the keys; the fingers should be curved so as to be all of the same length, so as that each should cover a key. Something should be placed under the feet of very young students, to prevent them from hanging loose in the air, and to support their frames in a just equilibrium; and this support should be diminished in proportion to their growth. The distance at which a person of mature age

should sit from the instrument should be about nine inches and less in proportion to the short arms of children. They should place themselves in the middle of the keys, in as natural and easy a posture as possible; the knees not too close, and the feet even. Great attention must be paid to the countenance of children, that no grimace or appearance of difficulty should be visible, and become habitual, which would be attended to by standers-by more than the music that is performing, however good and well executed. M. Couperin even advises a glass to be placed on the desk of the young performers in danger of becoming ridiculous, that they may correct themselves. Particular care should be taken to place the hands even, and not let very young subjects attempt reaching octaves too soon, as it flattens the left hand, and makes it seem to belong to a different person from the other. The time or measure should never be marked by the head, feet, or the whole person, which is unbecoming and construed into affectation. Even in counting the time it should be done in a whisper, or else it tends to prevent the ear from having any share in the performance. The fingers should be suspended as near the keys as possible, and all their force should come from the upper joints, not from the weight of the hand, which would be heavy and thumping. Children in their early lessons should not be suffered to practise alone; they are too giddy and playful to remember the rules, till duly impressed by care and habit. Couperin used to take away the key of the instrument during the first lessons, that they might not undo in his absence all that he had tried with great pains to inculcate. Shakes, beats, and trills, in all keys, must be early practised with both hands extremely slow, and quickened by degrees; as must be the exercises for each hand, called evolutions of fingering; for which see music plate. The weak fingers of both hands, that is, the ring finger and the little finger, must be very much exercised, to make them, if possible, equally brilliant with the others. Chords, if the hands are well placed on the instrument, are perhaps the best rules for fingering; for if the notes can be well and easily struck together, there will be no difficulty in breaking them into passages. The rapidly running up and down the keys, whatever number of flats and sharps there may be at the clef, depends on the thumb, which, in keys with flats, should be placed, in general, on C or F, and in most keys with many sharps upon B and E, that is, on a long key, which, if there are more than five sharps, will be E and B ♯. The thumb of each hand, as far as five flats, must be appropriated to F and C for the same reason; but neither the thumb nor the little finger, in the rapid ascent or descent of the scale, should be used for a short key, unless in playing octaves or chords composed entirely of flats and sharps. In practising quick passages, the fingers should be lifted up with a spring, and not allowed to hang on the keys, till wanted again, unless in arpeggioing chords, or in passages of expression. In the first practice of a shake, in order to keep the wrist quiet, place the thumb on the 5th, 4th, or 3d below, and keep the fingers that are unoccupied as tranquil as possible. Couperin was the first, we believe, who made it a rule for his scholars never to play two notes together with the same finger, unless in repeating chords. See examples of iteration, *Plate N° V*.

N° VIII. Shakes should be practised with all the fingers: Transient shakes, double shakes, a chain of running shakes turned, a series of double notes in 3ds, 6ths, and octaves; in the two latter, the thumb and the little finger only can be used, and nothing but downright drudgery and perseverance can acquire these modern tricks, so unnatural to the genius of keyed instruments. Double shakes

can only be gained, if at all, by long and patient practice. The experiment, however, should be made.

N^o IX. In order to transfer the fingers to different parts of the instrument, upwards or downwards, without quitting a note which ought to be sustained, the young student should change the fingers upon the same note with both hands without letting the key rise. There is no harm in letting children play their first lessons by heart: it fortifies the memory; occupies the ear more than the eye; and, indeed, it is impossible for them to find the keys without looking at them, till the fingers fall mechanically upon certain passages and chords, as the feet, in walking, move without the owner paying the least attention to them.

With respect to reading music readily, it must be acquired by playing first with one hand, and then with the other, several new pages of notes every day, without repeating any thing; and when that can be done readily, at sight, with each hand separately, then let the pupil begin playing simple strains with both hands. This will be practice for the eye alone. But in learning to execute difficulties, it must be done by beginning slow, and repeating quicker and quicker a thousand and a thousand times; this is practice for the finger. *Espression* depends greatly on the sustaining and cessation of sound; or, in technical language, on what the Italians term *legato* or *sostenuto*, and *staccato* or *sciolto*, as well as on *accents*, and the different shades of *piano* and *forte*.

In the evolutions of fingering, or short exercises to form the hands, it seems a paradox, but it may be truly said of Nos. III. and IV. that, by throwing a finger away, the fingers, in such passages, become inexhaustible.

In the course of these exercises, where the fingers are marked, the semicircle, or star, includes such notes as lie under the hand, without any contrivance or change: and in other places, where no fingers are marked, such are used as lie over the keys.

The detached passages, N^o VII. are meant to be severally repeated quicker and quicker, till the hand is tired.

FINGRIGO, in *Botany*. See PISONIA.

FINIA, in *Geography*, a town of Sweden, in the province of Schonon; 20 miles N. W. of Christianstadt.

FINIAL, in *Ancient Architecture*, the flower, fruit, or foliage terminating a pediment or pinnacle in the pointed style. This represented a lily, a trefoil, an acorn, a pomegranate, an endive, &c. according to the taste of the architect or artist.

FINIANA, or FINANA, in *Geography*, a town of Spain, in the province of Grenada; seven miles S. of Baça.

FINICA, a town of Asiatic Turkey, in Natolia, near the coast; 50 miles S. of Satalia.—Also, a river of Natolia, which runs into the Mediterranean, 14 miles W. N. W. of Cape Chelidoni.

FINIMARBOO, a town of Africa, in Bambarra; 96 miles W. N. W. of Sego.

FINING. See REFINING.

FINING of Wines. The usual method of fining down wines, so as to render them expeditiously bright, clear, and fit for use, is this: take an ounce of isinglass, beat it into thin shreds with a hammer, and dissolve it by boiling in a pint of water; this when cold becomes a stiff jelly. Whisk up some of this jelly into a froth with a little of the wine intended to be fined, then stir it well among the rest in the cask, and bung it down tight; by this means the wine will become bright in eight or ten days. This method, however, is found to be best suited to the white wines: for the red ones, the wine coopers commonly use the whites of eggs beat up to a froth, and mixed in the same manner

with their wines. The method by which these viscous bodies act in the operation is this; they entangle themselves among the flying lee or light feculencies that float in the wine, and thus forming a mass specifically heavier than the wine, they sink through the body thereof like a net, carrying down all the foulness they meet in the way to the bottom; but when the wine is extremely rich, so that its specific gravity is greater than that of the mass formed by the ingredients used in fining and the dregs or lee; this mass then rises upwards, and floats at the surface of the wine, which will in this case also draw off fine. See CLARIFICATION and FORCING.

FINIRE, in *Law*, was used to fine, or pay a fine upon composition and making satisfaction. It is the same with *finem facere*, mentioned in Leg. Hen. I. cap. 53.

FINISHING, in *Architecture*, &c. is frequently applied to the crowning or acroteria over a piece of building, placed there to terminate and finish it.

FINISTERRA, in *Geography*, a town of Spain, in the province of Galicia, near Cape Finisterre.

FINISTERRE, formerly a portion of Bretagne, in 48^o 25' N. latitude, now the most westerly department of France, bounded on the N., W., and S. by the sea, and on the E. by the departments of the North coasts and Morbihan, estimated at about 50 miles from N. to S. and 40 to 45 from E. to W., and containing 343 square leagues, and 474,349 inhabitants. It is divided into five districts, *viz.* Brest, having 149,610 inhabitants; Morlaix, 109,914; Chateaulin, 82,131; Quimper, 84,074; and Quimperlé, 48,620. Its capital is Quimper; and its other chief towns are Brest, Morlaix, Chateaulin, Lesneven, Landerneau, Crozon, Briec, Quimperlé, and Bannalec. Its chief rivers are the Aulne and Odet. The number of its cantons is 43, and that of its communes, 287; its contributions amount to 2,458,757 francs, and the expences charged upon it are 315,198 f. 66 c. This department is tolerably fertile, producing grain, flax, hemp, fruits, and good pastures, with mines of iron and lead.

FINISTERRE, *Cape, Calicum Promontorium*, called *Artabrum* by the ancients, and by some *Norium*, a cape on the N. W. coast of Spain, in the province of Galicia. It is nearly S. or a little westerly, about five leagues from cape Toriano, and ships may anchor on the E. of a large rock, in six or seven fathoms, where is a great bay that runs far inland. Forty-two leagues from Cape Finisterre, there is a large rock above water, dangerous to navigators. N. lat. 42^o 53' 52". W. long. 9 16' 15".

FINITE, something bounded or limited, in contradistinction to infinite.

The schoolmen make two kinds of finite; *viz.* the one as to *extension*, which is applied to things that have not all possible or conceivable extension.

The other as to *perfection*, applied to things which have not the last perfection.

To get an idea of a thing finite in point of perfection, we first conceive the thing as having certain perfections; and then conceive some other perfection which it has not, or some perfection in a farther degree. After the same manner I conceive a room to be finite, by having an idea of extension beyond what is contained therein.

FINITO, *Ital.* in *Music*, a canon or fugue is said to be finite, *scilicet*, when it is not perpetual, but when at some certain place all the several parts stop together on the chord of the key note; after having followed each other for several rounds, on signal being given by the leading part holding up his finger. See CANON.

FINITOR,

FINITOR, in *Astronomy*, the horizon; thus called, because it finishes or bounds the sight or prospect.

FINLAND, in *Geography*, a country of Europe, bounded on the north by Lapland, on the east by Russia, on the south by a gulf to which it gives name, and on the west by the gulf of Bothnia. This country was formerly divided into Russian and Swedish Finland. The former, or Russian Finland, anciently belonged to the Swedes; but it was partly ceded to the Russians by the peace of Nyfstadt in 1721, and partly at the treaty of Abo in 1743: its capital is Wiburgh, and it now constitutes the government of Wiburgh. (See *WIBURGH*.) The limits of Russia and Sweden, settled by the peace of Abo, are formed by the river Kyman; which flows into the centre of the gulf of Finland; on the south bank of which are a wooden house, a rampart of earth, and a small battery. The frontiers are defended by *Fredericksham*, which see. This province retains most of its ancient privileges, with some modifications under the new government. The country produces, besides pasture, wheat, rye, oats, and barley, but not sufficient for the inhabitants. Wiburgh retains its own civil and criminal courts of justice; in penal cases, not capital, the punishments prescribed by the provincial judicature are inflicted; but whenever a criminal is condemned to death, the Russian laws interpose, relieve him from the sentence of beheading or hanging, &c. enjoined by the Swedish order, and consign him to the knout and transportation to Siberia. In the governor's court business is transacted in the Swedish, German, and Russian tongues; the peasants use only the Finnish dialect, but the inhabitants of the towns understand also Swedish, and many of them German. The Lutheran is the established religion of the province, but the Greek worship has been lately introduced by the Russians. This part of Finland is not so extensive as Swedish Finland. It is remarkable, that in both countries the productions of nature are sooner ripe in the parts covered with forests, than on the sea-coast and islands. The interval between seed-time and harvest is from 10 to 12 weeks. The Finns apply principally to the culture of hemp, flax, and tobacco, which thrives well in their country. As to trees, those which bear fruit, such as cherry and plum-trees, are almost always destroyed by the rigour of winter; the mulberry is planted and thrives only on the islands; the oak is said not to grow beyond 61°, and the ash beyond 62°. The forests of firs furnish in Finland the principal articles of commerce in wood, charcoal, timber, and planks, which are sent to Wiburgh, Stockholm, &c. for exportation. The country abounds with game, and in the lakes and rivers various kinds of fish are plentiful. At the bottom of the morasses they dig earth, from which iron is extracted, and they have some mines of lead. The peasants of Finland differ very much from the Russians in their aspect and dress; most of them have fair complexions, and many of them red hair, which they part at the top and allow to flow at considerable length over their shoulders; they also shave their beards; whereas the Russians have generally dark complexions and hair, which they cut short, and they also suffer their beards to grow. The Finns, by their commerce with foreigners, are in general more civilized than those Russians who do not reside in the capital or in their vicinity. The smallest villages of Finland afford much better accommodations than are usually met with in the largest towns of Russia. In the 12th century great pains were taken to convert the Finns to Christianity; and Henry, who was bishop of Upsal, in 1157, fell a martyr to his zeal in the accomplishment of this benevolent design. That prelate founded the first cathedral in Finland at Randamoki; but the see was afterwards

transferred to Abo, not far from the former place. Martia Skytte, and Peter Serkilar, were the first promoters of Lutheranism in this country. The provinces of Swedish Finland are Finland Proper, the isle of Oeland or Aland, Ostrobothnia, Tavastaland, Nyland, Savolax, and that part of the sief of Kymene and Carelia, which Sweden reserved to itself; but the whole of Finland has lately (1809) been ceded to Russia; in consequence of the unsuccessful struggles of the Swedes to maintain their independence; and by the treaty of peace concluded between Russia and Sweden, and signed at Fredericksham, the incorporation of the grand duchy of Finland with the Russian empire was confirmed. The town of Torneo, and the river of the same name, form the frontiers.

FINLAND Proper, a province, lately belonging to Sweden, situated on the southern part of Finland, considered in its utmost extent, bounded on the S. by the gulf of Finland, and on the west by that of Bothnia; about 160 miles in length and 10 in breadth. The soil is fertile, and the land, especially in the southern parts, produces good corn, hay, and hops. It has several fine lakes and rivers, which yield abundance of fish, and on part of the coast is a pearl fishery. The inhabitants subsist by agriculture, grazing, fishing, and the manufacture of woollen ware. The principal articles of their commerce are grain, meal, cattle, butter, talc, linen, yarn stockings, &c. Finland is divided into north and south; the capital of the former is Biorneborg, and that of the latter Abo.

FINLAND, Gulf of, that part of the Baltic sea which washes the coasts of the governments of St. Petersburg, Revel and Wiburgh; it is above 400 versts in length, and from 100 to 120 in breadth. The gulf of Finland is of difficult navigation, both on account of the heavy gales of wind that are so frequent here, and the multitude of rocks and shelves with which it abounds.

FINMARK, called also *Lapmark*, a province of Norway, bounded on the N. by the northern ocean, on the E. by the northern ocean and the territories of Russia, on the S. by Swedish Lapland, and on the W. by the northern ocean. The coast of this country is well inhabited, but it has neither towns nor villages. The inhabitants subsist chiefly by fishing, and their country yields the best salmon in Norway. The sun, such is their latitude, continues above their horizon in summer for some weeks. Finmark has a particular governor, register, and judge. It is divided into West Finmark, which includes twelve churches and chapels, served by five preachers; and East Finmark, in which are nine churches and chapels, served by three preachers. See *FINNS*.

FINN, a river of the county of Donegal, Ireland, which flows from a lake of the same name, and, after a course of several miles in an eastern direction, joins the river Foyle, near Strabane.

FINNERYDIA, a town of Sweden, in West Gothland, 34 miles S.W. of Orebro.

FINNHAR, a small island on the west side of the gulf of Bothnia. N. lat. 60° 58'. E. long. 17°.

FINNIKIN, in *Ornithology*, the name of a particular species of pigeon, called by More the *Columba in gyrum floctens*. It is of the shape and size of the common pigeon. The crown of its head has something of the resemblance of a snake's head; and it is gravel-eyed, and has a tuft of feathers on the hinder part of its crown, which runs down its neck not unlike a horse's mane. It is not feather-legged, and is in colour always either a black or blue pied.

They have their name from their singular manner of courting the female, which is always by rising over her

and making three or four turns, flapping the wings, and then turning as many times round the other way.

FINNIS BAY, in *Geography*, a bay of Scotland, on the east coast of the island of Harris. N. lat. 57° 53'. W. long. 6 55'.

FINNS, a race of persons, who are said to be the aborigines of Russia, and who inhabited the regions of the Volga and the Duna. These people, though they form one main stem of the inhabitants of Russia (the Slavonians being the other), have never, in any of their branches, risen into a ruling nation; yet as they are the common stock of most of the northern nations of Europe, they are distinguished by their antiquity, and by their wide extent from Scandinavia to a great distance among the Asiatic nations of the north, and thence again to the shores of the Volga and the Caspian. Although the Finns have been thus widely dispersed, yet they have preserved a general resemblance in bodily frame, in national character, in language, and in manners. It is also remarkable, that the greater number of those who belong to the Finnish race, still dwell only in the north, which has ever been their favourite abode, and on which account they are called inhabitants of morasses or fens; and the fishery and chase have been their chief occupation and trade. Which of these widely dispersed people has the best claim to be considered as the parent stock, it is not easy to decide. The aboriginal name of Finns, known to the Roman historian Tacitus, is not in use with any of these nations; but they call themselves by a different appellation. None of these people have ever exhibited a conspicuous figure on the theatre of the world, nor acquired a permanent independence; but they have all, as far back as history can trace them, been a prey to their more enterprising and powerful neighbours. Accordingly, they have no chronicles of their own; and their history is only to be found in the annals of their conquerors. Of their ancient history nothing certain is known, except that they possessed the greater part of Scandinavia and Russia in the north, and separated into several tribes, which either lived entirely without any government, or, like the Permians and proper Finns, under their own kings. All these were gradually subjugated by three nations, under the dominion of which they still remain; *viz.* the Norwegians, the Russians, and the Swedes. The Norwegians were the first who subjected a part of the Finnish north. Finmark, which is a large province extending even to the east of Cape Nord towards Russian Lapland, has ever been tributary to them. Yet it appears that, long before the commencement of the 10th century, the whole tract, from Wardhuys to the White sea, was independent of them; and that only the remoter Finns, about the gulf of Bothnia and Finland, and on the Dwina, obtained their national freedom.

The inhabitants of Finmark have been amply described by Leems (*De Laponibus Finmarchiæ*, Copenhagen, 1767, 4to.) cited in Pinkerton's *Geography*. This race of men, he says, is of small size, generally about four feet, with short black hair, narrow dark eyes, large heads, and high cheek-bones, a wide mouth, and thick lips, and of a swarthy complexion. In the southern part of Finmark they are mingled with Norwegians; but the northern wilderness is wholly their own. They call themselves "Same," their speech "Same-giel," and their country "Same-edna," being probably of the same race as the Samoieds. The language has only an affinity with the Finnish, but not nearly so much as the Danish has with the German; and, it should seem, that they had anciently a different speech, which they enriched with large additions from that of their more polished neighbours the Finns. Towards the shore they build

huts; and on the mountains use tents of a flatly conic form, and divided into two parts by a kind of passage; each part having three rude subdivisions; the two farthest for the master, mistress, and guests; the middle on each side of the fire for the children; and those nearest the door for the servants: behind these the cattle had a refuge, but the cattle are few, the rein deer constituting their chief wealth. The sun absents himself for seven weeks, and yet from ten in the forenoon to one in the afternoon, the daylight will enable a person to read without a candle; nevertheless the stars are visible, and the moon, when apparent, shines all the day. The sun never sets for seven weeks in summer; but in the night his beams are dull, and he assumes a ruddy hue. Several rivers, particularly the Tana, in eastern Finmark, sometimes much swelled by the melted snow, supply salmon and other fish, the chief food of the Laplanders; though at a festival they have mutton or rein-deer, and mead. The men wear conic red caps, lined with fur, and a kind of robe of cloth or skin; the poor sometimes use that of salmon, which appears like a white shagreen; the head and neck are protected with a sort of cowl, and the vest is of undressed sheep-skin, with the wool inwards. The head-dress of the women is narrowed in the middle, widening like a basin at the top: the vest and robe resemble those of the men. Their amusements are shooting with the bow at a mark, a kind of tennis, and a game resembling draughts. They are also fond of wrestling, and other exercises. They were formerly addicted to magic, and were fabled by ancient times to invoke a dæmon in the shape of a fly, which was called the "gan-fly," and commissioned to sting their enemies. Till recent times they were immersed in paganism, regarding particular mountains and rocks as gods. Their chief god was "Radien," who dwelled in the starry heavens; in the lower aerial regions were "Beivi," or the sun, a god, as Grotius has observed, very unjust to them; with "Horangalis," or the thunderer, and other divinities. On earth were the gods of hunting and fishing; and the goddess "Maderakko," with her daughter "Sarakka," a kind of Venus, who prepared the body after Radien had sent the soul. The "Saivo Olmak," or gods of the mountains, were supposed to be oracular. The places of sacrifice were chiefly holy mountains, near the firth of Waranger, and along the Tana, and some on the bay of Porfanger. Their magical songs and drums are very trivial. For the conversion of the Laplanders to Christianity, Eric Bredal, bishop of Drontheim, made some vain attempts about the year 1660; but the royal mission was not founded till 1714; and extended to the Laplanders of Finmark, with those of Norland to the south, being a considerable portion of the diocese of Drontheim. Since that period, the missionaries have been resolute, and industrious, and successful: there being commonly two for Finmark, one for the east, who presides over Waranger, Tana, and Laxefjord; the other for the west, over Porfanger, Hvaisfund, and Al-ten.

The Russians were the people who, next to the Norwegians, dispersed themselves among the Northern Finns; and though at first, on their settling about the Volkhof, they lived on good terms with their neighbours the Tschudes or Finns, and even elected a government conjointly with them, yet afterwards they, later than the Norwegians, and earlier than the Swedes, conquered and subdued them. At first the Russians had merely the region about the gulf of Finland, or on the Kyrialabotn, and about the Ladoga lake, quite up to the White sea. They afterwards spread farther round in these desert countries, and subjected to themselves a part of Finland. In the sequel they took not only the whole

whole of Lapmark round Kola, but proceeded to levy a tribute on the Finns in the present Finmark, and on those who dwelt in Trumfen as far as Malanger. The other Finnish nations in the East, on the Volga, and in Siberia, became subject to them with their gradual extension into these regions, by the conquest of the Tartar kingdoms and the discovery of Siberia. The Swedes were the last who founded a sovereignty in the Finnish parts of the North. It was not till the middle of the 12th century, about the year 1157, that king Erik, the saint, undertook the subjugation and conversion of the proper Finns; 100 years afterwards the Swedes entered Tavastland; towards the end of the 13th century they established themselves in Karelia; and about the same time the Laplanders were also reduced under their authority. Thus the whole of the Finnish North was partitioned among three sovereigns, and the nation itself was removed from the rank of an independent people. Of the 13 tribes into which the Finnish stock was divided, 12 belong either wholly or in part to the inhabitants of the Russian empire; viz. the Laplanders, the Finns, the Esthonian, the Livonian, Tschermiffes, Tschuvasches, Mordvines, Votjaks, Permiaks, Siryanes, Vogules, and Kondish Ostjaks. The Madhars alone, the great mass of the mixed multitudes whom we at present call Hungarians, are the only Finnish nation which belongs not to Russia, and also the only one that has preserved its national independence.

The country which is inhabited by the Finnish nation comprises the north-eastern corner of the Bothnic and Finnish gulfs, interspersed throughout with mountains, rocks, morasses, and lakes, between the 60th and 65th degrees of N. latitude; its circumference being computed at 30,000 versts. The greater part of it *did* belong to the kingdom of Sweden; the smaller south-eastern portion, till of late possessed by Russia, contained Ingermanland, Kexholm, and Karelia, forming the government of Vyborg or Wiburgh, and part of that of St. Petersburg. In the government of Vyborg, the Finns compose by far the greater part of the inhabitants, or more properly they are the people of the country. In most of the circles of the Petersburg government, they, with the Ingrians, are likewise the main body of the population; and in the government of Tver and Novgorod, they form considerable colonies, which have long been settled in these regions. The number of all the Finns living in Russia cannot be correctly ascertained; but they probably exceed 400,000 persons. *Pooke's Russ. Emp.* vol. i.

FINO, a small island in the Baltic, near the E. coast of Sweden. N. lat. 58° 9'. E. long. 16° 42'.

FINO, *Cape*, a cape on the coast of Genoa. N. lat. 44° 19'. E. long. 8° 6'.

FINOCHIO, in *Gardening*, the name of a plant sometimes cultivated as a salad herb. See ANETHUM.

It is raised by sowing the well ripened seeds procured from Italy, about the end of March in a warm situation, on a bed of light rich earth in the drill manner, very thin, covering them in lightly with the fine mould. The drills should not be nearer together than about eighteen inches. The plants will be up in about a month, when they must be thinned out to six or seven inches distance, and be kept perfectly clean from weeds. When the stalks begin to swell out above the surface of the ground, they should be earthed up in the manner of cellery, when in the course of a fortnight they will be ready for use, and eat crisp and tender. Successive crops should be sown every three weeks until July. The late put in crops being occasionally watered and shaded from the heat of the sun.

This plant is not now much cultivated in our kitchen gardens.

FINOW, in *Geography*, a town of Germany, in the Upper Mark of Brandenburg; 32 miles N. E. of Berlin.

FINSCALE, in *Ichthyology*, an English name for the river fish, more usually called the rudd, the *rutilus latior*, or *rubellio fluviatilis* of authors. See CYPRINUS *erythrophthalmus*.

FINSPANG, in *Geography*, a town of Sweden, in East Gothland; 15 miles N. W. of Nordkiöping.

FINSTER-AAR-HORN, a high mountain of Switzerland, in the canton of Bern; the elevation of which has been found by actual measurement to be 14,116 English feet.

FINSTER Munster, a town of the Tyrol; 12 miles N. E. of Triafp.

FINSTERBACH, a river of Franconia, which runs into the Rednitz, 2 miles N. of Roth.

FINSTERWALDA, a town of Saxony, in the margraviate of Meissen; 36 miles N. of Dresden. N. lat. 51° 37'. E. long. 13° 56'.

FINTO, *Ital.* in *Musie*, implies a feint in preparing for something that is not performed, as *cadenza a-finita* implies the making a full clofe expected, when, instead of the base falling a 5th or raising a 4th, another unexpected base and its harmony are given, which at present is called a *disappointed cadence*, and may be brought about various ways.

FINTONA, in *Geography*, a small post town of Ireland, in the county of Tyrone, on the road from Omagh to Enniskillen; 7 miles S. from Omagh, and 94 miles N. W. from Dublin.

FINTRAY, a town of Scotland, in the county of Stirling, containing about 1000 inhabitants; 8 miles S. W. of Stirling.

FINVARRA POINT, a cape of Ireland, in the county of Clare, on the southern coast of Galway bay. W. long. 9° 4'. N. lat. 53° 7'.

FIONDA, a town of Asiatic Turkey, in Natolia, in the gulf of Satalia; anciently called *Phafelis*, near a famous pass into Pamphilia; now the see of a Greek bishop, though much decayed; 28 miles S. of Satalia. N. lat. 36° 36'. E. long. 30° 26'.

FIORA, a river which rises in the Siennese, and runs into the sea below Montalto, in the duchy of Castro.

FIORAVANTI, LEONARD, in *Biography*, a physician of Bologna, in the sixteenth century, who possessed a considerable degree of reputation among his contemporaries, not only on account of his knowledge in medicine, but also of his chyrurgical dexterity. Nevertheless he was an arrant empiric, in the modern sense of the word, and in the writings which he left behind him, he dwells at great length on the excellence of the secret remedies which he possessed, and is violent in his condemnation of blood-letting. He died on the 4th of September 1588. The titles of his works, which are in Italian, are as follows; "Del Specchio di Scientia Univerfale," Venice, 1564. "Regimento della peste," *ibid.* 1565. "Capricci Medicinali," *ibid.* 1568. "Il Tesoro della vita humana," *ibid.* 1570. "Compendio dei Secreti Naturali," Turin, 1580, Venice, 1581, &c. "Della Fisica, divisa in Libri Quattro," Venice, 1582, "Chirurgia," *ibid.* 1588. All these works have undergone several editions.—Eloy.

FIORENTINO, in *Geography*, a town of Italy, in the Campagna di Roma; 25 miles N. of Terracina. N. lat. 41° 42'. E. long. 13° 6'.—Alfo, a town of Naples, in Capitanata; 7 miles S. of Lucera.

FIORENZUOLA, a town of Etruria, in a valley of the Apennines, on the site of the ancient Fidentia; 22 miles N. of Florence.—Alfo, a town of the duchy of Parma.

—Alfo,

—Alfo, a town of Naples, in Capitanata, anciently called *Florentinum*; now decayed; 10 miles S. of St. Savaro.

FIORI, MARIO DA, in *Biography*, a painter of flowers, whose real name was Mario Nuzzi. He was born at Perona in the kingdom of Naples in 1623, and studied with his uncle Tomaso Salini. He imitated the lighter productions of nature, as flowers, shells, &c. with great beauty. A fulness and richness of touch and colour are given by him with great elegance and lightness. It was so much the taste of the time to admire his productions, that he could not complete them fast enough for the demand; and what was more to his credit, Domenichini and other artists of renown were not ashamed to paint in conjunction with him. One of his most capital works is in the church of St. Andrea della Valle at Rome. It is a wreath of flowers encircling the portrait of St. Gaetano, which was painted by Andrea Camassei. At Wilton is a very beautiful painting of his; a wreath of flowers round a head of the virgin, by Carlo Dolci. He died in 1673, at 70 years of age.

FIORITO, *Ital.* is a musical term, implying flowery, ornamented; as *canto fiorito*, florid song, *contrappunto fiorito*; to distinguish them from *canto fermo*, and *contrappunto semplice*.

FIORLITA, in *Geography*, a small island of the Mediterranean, at the entrance of the gulf of Tarento. N. lat. 40° 14'. E. long. 18°.

FIORONI, GIAN. ANDREA, in *Biography*, maestro di cappella at the great church or Duomo in Milan, about the middle of the last century. He was an excellent contrapuntist alla Palestrina, that is to say, in the style of our best old masters in their services and full anthems, which consist of good harmony, ingenious points and contrivances, but no melody. Sig. Fioroni is a voluminous composer and publisher of masses and motets in eight parts, *à due voci*. So that though this style, and that of the church, are abandoned in Italy, on days of festival, when instruments and secular singers are employed, the ancient grave style of the 16th century is not wholly lost.

FIR-TREE, in *Botany*. See *Abies* and *Pinus*.

FIR-Tree, the common name of a tree of the evergreen timber kind, frequently met with in the more elevated and mountainous situations of the colder climates of the north. It has, for the most part, single leaves, which are produced on every side of the branches. This is a tree which is capable of being raised upon almost any sort of soil which is not very retentive of moisture; and it is both rapid in its growth, and hardy in its nature, but not perhaps so ornamental as some others of the evergreen kind.

The usual method of raising these trees is by sowing the seeds taken from the well ripened cones which they produce. The mode of extricating the seeds from the cones is, either by exposing them to the gentle heat of a fire, or by soaking them for a short time in warm water, by which they readily open and emit the seeds. The former method is the best, when due attention is paid not to expose them to too great a degree of heat. This should not however be done until the period of sowing or putting them into the ground. The best way is to sow them in a nursery where the land has been well prepared, in order that they may be well protected from the ravages of birds at the time of their coming up; as they are very apt to destroy them at that period, by picking off the husks of the seeds which come up along with the plants.

The proper time of putting the seeds into the ground is about the end of March, or beginning of the following month. They should be sown on a bed of light earth, and covered to the depth of about half an inch by means of a

garden rake. The plants should be continued in this bed until the following spring, being kept perfectly clean from weeds. At that time other beds should be put in a proper state of preparation for receiving the young plants; into which they should be carefully transplanted in rows, at the distance of six or eight inches from each other, and three or four inches apart in the rows. When the season happens to be very dry afterwards, it may be proper to water the plants once or twice a week according to the heat of the weather; and in some cases it may be requisite to cover the beds with mats in order to screen them from the sun and drying winds, until they have taken good root; after which no further care is necessary, except that of keeping them free from weeds. The plants may continue in these beds two years; at the end of which time they may be removed into other spaces of open ground properly prepared for them, being placed out at such distances as may be most suitable for them. The most usual distances in these cases are four or five feet from row to row, and two or three feet apart in the rows.

After they have been planted out, when the weather happens to be dry, they should have a good watering to settle the mould to their roots; and which may be repeated three or four times, in case the season continues droughty, with great benefit in promoting their taking root, and securing them from the effects of drying winds.

The plants may remain in these situations for two or three years longer, or until they may be wanted; during which time the ground should be dug between the rows in every spring, and be afterwards kept perfectly clean from weeds by frequent hoeing, care being taken in the diggings not to cut or injure their roots. This is all that is requisite in their cultivation while they remain in such places.

When they are to be removed into the situations where they are to remain, great care is necessary in taking up the plants, not to cut off or hurt the roots, nor to suffer them to continue any length of time exposed out of the ground, before they are replanted. The most safe time for performing the business of removing this sort of trees for finally planting out in moist soil is the beginning of April; though in dry lands they may often be planted about Michaelmas, with success.

Fir trees are frequently removed at the height of six or seven feet and sometimes more, but the height of two or three feet is much better, and plants of this height generally, in the course of a few years, surpass those that have greater heights when first set out.

The first, or large sort of plant, must, at first planting out, be always well secured by stakes or other means, in order to prevent their being moved and made loose by winds, which, whenever they occur, are sure of destroying the trees. The small plants only stand in need of having the mould firmly trodden in about their roots during the time they are planting out.

The vast improvements that have been made by planting large masses of trees of the fir kind on the poor, bare, bleak, exposed, moory, and heathy situations in the northern parts of Scotland, sufficiently shew their importance, and plainly demonstrate the advantage of such undertakings in such places, where properly managed. And though it may be admitted that the Scotch fir is amongst the most perishable and least valuable sorts of timber wood that can be raised, and consequently sells in general, at the least price; yet as the expence of raising it is very trifling, the returns are in all cases so abundant as to fully satisfy those who have engaged in the forming of such plantations. This has even been the case when no other circumstance but the direct in-

FIR-TREE.

come which has arisen from such plantations themselves has been taken into the account. But when the collateral advantages are considered likewise, the benefit occasioned by them is evidently extremely great. It has been stated by the author of the "Essays on Rural Affairs" that in the vicinity of plantations of the fir kind, houses can be raised at so little expence, and the roofs are so much straighter, and better than the ordinary ones, that settlers in such situations are induced to make their houses much neater and more commodious than in other places; and besides rails, and other kinds of materials for dead fences, can be so easily procured, that the poor people are first enabled to have good well-fenced gardens, and then commodious inclosures of larger extent; the branches likewise afford fuel to them, which adds greatly to the comforts of their situation. The cutting and manufacturing of the wood into various kinds of utensils furnish employment for a great many persons; population is thereby increased, and with an augmentation of population, its necessary consequence, the desire for land to produce the necessaries of life, and of course an increase of rent to the proprietor. These new settlers in the desert wastes of Scotland, like those in America, cultivate and improve the soil in proportion as the trees are removed from it. At this moment, it is added, Mr. G Dempster, who will be long respected by his countrymen, sees fields on his estate rapidly converting, in this way, into cultivated ground, and yielding him ten or twelve shillings per acre in rent, not only without any expence to himself, but after having derived a considerable profit from the sale of woods of his own planting, which grew upon land that twenty-five years ago was not worth to him above two pence the acre, and which might have remained in that state, perhaps for ages to come, had it not been planted at all. It is contended by the same writer, that it is by a judicious management of this sort that men of large landed estates, by a little fore-sight, find themselves enabled to provide both employment and subsistence, with much profit, to a numerous people, who must otherwise have either remained in a destitute condition, or have abandoned a country, which did not properly provide for their accommodation.

It may be remarked likewise that a plantation of Scotch firs may be made at much less expence than of any other sort of trees in those northern parts of the kingdom, as the young plants can be afforded at a lower price than any others. In Aberdeenshire, where planting is so general as to have become a sort of occupation, fir plants of two years growth, above which age no experienced planter will ever buy them, sometimes will be sold at the very low rate of fourpence the thousand, which consists of twelve hundred plants; and they formerly seldom exceeded eightpence; on the average about sixpence, or one halfpenny the hundred: but they have lately been considerably higher. There are men who make a business of forming plantations, who will undertake to complete the whole, enclosing and planting, at the distance of one yard each way, and uphold them for five years, that is, supply any deficiencies that may take place, at the rate of from ten to fifteen or thirty shillings the Scotch acre, which is nearly equal to one and a quarter English, according to the size of the inclosure, and the nature of the fence. In all cases of this kind, it is supposed that the plantations are of the extent of thirty or forty acres or upwards; for where the inclosures are smaller, the expence of inclosing is proportionally augmented. The charge is thus not only rendered moderate, but the whole of the expence that is to be incurred, ascertained before the plantation is begun, by which the being involved in unforeseen difficulties is fully obviated.

Experience has fully shewn that there is scarcely any soil so bad, or any exposure so bleak, that the fir-tree will not live in, if the plantation be of sufficient extent, and not upon the very summits of high peaked hills. They do not indeed bear the sea air very well, where they are much exposed to the severity of its blasts; nor is the wood ever of so good a quality, or the tree long lived, upon soils of the clayey kind. It has been found that in the southern parts of the kingdom, the pineaster bears the sea blast much better than any other of the fir tribe. This is a discovery of great importance, and which deserves the attention of improvers in the way of planting. The spruce fir will however bear a still more exposed situation than the Scotch fir; and after a few years from the time of planting, it shoots up with still greater luxuriance. This is the case probably only in particular situations. But the cones are not to be had in equal abundance; and the plants being more difficult in the rearing, they are sold at a much higher price, usually about six shillings the thousand, fit for being planted out. In a good soil the silver fir also prospers well, and is a beautiful tree, on account of the depth of its shade; but the price of the plants is too great to admit of large plantations of it being made with advantage. But wherever the situation is bleak, and much exposed to strong blasts of wind, the plantation must not only be of considerable extent, if the trees be expected to thrive, but they must be planted very close together, so that each plant may stand at the distance of from two to three feet at most from each other. The more exposed the situation is, the closer they should be planted; as it may be observed that until the branches begin to intermix, and give a mutual support to each other, the trees never begin to advance with vigour. Where the plantations are thus thick, there is a necessity for beginning to thin them out at a pretty early period, so that after the tenth to the fifteenth year from the time of planting, persons must be constantly employed in thinning them: and there are very few situations, indeed, in which the thinnings cannot be disposed of to advantage, or in which such sorts of plantations cannot be made.

It has been remarked by an able writer, in the Transactions of the Bath Agricultural Society, that though he does not think that the Scotch fir can, in this country, ever equal the yellow deal from the Baltic, yet it may be worth propagating, as being useful in ordinary buildings. The drier the soil is on which this sort of timber grows, the slower is its progress; but the closer its pores, the more superior its quality. When planted in rich laud these trees will shoot three or four feet in a season, and equal, if not surpass, the beech in growth. In his plantations, though chiefly confined to chalky banks, in a north-west exposure, the trees evince, that when once rooted, few obstacles will prevent their profitable progress. From observing the mistakes of others in endeavouring to ornament their naked downs too suddenly, he has learnt the necessity of planting firs when only a foot in height, and by opening the ground some time before, inverting the turf at the bottoms of the holes, and throwing the mould upon it in hillocks to meliorate, his plantations succeeded well: for though the soil is scarcely six inches in depth, the firs set in 1766 are now 30 feet in height, and from two feet six inches, to two feet, in circumference, at four feet from the ground; some few planted at the same time in a deeper soil, and warmer situation, are now about three feet round. And spruce firs, planted in 1766, likewise in a tolerably good soil, are now 40 feet in height, and from two feet ten inches and a half, to three feet, round. But he has seen plantations that far surpassed either of these in growth; they however occupied ground which was infinitely more valuable. See PINUS. In

hard,

hard, scarce seasons the tops or shoots of the fir tree have been useful as a food for cattle, sheep, &c.

FIR, *Moss upright*. See LYCOPODIUM.

FIR, *Scotch*, in *Botany*. See PINUS.

FIR-cones, *fossil*, in *Natural History*, are extraneous fossils, resembling the cones of the fir-tree. Numbers of these have been described by different authors, who appear evidently to have confounded recent and peat fossils with those belonging to, or found lodged in the undisturbed strata, or to have had but slight evidence of the identity of the fossils with recent cones. We have been told that a very perfect fir-cone was, a few years ago, found at Apsley in Bedfordshire, not many inches beneath the soil, in a completely silicious state. The many fables that have been published respecting the petrifying springs of this place, would have induced the writer to have taken no notice of this, had it not been related to him by a gentleman of veracity, and a competent judge of these matters; but since he has had himself the opportunity of making enquiries on the spot concerning this fossil.

FIR-wood, *fossil*, has generally been that obtained from out of peat mosses, in which recent fir-trees have been preserved during the growth of the peat; and, as Mr. Parkinson thinks, have undergone a degree of the bituminous FERMENTATION (which see), by which their inflammability has not only been preserved, but in some instances heightened. The same gentleman (*Organic Remains*, i. 400.) figures a silicious remain, (Plate II. fig. 4 and 5.) which he describes as a piece of fir, but we think without offering sufficient proof of its identity to any of the recent fir tribe.

FIRABUS, in *Geography*, a town of Persia, in the province of Mecran; 45 miles W. S. W. of Kidge.

FIRAN, a small island in the Red sea, about 18 miles from the coast of Arabia, celebrated for its fisheries of pearl. N. lat. 17° 13'. E. long. 41° 30'.

FIRANDO, an island and kingdom of Japan, with a good harbour, in the sea of Corea. N. lat. 33° 35'. E. long. 130° 40'.

FIRE. This word has been used to express things somewhat differing from each other; yet bearing analogy to its most usual and most common signification, which is that of an active natural process, attended with the emission of heat and light, and likewise with the decomposition of certain substances, which are said to be *burning*, or in a *state of combustion*, during the process, and are said to be *burnt* after the termination of the process.

The general use of fire, which comes continually under our observation, suggests to our minds the meaning of the word perhaps much more readily than the recollection of the above stated definition; the latter, however, is attended with this advantage, namely, that it defines the limits of the meaning, whence it prevents its equivocal application.

The various spectacles which fire exhibits to our senses; its astonishing effects, and the innumerable uses to which it may be applied, have, at all times, rendered it an object of the utmost consequence to the human species. The newborn infant generally fixes his eyes to the flame of a candle, or to a common culinary fire, in preference to any other object; at a more advanced age the various means of exciting and of employing fires occupy the thoughts of a very great portion of the human species; and the industry of philosophers has at all times endeavoured to investigate the nature, and to account for the effects of fire.

It is not every kind of bodies that are capable of combustion. Those which are capable of supplying a fire, or of being burnt, are called *combustibles*, and such are either

simple, as hydrogen, sulphur, and phosphorus; or compound, *viz.* those which consist of various substances together with a notable proportion of one or more of the above-mentioned simple combustibles; such as wood, coal, oils, &c. Several other bodies are not combustibles; these, however, may, by the action of a fire, be rendered red-hot, so as to emit heat and light, but they do not undergo any decomposition; or if they do undergo any, it is not of that kind which a fire produces amongst bodies that are really combustibles. The incombustible bodies that are rendered red-hot, are said to be in a state of ignition, or of incandescence, and this incandescence, which emits heat and light, exists no longer than the cause which produces it; for after that it begins to diminish, and gradually vanishes; whereas the real combustibles, when once set on fire, continue of themselves to burn, until the materials are lost. Thus a pebble or a brick, by being placed in the middle of a common fire, may be easily rendered red-hot, but as soon as it is removed from the fire, its heat and light will gradually diminish, and will lastly vanish; the pebble or the brick remaining in the same state as it was before the operation. On the other hand, a piece or two of wood set on fire will of themselves continue to burn until their whole substance is changed into something quite different from what it was before the combustion.

Sometimes a substance which is actually a combustible, may, when placed in a common fire, be only ignited, and act like an incombustible body; that is, without undergoing any perceptible decomposition. The reason of this is, that the given combustible requires to be exposed to a very high temperature before it will suffer decomposition; therefore when placed in a lower temperature, yet sufficient to render it red-hot, it will then only acquire a state of incandescence. Thus a diamond, which is perfectly combustible in a very high temperature, may be made repeatedly red-hot and cooled, without the least alteration of its nature.

It may also happen that a combustible body may be placed in a degree of temperature much higher than that which is necessary for its combustion; yet the combustion will not take place for want of some of the circumstances upon which that process necessarily depends. Thus a piece of charcoal placed in a close vessel may be rendered red-hot, and may be kept in that state for any length of time, without undergoing the least decomposition. The reason of which is, that in a close vessel no oxygen gas can come in contact with the ignited charcoal; and without the presence of oxygen, or of substances which can yield oxygen, no combustion can take place. See the articles COMBUSTION and EXCITATION, wherein whatever belongs to the theory of combustion will be found.

From the former of these articles it appears, that no fire can continue long without a constant supply of a combustible substance, and of oxygen; for the whole process consists in a decomposition of both these substances, and the formation of new compounds, at the same time that the latent heat, or caloric, and the light, are separated and are set at liberty. As fire is of great and constant use for economical purposes, no pains have been spared to determine how the greatest effect may be produced in the safest and most economical manner possible, relative to all species of fire, from the burning of the least lamp, to that of the most powerful furnace. The combustibles, which are used for all these kinds of fire, are collectively called *fuels*, and in all cases the difficulty is to determine which kind of fuel is (according to other concurring circumstances of place, expense, &c.) the fittest for any given purpose. The full consideration of these particulars will be found under a variety of articles,

such as **FUPL, LAMP, LIGHT, FURNACE, &c.**; we shall nevertheless barely mention in this place some of the leading facts, which have been determined in consequence of repeated experiments, and which may, for the present, furnish the reader with a sufficient idea of the limits within which our powers of employing fires have as yet been confined.

Half an ounce of spermaceti oil, of the best kind, in a proper lamp, which is furnished with a wick of a single thread of cotton, may be made to burn for about twenty hours, and it seems that no smaller or cheaper quantity of any other combustible substance is known, which will maintain a fire for nearly so long a time. The Chinese use a very peculiar mode of continuing a small fire. A very light stick, about a twentieth of an inch in diameter, and about fourteen inches in length, is crusted over with a fine sort of saw-dust, wherein perhaps a very small quantity of nitre may be contained. The saw-dust is probably made to adhere to the stick by means of weak lize. If one of these sticks so crusted be lighted at one extremity, it will continue to burn, not with a flame, but like tinder, and will last about a quarter of an hour or twenty minutes. The Chinese keep such sticks burning before their idols, or for the purpose of lighting their pipes, even in their boats upon water; and when one of them is nearly out, another is put in its place. The flame of a lamp, furnished with spirit of wine, is much more active than when furnished with oil, and it is to be remarked that the flame of spirit of wine gives much more heat, and at the same time much less light, than the like flame of oil. The flame of burning hydrogen gas in common air is not very active, at least not nearly so active as a similar sized flame from oil; yet it is said that the flame of hydrogen gas, urged by pure oxygen gas, produces the most active fire known. For this experiment the two gases must not be mixed in a common vessel, and then let out of a small aperture in order to be lighted, and to produce a stream of fire; for in that case the whole quantity of mixed gases would at once explode, and burst the vessel; but the two gases should be kept in separate vessels, as, for instance, in two bladders furnished with stop-cocks, and when the stream of hydrogen is burning, then the stream of oxygen ought to be directed towards it. The gas, which is extricated from coal by means of heat, has been found useful for lighting apartments in certain circumstances, but the particulars will be found detailed under the article **FLAME**. For a culinary, or common fire place, several species of coal furnish, *ceteris paribus*, the most lasting, and, upon the whole, the most useful fire. The same will do for large furnaces; but for small furnaces, wherein a clear fire may be wanted, or for drying malt, &c. coke or charred coal is preferred; for the action of charring expels from the coal a good deal of gross vapour, which otherwise renders the fire smoky, especially at first. The greatest heat of an air furnace, eight inches in diameter, according to Wedgwood's estimation, amounts to about 21,877° of Fahrenheit's thermometer, or to 160° of Wedgwood's.

From the above-mentioned statements one may be easily led to conceive what degree of credit must be given to those idle stories of perpetual fires, and of lamps having been found actually burning in old tombs, and stone coffins. The improbability, or rather the absurdity of the accounts, is so very glaring as to render them only fit for novels and low poems.

Whatever belongs to fire, such as its excitation, its theory, its economical uses, its natural devastations, &c.; obtrudes itself on our notice under so many other obvious arti-

cles, as to supersede the necessity of rendering the present very prolix; there are, however, two particulars, which may with more propriety be expected in the present; and therefore we shall briefly subjoin them. These are a short history of the principal opinions that have been entertained respecting the nature of fire, and some remarks on the various senses in which the word fire has been used.

The opinions of the ancient philosophers respecting fire were various and fanciful. Ignorant of the leading facts which a theory is required to account for, and unassisted by experiments or tools, they generally made use of words which convey no definite ideas. They called it an active fermentation, an intestine motion, a repulsive agent, and so forth; but no real attempt towards a rational investigation is to be found in their works. And though some of their assertions seem to coincide with the more rational modern theories: yet that apparent coincidence must be considered as being accidental; for it is not grounded upon any regular reasoning. It must be acknowledged, however, that almost all the opinions, either ancient or modern, respecting fire, may be divided into two classes; for some of them asserted that fire was nothing more than a violent agitation, in some unknown manner, of the parts of burning bodies; whilst others attributed it to something peculiar, and *sui generis* which either existed in all combustible bodies, or was communicated to them. The former, which is called the mechanical hypothesis, was believed and maintained by the most able philosophers of much earlier, and much more enlightened times. Bacon, Boyle, and Newton, were of that opinion; and there seems to have existed a considerable struggle between those distinguished persons, and some celebrated chemists of those times, who maintained that fire was a fluid of a peculiar nature. The former asserted that the phenomena of fire could be accounted for on the supposition that fire consisted in nothing more than the violent agitation of the parts of the bodies concerned; but as no such motion could be produced without an adequate cause, they were considerably perplexed by it, and, in fact, their attempts towards an explanation are very confused. Boyle says that when a piece of iron becomes hot by hammering, "there is nothing to make it so, except the forcible motion of the hammer impressing a vehement and variously determined agitation on the small parts of the iron."—It is to be remarked, that the same Mr. Boyle, on observing the phenomena of the metallic bodies acquiring additional weight by their calcination, was induced to publish a treatise on the possibility of rendering fire and flame ponderable. Bacon defines heat, (which he considers as meaning the same thing as fire) to be "an expansive undulatory motion in the minute particles of a body, whereby they tend with some rapidity from a centre towards a circumference, and at the same time a little upwards." Newton did not attempt to assert any thing positive concerning it; but he conjectured that gross bodies and light might be convertible into one another; and that great bodies of the size of our earth, when violently heated, might continue and increase their heat by the mutual action and re-action of their parts.

The first of the chemists who attempted to form chemistry into a regular system, was John Joachim Becher, but the famous George Ernest Stahl, (who was born in the year 1660, and died in the year 1734,) by following Becher's plan, continued to raise the science, endeavouring to collect the principal facts then known into a coherent system, by connecting them by means of general principles. This intelligent man, amongst other improvements, formed the famous phlogistic theory of fire (see the article **COM-**

BUSTION), which was almost universally adopted, notwithstanding its insufficiency to account for some of the most essential phenomena of combustion. This theory continued in vogue until towards the close of the last century, when a new system of chemistry, and a new theory of fire was announced to the world by the immortal Lavoisier, who unfortunately died in the year 1794. His hypothesis, besides the conviction with which its bare enunciation was attended, has continually derived additional confirmation from a variety of new facts and subsequent experiments. This Lavoisier's hypothesis will be found particularly described under the article COMBUSTION.

Since the publication of Lavoisier's hypothesis, or rather established theory, an objection, apparently of importance, has been made to it by Count Rumford, in consequence of some experiments which he made upon friction. This gentleman found, that in boring a cannon during half an hour, the temperature was raised 70°; and that it suffered a loss of 837 grains by the dust and scales torn off, which amounted to $\frac{1}{12}$ th part of the cylinder. He then, calculating upon the supposition that all the heat so raised was given out by those scales and dust, concludes that they must have lost 66,360° of temperature; when at the same time he found that their specific heat was not thereby sensibly diminished. This observation made him doubt the existence of the *caloric* proposed by Lavoisier, as a principle *sui generis*, &c. and prompted him to make certain unwarrantable queries respecting the nature of fire; but he omitted to notice a very material circumstance; namely, the compression which the whole piece of metal suffered in consequence of the boring; hence Mr. Dalton justly says, "the heat excited does not arise from the scales merely, else how should hammering make a body red-hot without any loss of scales? The fact is, the whole mass of metal is more or less condensed by the violence used in boring, and a rise of temperature of 70°, or 100°, is too small to produce a sensible diminution in its capacity for heat. Does Count Rumford suppose, that if in this case the quantity of metal operated upon had been one pound, and the dust produced the same as above, that the whole quantity of heat evolved would have been the same?"

The word fire has also been used both figuratively and incorrectly. The allegorical expressions of *the fire of the imagination*, *the fire of youth*, *the fire of contention*, and so forth, do not fall under the cognizance of natural philosophy; but the scientific use of that word for expressing heat without light, or light without heat, or lastly, things which have neither heat nor light, is in want of correction. Thus phosphorescent substances, like certain pieces of decayed wood, fish, &c. are frequently said to be on fire; whereas they are not attended with any degree of heat. Also the heat of fermenting substances, and of other kinds of chemical combinations, has often been called their fire. But the most singular use of that word is its being often employed for expressing the electric fluid, which in its quiescent state shews neither heat nor light. It is true that in a vast number of electrical experiments fire is actually produced, and every electric spark is capable of setting fire to certain inflammable bodies. A very small spark of electricity, such indeed as may appear not bigger than a pin's head, is sufficient to inflame hydrogen gas. But it must be considered that the effects of fire take place only when the electric fluid is obliged to pass through certain substances which in some measure obstruct its free motion. A Leyden phial fully charged with electricity, and left insulated, does not shew the least perceptible mark of light or of heat, more than a similar phial not charged with electricity. Let the charged

phial be discharged through a substance which resists its passage, (and all substances obstruct the passage of the electric fluid more or less,) and the most astonishing effects of fire are produced; metallic bodies are fused, and even dispersed into smoke, combustible bodies are inflamed, hard bodies are broken, &c. If the discharge be made through the best vacuum which can be effected by means of an air-pump, the light and the heat will hardly be perceptible, because that vacuum offers a very trifling resistance to the passage of the electric fluid. In short it is universally true that the production of fire, that is the evolution of light and heat, is, if not exactly, at least nearly proportionate, to the obstruction which a given quantity of electric fluid meets with in its passage from one place to another. Therefore, upon these and other obvious considerations, which would be useless to mention in this place, instead of looking upon the electric fluid as fire, would it not be more rational to attribute the effects of fire, which are observed in electrical experiments, to the force of friction? In the boring of holes with hard tools, in the driving of nails through wood, in the quick passage of a bullet through the air or through harder substances, and in a great many other such like cases, no one hesitates to attribute the production of heat to friction or pressure; and if the very rapid movement of the electric fluid through bodies, and its immense elasticity be considered, it should seem that the effects of fire which are observed in electrical experiments, ought likewise to be attributed to the above-mentioned cause of friction or pressure.

FIRE, in *Medicine* and *Surgery*, is used in the same sense with cautery. See CAUTERY and CAUSTIC.

Fire also gives the denomination to divers diseases, as,

FIRE, *St. Anthony's*. It seems clear that the erysipelas was first so called in the south of France, and in the 12th century, where and when this disorder was exceedingly prevalent, from the success of the monks of St. Anthony (whose profession it was to attend the sick, and who therefore carried the figure of a crutch upon the left shoulder) in curing it. They made great use of lard in these cures; hence their pigs were allowed to range free through the neighbouring grounds; and that they might be distinguished from other pigs, bells were hung round their necks. These circumstances account for the figure of St. Anthony, the Egyptian hermit of the 4th century, being represented with the pig, the bell, and the letter Tau upon his shoulder. Paquet in Molanum, de imaginibus.

FIRE, *swalking*, called also *Will-with-a-wisp*, *Jack-in-a-lantern*, *ignis fatuus*, &c. See IGNIS FATUUS.

FIRE, in *Theology*, is frequently understood of the punishment of the wicked after death. See HELL.

It is supposed the world will perish at last by fire. See CONFLAGATION.

God has made several revelations of himself under the appearance of fire; he appeared to Moses under the form of a fire burning in a bush; the Holy Ghost descended on the apostles in tongues of fire; and the camp of the Israelites was guided and conducted in the night time by a pillar of fire.

The Chaldeans had an high veneration for fire, which they accounted a divinity; and in the province of Babylon there was a city consecrated to this usage, which was called the city of Ur, or of Fire.

The Persians also adored God under the image or representation of fire, because it is fire that gives motion to every thing in nature. They had temples, which they called "Pvrea;" fire temples set apart solely for the preservation of the sacred fire. They are said to have in that empire fires still subsisting, which have burnt many thousand years. See FIRE *everlasting*, GABRES, and MAGI. The worship

of the goddess Vesta (see VESTA) and of fire was brought into Italy by Æneas and the other Trojans, who landed there; but the Phrygians themselves had received it from the eastern nations. Fire was held in religious veneration among the Gauls; and similar sentiments and practice have prevailed in several countries of America.

The Hebrews kept up the holy fire in the temple. This holy fire descended from heaven, first upon the altar in the tabernacle at the consecration of Aaron and his sons to the priesthood, Lev. ix. 24. and afterwards it descended anew on the altar in the temple of Solomon, at the consecration of that temple, 2 Chron. vii. 1. And there it was constantly maintained by the priest day and night, without suffering it ever to go out; and with this all the sacrifices were offered that required fire. This fire, according to some of the Jewish writers, was extinguished in the days of Manasseh; but the more general opinion among them, is, that it continued till the destruction of the temple by the Chaldeans; after that it was never more restored; but instead of it they had only common fire in the second temple.

The Vestals were appointed expressly to keep up the sacred fire of the Romans. See VESTALS.

Vulcan was worshipped among the ancients, and particularly the Egyptians, as the inventor of fire; and Boerhaave has made it highly probable, that the Vulcan of the heathens was the Tubal-Cain of the Hebrews, the first who appears to have known the use of fire, and to have applied it in the fusion of metals and other preparations of chemistry. See PROMETHEUS.

FIRE, *Divination by*. See PYROMANCY.

FIRE, in the *Manege*. To give the fire to a horse is to apply the firing-iron red-hot to some preternatural swelling in order to discuss it, which is oftentimes done by clapping the firing-iron upon the skin without piercing through. We give the fire to farcy knots, by running a pointed burning iron into the ulcers. We likewise give the fire for wrenches of the patterns. See FIRING-IRON.

FIRE, in the *Military Language*, is sometimes applied to the fires lighted in an army in the night-time.

But the term fire or firing is more frequently used for the discharge of the fire-arms, or the shot made on the enemy from the artillery, &c. And accordingly it is used as a word of command to soldiers of all denominations to discharge their fire-arms, grenades, cannon, &c. The fire of the infantry is by a regular discharge of their fire-locks, by platoons, divisions, &c. that of the cavalry with their fuses and pistols; and that of the place besieged from their artillery. See EXERCISE and FIRING.

In fortification, the *fire of the place* denotes the flank, or that part of the curtain where the line of defence terminates from whence they fire to defend the opposite face of the bastion.

FIRE-ARMS, a term attaching to all weapons, principally of an offensive nature, from which bullets, &c. may be impelled by the force of gun-powder. These are generally divided into two species, the one requiring much labour to transport, and known by the names of artillery, ordnance, cannon, great-gun, &c. and again subdivided into classes, such as the mortar, the howitzer, the culverin, the demi-culverin, the royal, &c. &c.; the other species are made on a portable principle, and comprise those implements commonly called muskets, carabines, match-locks, arquebusses, blunderbusses, fuzils, together with pistols of various sizes and descriptions; forming in the whole an ample catalogue of inventions suited to enabling the human race not only to defend itself against beasts of prey, and to attain

provisions from among the several inhabitants of the earth, the air, or the waters, but to destroy each other wholesale; as though we were afraid that our increasing population should ultimately condemn us either to starvation, or to resort to the most horrid means of supporting existence, viz. Cannibalism.

In treating of ARTILLERY, we have already explained the nature of ordnance in general, and shewn the proportions severally of the different *natures*, as the various sizes are technically called; therefore, in this place our attention will be chiefly directed towards those matters relating to fire arms in general; by which we mean to be understood as applying that term to those lesser weapons popularly called "small-arms."

The several nations of Europe, among which the arts have made such rapid progress, have long since banished the more rude and uncertain mode of igniting the powder in the priming pan by means of a match, which being formed of some substance that retains fire, but burns very slowly, could merely, by the motion of a small lever, acted upon by a finger, be applied thereto. This method is, however, very generally retained among the nations of the East; where the bark of the *praus*, an indigenous tree every where abounding, supplies the *palectab*, or match, in very great perfection; merely by causing the shreds stripped off from the lesser branches to be beaten with a heavy iron mallet, or hammer, in the course of its drying, which it does in a few days: the fibres are then twisted to about the thickness of a swan's quill, and to any length that may be judged necessary; the spare part being allowed to hang down at the side of the lock, or lever. The use of matches is not only attended with great delay, but, in consequence of the necessity which exists for blowing the *palectab* previous to applying it to the pan, must, in many instances, subject the operator to danger, or eventually to accidental contact, between the sparks and the firing.

Match-locks, such as are in Hindoostan, which, including China and Tartary, may be considered their head-quarters, are not applied to the shoulder when about to be discharged; but having a long stock, of a batten-form, are placed under the arm. This takes off the recoil; or rather causes it not to be felt; an object of some importance when it is known that these pieces are generally charged heavily; and, that on account of the scarcity of lead, malleated iron balls are in general use: these, being very rough, require to be rammed down very hard, otherwise they would remain in the upper part of the bore, and subject the barrel to be burst, as very frequently happens in consequence of the immense resistance the ball makes in its course through a long barrel, every where presenting an unfinished surface. On the other hand it is to be remarked, that match-locks throw balls to great distances; and, owing to the deliberate manner in which they may be discharged, without any tug at a stiff trigger, or the fear of a *kick* from the butt, are found to do immense execution; most of those persons who use them are, indeed, as expert as the generality of rifle-men. Many of these pieces are so long and heavy, as to require moveable rests: those mounted as wall pieces, and called *jinjauls*, often throwing a ball near a mile, and weighing from fifty to sixty pounds.

The muskets in use among the armies in Europe are far more compact, carrying a larger ball, and in every respect better finished. These are provided with spring-locks, which impel the flint towards a steel plate, called the hammer, by which the sparks are directed into the pan. It is to be regretted that the flint usually provided for our military are not of a better quality; so as to insure their striking

fire with greater certainty. Our fire-locks are indeed far too heavy, for which it is assigned as a reason, that lighter pieces would not send the balls to a sufficient distance; but if we consider the well ascertained fact, that not one musket ball in an hundred strikes upon an opposing line of troops, we certainly should set our minds rather more at ease, on the score of impetus in a weapon so very little contributing to the success of the day. It may not be too much to assert, that the decrease of weight, whereby fatigue and labour would be greatly lessened, would enable our brave soldiers to act with greater promptitude in general, and to use their bayonets, which are really efficient in their hands, with more activity and vigour.

English fire-arms of every kind are made to the greatest perfection; their bores being perfectly smooth, and the locks remarkably neat, strong, and active. The sizes of the balls are all regulated when for public service; being cast in moulds of particular diameters; so that no mistake can be made, unless through shameful neglect, in supplying ammunition to the several corps. The British standard is as follows:

Nature of the Piece.	Number of Balls to one Pound of Lead.	Diameter of each Ball in Inches.
Wall Pieces - - -	6 $\frac{3}{4}$.89
Muskets - - -	14 $\frac{1}{2}$.68
Carabines - - -	20	.60
Pistols - - -	34	.51
7 Barrel Guns - -	46 $\frac{1}{2}$.46

In order to preserve a regularity in the supply of balls for pieces not on any regular scale, or establishment, it is usual to ascertain what ball will fit the bore in a proper manner; so as to allow of four folds of paper, (*i. e.* two on each side,) necessary to wind around the ball when made into a cartridge. The ball is then tried in a gauge, that is, a bar pierced with holes, all declining in size, in regular order, and numbered from one, which suits a wall-piece, to buck-shot; which is ordinarily estimated at about No. 30 or 32. Whatever hole the ball may pass through, but in so close a manner, as to stop in the next smaller hole, gives the designation of the bore on the register. But it is more usual to cast balls in moulds, designated according to the number of balls of that size made from a pound of lead. Therefore musket balls would be called No. 14, and carbine balls No. 20.

The mention of seven-barrelled-guns leads us to contemplate, with no slight admiration, the perfection to which this branch of mechanism has been brought! This perfection has naturally been produced by successive stages, each of which has had numerous candidates, to whom public liberality has been the inducement, and proved the reward. When we consider that a man provided with a musket having seven barrels, yet but one lock, may discharge seven times in less than half a minute, without any intermediate operations of priming or loading, we must yield our tribute of applause to the ingenuity of the inventor, though we cannot refrain from reflecting on that purpose to which it is devoted.

As to pistols, &c. they are made upon various scales, and for the particular purposes of those who are to use them. Thus, what we call horse-pistols, are intended to occupy the holsters attached to saddles; duelling-pistols, which are usually provided with hair-triggers, that act upon the slightest touch, are destined to the decision of those knotty points at which *honour* so speedily takes umbrage; while the

pocket-pistol, made upon a diminutive scale, may be intended either for the use of the robber, or to repel his presumption. Whatever may be the purpose of fire-arms, whether for the military, for sporting, or for general defence, nothing can be more improper than leaving them loaded in places accessible to servants, strangers, and especially to children. We should suppose that the immense number of accidents that happen, and are publicly notified in the daily prints, might operate as a stimulus towards the securing of fire-arms, beyond those ordinary means of accessibility, which place them within the reach of every one whose ill-fated curiosity may induce to handle them. Strange to say! we shudder at the detail of one of those accidental murders which too often occurs, yet neglect to benefit by the melancholy lesson, until some domestic calamity of the same nature may burthen the negligent proprietor with shame, affliction, and remorse.

FIRE-arrow is a small iron dart furnished with springs and bars, together with a match impregnated in powder and sulphur, which is wound about its shaft. It is used by privateers and pirates to fire the sails of the enemy, and for this purpose is discharged from a musket or a swivel-gun. The match being kindled by the explosion, communicates the flame to the sail, against which it is directed, where the arrow is fastened by means of its bars and springs. As this is peculiar to hot climates, particularly the West Indies, the sails being extremely dry, are instantly set on fire, and the fire is conveyed to the masts, rigging, and finally to the vessel itself.

FIRE-ball, a composition of meal-powder, sulphur, salt-petre, rosin, pitch, &c. about the bigness of a hand-grenade, made of an iron sheet, filled and covered over with several coats of the above mixture, the last coat being of grained powder. Thick brown paper made into the form of a shell adapted to the size of the mortar, and filled with an equal quantity of sulphur, pitch, rosin, and meal powder, well mixed and put in warm, will answer the purpose as well as any thing else. This is to be thrown into the enemy's works in the night-time, to discover where they are; or to fire houses, galleries, or blinds of the besiegers. The balls used for this intention are prepared with mealed powder, salt-petre, sulphur, rosin, steel or iron filings, fir-tree saw-dust boiled in salt-petre ley, and birchwood charcoal, well rammed into a shell, having various holes filled with small barrels, loaded with musket-balls, and immersed in melted pitch, rosin, and turpentine oil. They are sometimes armed with spikes or hooks of iron, that they may not roll off, but stick or hang where they are desired to have any effect. See **BALLS**.

FIRE-bare, in our *Old Writers*, is used for a beacon. "Quod sine dilatione levare & reparari fac signa & fire-bares, super montes altiores in quolibet hundredo, ita quod tota patria per illa signa, quotiescunque necesse fuerit, prænunciare poterit." Ordin. Observand. Temp. Edw. II.

FIRE-barrels. See **BARRELS**, and **FIRE-ship**.
FIRE-blast, a disease or accident to which the hop plant is much exposed. It chiefly occurs towards the later periods of the growth of the crops. It is supposed by most hop-planters to depend upon the particular state of the air or weather at the time; but it is more probable that it may be caused by lightning, as it takes place very suddenly at those seasons when it mostly prevails, and generally affects the most forward and luxuriant bins. See **HOPS**.

FIRE, bon. M. Mahudel has a dissertation on the origin of bon-fires, wherein he endeavours to make it appear that they were unknown to the ancients, and consequently must be a modern invention.

He does not deny that the ancients had rejoicings on occasion of the conclusion of a peace or alliance, or the news of a victory's being obtained against their enemies, on the birth-day, proclamation, or marriage of their prince; as also when they recovered from a dangerous sickness; but, according to him, the fire on all these occasions served only to burn the victims or the incense; and as these sacrifices were mostly offered in the night-time, the illuminations were only intended to give light to perform the ceremonies. Hist. Acad. Inscip. tom. ii. p. 330, seq.

Fire-bote, a term signifying a quantity of wood bound up for fuel, which, by the common law, the tenants may, for necessary firing, take out of the lands that have been granted to them.

Fire-clay, is that particular kind of clay which is proper for making bricks or vessels intended to stand a high degree of heat. The third coal shale or series of argillaceous coal measures, between the third and fourth grit rock, reckoning from the mill-stone grit upwards, which traverses Derbyshire and part of Yorkshire, and produces *cross-stone* and fossil *reefs* in great abundance, contains a very excellent fire-clay, which is dug at Heaze-nether-end, Wheaterost, Birkin Lane, and other places. The strata of the fourth or lower limestone of this district sometimes produce alluvial masses of fire-clay, of good quality, as at Milk hill gate, near Water-house, Staffordshire, and near Newhaven-house, Derbyshire.

It is found that clay, more or less fit for fire-bricks, is found immediately beneath almost every seam of coals, and where it is not soft in the form of clay, the clunch and other indurated substances composing the immediate floor of coals, will generally fall by exposure to the weather, into a brick clay or earth. See FLOOR.

Fire-cocks. Churchwardens in London, and within the bills of mortality, are to fix fire-cocks at proper distances in streets, and written marks near them, and to keep in every house thus marked an instrument or key for opening the plug, and a large engine and hand-engine for extinguishing fire, under the penalty of 10*l*. The turn-cock whose water shall come first into a main-pipe at a fire, shall have 10*l*. the first engine that is brought shall entitle to 3*0s*. the second to 20*0s*. and the third to 10*0s*. 6 Ann, cap. 31. 12 Geo. III. cap. 73. To prevent fires, it is required that workmen in the city of London, &c. build all front and rear walls of brick or stone; and that the front walls be 18 inches above the gutter, and coped with stone, tile, or brick; and party-walls between house and house, those belonging to houses, the expence of building which is more than 120*l*. to be of the thickness of 1 foot nine inches, or 2½ bricks in the lowest story; and of 2 bricks, or 1 foot 5½ inches from thence to the garret floor; and from the garret upwards 1½ brick, or 13 inches, and to be carried up to the full height of 18 inches above the adjoining gutters; and it is also required, that no timbers, except the girders, binding and trimming joints, and the templets under the same, shall be laid into such party-walls; and that there shall be 5 inches of solid brick-work left at or between the ends of all lentils, wall-plates, and bond timbers. See BUILDING, and stat. 7 Anne, c. 17. 11 Geo. I. c. 28. 33 Geo. II. cap. 30. and 4 Geo. III. cap. 14. And on the breaking out of any fire, all the constables and beaules shall repair to the place with their staves, and be assisting in putting out the same, and causing people to work, &c. No action shall be had against any person in whose house or chamber a fire shall begin, 6 Anne, 10 Anne, c. 14. But if such fire happens through negligence of any servant, such servant shall forfeit 100*l*. to be distributed among the suffer-

ers; or, in default of payment, shall be committed to some work-house, and there kept to hard labour for eighteen months. See ARSON.

All the laws relating to the prevention, &c. of fire, are reduced into one statute, and former statutes repealed, by 12 Geo. III. cap. 73.

Fire-damp, in *Natural History*. See DAMP.

Fire-eater. We have a great number of mountebanks who have procured the attention and wonder of the public by eating of fire, walking on fire, washing their hands in melted lead, and the like tricks.

The most celebrated of these was our countryman Richardson, much talked of abroad. His secret, as related in the *Journals des Savans* of the year 1680, consisted in a pure spirit of sulphur, wherewith he rubbed his hands and the parts that were to touch the fire, which burning and cauterizing the epidermis, hardened and enabled the skin to resist the fire.

Indeed this is no new thing; Amb. Paré assures us he had tried on himself, that after washing the hands in urine, and with unguentum aureum, one may safely wash them in melted lead.

He adds also, that by washing his hands in the juice of onions, he could bear a hot shovel on them while it melted lead.

Fire, Electrical. See ELECTRICITY.

Fire-engine, is a machine for extinguishing accidental fires by means of a stream of jet of water. The common squirting fire-engine consists of a lifting pump placed in a circular or cylindric vessel of water, and wrought by two levers that act always together. During the stroke, the quantity of water raised by the piston of the pump spouts with force through a pipe joined to the pump-barrel, and made capable of any degree of elevation by means of a yielding leather pipe, or by a ball and socket turning every way, screwed on the top of the pump. The vessel containing the water is covered with a strainer, which prevents the dirt and filth poured into it with the water from choking the pump-work. Between the strokes of this engine the stream is discontinued for want of an air-vessel. However, in some cases, engines of this construction have their use, because the stream, though interrupted, is much finer than when the engine is made to throw water in a continued stream. The best engine of this latter kind is that of Mr. Newsham, formerly an engine-maker in London. A perspective view of the whole engine, ready for working, is represented in *Plate III. Hydraulics, &c. fig. 4*. This engine consists of a cistern A B, about three times as long as it is broad, made of thick oaken planks, the joints of which are lined with sheet-copper, and easily moveable by means of a pole and cross bar C in the fore part of the engine, which is so contrived as to slide back under the cover of the cistern, and on four solid wheels, two of which are seen at D and E. The hind axle-tree, to which the wheel E and its opposite are fixed, are fastened across under the bottom of the cistern; but the fore axle-tree, bearing the wheel D, &c. is put on a strong pin or bolt, strongly fastened in a horizontal situation in the middle of the front of the bottom of the cistern, by which contrivance the two fore wheels and the axle tree have a circular motion round the bolt, so that the engine may stand as firm on rough or sloping ground as if it was level. Upon the ground next to the hind part of the engine may be seen a leathern pipe F, one end of which may be screwed on and off upon occasion to a brass cock at the lower end of the cistern: the other end is immersed in the water, supplied by a pond, fire-plug, &c. and the pipe becomes a sucking pipe for furnishing

aising the pumps of the engine by its working, without pouring water into the cistern. To the hind part of the cistern is fastened a wooden trough G, with a copper grate for keeping out stones, sand, and dirt, through which the cistern is supplied with water when the sucking pipe cannot be used. The fore part of the cistern is also separated from the rest of its cavity by another copper grate, through which water may be poured into the cistern. Those that work the pumps of this engine move the handles visible at the long sides, up and down, and are assisted by others who stand on two suspended treddles, throwing their weight alternately on each of them, and keeping themselves steady by taking hold of two round horizontal rails, H, I, framed into four vertical stands, which reach to the bottom of the cistern, and are well secured to its sides. Over the hind trough there is an iron handle or key K, serving to open or shut a cock placed under it on the bottom of the cistern, the use of which we shall explain in the sequel of this article. L is an inverted pyramidal box or case which preserves the pumps and air vessels from damage, and also supports a wooden frame M, on which stands a man, who, by raising or depressing, and turning about the spout N, directs the stream of water as occasion requires. This spout is made of two pieces of brass pipe, each of which has an elbow; the lower is screwed over the upper end T (see *fig. 5.*) of the pipe that goes through the air-vessel, and the upper part screws on to the lower by a screw of several threads, so truly turned as to be water-tight in every situation. The conic form of the spouting-pipe serves for wire-drawing the water in its passage through it, which occasions a friction that produces such a velocity of the jet as to render it capable of breaking windows, &c. whilst the valves and leather pipes of the engines have sufficient water-way to supply the jet in its greatest velocity. Leather pipes of considerable length may be screwed at one end of the nosel of the engine, and furnished at the other end with a wooden or brass pipe for guiding the water into the inner apartments of houses, &c. Between the pyramidal box L, and the fore-end of the engine, there is a strong iron bar O, lying in an horizontal position over the middle of the cistern, and playing in brasses supported by two wooden stands; one of which, P, is placed between the two fore-stands of the upper rails, and the other is hid in the inclosure over the hind part. Upon proper squares of this bar are fitted, one near each end, two strong cross bars, which take hold of the long wooden cylindrical handles, by means of which the engine is worked; and the treddles by which they are assisted are suspended at each end by chains in the form of a watch chain, and receive their motion jointly with the handles that are on the same side, by means of two circular sectors of iron fastened together, and fixed upon proper squares of the middle horizontal bar; the two fore ones may be seen at Q; the two hind ones represented on a large scale in *fig. 6.* differ from the former only in thickness; for the fore sectors are made to carry only one chain each, fastened by one end to their upper part, and by the lower end to the treddles; whereas the sole of the two hind sectors is wide enough to carry two chains each; one set fastened like those of the fore ones for the motion of the treddles: and the other two chains are fastened by their lower ends to the lower part of these sectors, and by their upper ends to the top of the piston bars, in order to give them motion. See *fig. 6.* in which the hind sectors and their apparatus are represented as they would appear to a person standing between the two fore-wheels, and looking at the hind part of the engine. The square over the letter A is the section of the middle bar, on which, right over

the two barrels, are placed the two sectors B C A and D E A, forged together. E G H K and *f g h k* are the two piston rods; and the openings between the letters G, H, and *g, h*, are the spaces through which the hind parts of the two treddles pass. L and M represent two strong studs rivetted on the other side of the bars on which they are placed; and to each of these is fastened a chain like a watch-chain, fixed by their upper ends to the upper extremities D and B of the iron sectors, by which they are drawn up and down alternately. These sectors give also an alternate motion up and down to the piston-rods, by means of two other chains left white in the figure, in order to distinguish them from the others: these are fastened by their lower ends to the lower extremities of the sectors E and C, and their upper ends terminating in a male screw, are made tight to the piston-rods at I and *f*, by two nuts. The shape of the piston-rods, and the size and situation of the chains that give them motion, are so contrived, that the vertical axis of the pistons is exactly in the middle of the breadth of the perpendicular part of the chains, and the upper part of the piston-rod taken together. P Q represents one of the two cross bars through the ends of which pass the long handles to which the men apply their hands when they work the engine; these cross bars are fitted on the middle bar at some distance from the sectors.

The other parts of this useful engine may be understood by the help of *fig. 5.* which represents a vertical section taken through the middle line of the hind part of the engine, as also the section of the air-vessel, and that of one of the barrels, and likewise the profiles of the hind sectors, and of several other parts. A B is the section of the bottom of the cistern, and C that of the hindmost axle-tree. D E is the vertical section of a strong piece of cast brass or hard metal, so worked as to have a hollow in it, represented by the white part, and fixed to the bottom of the cistern: this reaches from the opening D through the cock W, and afterwards divides itself into two branches, so as to open under the two barrels; one of these branches is exhibited in the figure, and the other is exactly behind this. Through this channel, which may be called the sucking-piece, water is conveyed to the pumps by the pressure of the atmosphere, either from the cistern itself, or from any place at a distance, by means of a leathern pipe F, *fig. 7.* which screws on to the sucking-piece at D, *fig. 5.* under the hind trough Z, the grate of which is represented by the horizontal strokes. F G represents the vertical section of another piece of cast brass or hard metal that may be called the communication-piece, having two hollows for conveying the water from under the two pistons to the two openings of the flanch of the air-vessel; one of these hollows appears in the figure; the other lies exactly behind this, though not in a parallel direction. Between the section of the sucking-piece D E, and that of the communication-piece F G, may be observed the section of one of the plates of leather, which makes all tight, and forms one of the two sucking valves, of which there is another just behind this under the other barrel. R S T is the section of the copper air-vessel, and T V that of the conduit-pipe; this vessel is screwed on to the hind part of the communication-piece, and at top is fastened by a collar of iron to a cross piece of timber. Between the flanch of the air-vessel and the communication-piece may be observed the section of one of the plates of leather, making all tight, and screwing one of the two forcing valves, of which there is another just behind this, exactly over the other opening of the communication from the air-vessel. These valves are lead

with a lump of cast iron or lead, having a tail or teat let through the flap of the valve and cross-pinned under it; and it is to be observed, that though both the valves are represented open in the figure, they are never both open at the same time; for when the engine is not at work they are closed down by the weights on their upper surfaces; and when the engine works, two are shut, and the other two are open alternately by the motion of the pistons and the action of the atmosphere, together with the re-action of the air contained in the air-vessel. HI is the section of one of the barrels of the two pumps, which are both sucking and forcing, as is evident from the position of the valves and the structure of the pistons, each of which is composed of two iron plates, of two wooden trenchers, and of two flat pieces of leather turning one up and the other down. LK represents one of the piston-rods edge-wise, behind which is one of the chains, the top screw of which, K, can only be seen. M is the end of the middle bar, and N a section of the hindmost of the two middle stands which support the middle bar. O represents the end of the profile of one of the treddles, passing through the rectangular holes of the piston-rods, as in *fig. 8*. The weight on these treddles brings them and the piston-rods down alternately, and they are raised up again by help of the other set of chains, one of which may be seen edge-wise in this figure, placed on the sole of one of the feetors, &c. See *fig. 6*.

PQ is part of the cross bars which carry the handles seen edge-wise, and XY represents an iron handle, by the help of which the cock W may be placed in the several situations requisite for the use of the engine. The mechanism of the cock W may be understood by *figs. 9, 10, and 11*, which represent the horizontal section of it in three different situations. It has three holes that are left white in these figures. In *fig. 9*, the position of the cock is represented when the handle XY or K is in a direction parallel to DE, or to the middle bar, as in *fig. 5*, and *fig. 4*. In this position, the water supplied by the sucking-piece enters at D, and proceeds directly through the cock W to the valve under the two pistons; and there is now no communication from the barrels with the cavity of the cistern. In *fig. 10*, we have the position of the cock when the handle XY is turned one quarter of a revolution towards the eye from the last mentioned situation, in which case there is no communication from the barrels with the outer extremity of the sucking-piece, but the water poured into the fore and hind trough, and passing from thence into the cavity of the cistern, enters the cock side-wise at W, and, turning at right angles through the cock towards E, proceeds to the barrels of the pumps. *Fig. 11*, represents the cock W when the handle is placed diametrically opposite to its last situation, in which case there is no communication from the under-side of the barrels with the cavity of the cistern or the outward end of the sucking-piece; but this situation affords a communication from the cavity of the cistern with the outside of the engine, and the water left in the cavity of the cistern may by this means be employed when the engine has done working. These engines are made of five or six different sizes. See Defaguliers's Course of Exper. Philos. vol. ii. p. 505-518.

The principles on which this engine acts, so as to produce a continued stream, are obvious; the water, being driven into the air-vessel, as in the operation of common sucking and forcing pumps, will compress the air contained in it, and proportionably increase its spring, since the force of the air's spring will always be inversely as the space

which it possesses; therefore, when the air-vessel is half filled with water, the spring of the included air, which in its original state counterbalanced the pressure of the atmosphere, being now compressed into half the space, will be equal to twice the pressure of the atmosphere; and by its action on the subjacent water will cause it to rise through the conduit-pipe, and to play a jet of 32 or 33 feet high, abating the effect of friction. When the air-vessel is two-thirds full of water, the space which the air occupies is only one-third of its first space; therefore its spring being three times as great as that of the common air, will project the water with twice the force of the atmosphere, or to the height of 64 or 66 feet. In the same manner, when the air-vessel is three-fourths full of water, the air will be compressed into one-fourth of its original space, and cause the water to ascend in air with the force of three atmospheres, or to the height of 96 or 99 feet, &c. as in the following table:

Height of the water.	Height of the compressed air.	Proportion of the air's spring.	Height to which the water will rise.
1	1	2	33 feet
2	1/2	3	66
3	1/3	4	99
4	1/4	5	132
5	1/5	6	165
6	1/6	7	198
7	1/7	8	231
8	1/8	9	264
9	1/9	10	297

See Martin's Philos. Brit. vol. ii. p. 69, &c.

The fire engine, by Rowntree, is a double-force pump, of a peculiar construction, similar in its action to the *beer-engine*, but as it is on a much larger scale, its constructions are of course varied. In this engine, *figs. 1. and 2. Plate IV. Hydraulics*, are two elevations at right angles to each other, of the external part of the engine mounted on four wheels. *Figs. 3. and 4.* are two sections perpendicular to each other, of the body of the engine or pump; *figs. 5. and 6.* are parts of the engine. The same letters are used as far as they apply in all the figures, A, A, A, A; *fig. 3. and 4.* is a cast-iron cylinder truly bored, ten inches diameter and fifteen long, and having a flanch at each end whereon to screw two covers, with stuffing boxes, *a, a*, in their centres, through which the spindle, B, B, of the engine passes, and being tight packed with hemp round the collar, makes a tight joint; the piston, D, is affixed to the spindle within the cylinder, and fits it tight all round by means of leathers; at E, *fig. 4.* a partition, called a fiddle, is fixed in the cylinder, and fits against the back of the spindle tight by a leather.

We have now a cylinder divided by the fiddle, E, and piston, into two parts, whose capacity can be increased and diminished by moving the piston, with proper passages and valves to bring and convey away the water: this will form a pump. These passages are cast in one piece with the cylinder: one, *d*, for bringing the water is square, and extends about 1/3 round the cylinder; it connects at bottom with a pipe, *e*; at its two upper ends it opens into two large chambers, *f, g*, extending near the whole length of the cylinder, and closed by covers, *b, b*, screwed on; *i, k*, are square openings (shown by dotted squares in *fig. 3.*) in the cylinder communicating with the chambers: *f, g, lm*, are two valves, closing their ends of the curved passage, *d*, and preventing any water

water returning down the passage, *d*; *n, o*, are two passages from the top of the cylinder to convey away the water; they come out in the top of the cylinder, which, together with the top of the chambers, *f, g*, form a large flat surface, and are covered by two valves, *p, q*, to retain the water which has passed through them. A chamber, *K*, is screwed over these valves, and has the air-vessel, *k*, *figs.* 1. and 2. screwed into its top; from each side of this chamber a pipe, *w, w*, proceeds, to which a hose is screwed, as shewn in *fig.* 1. Levers, *x, x*, are fixed to the spindle at each end, as shewn in *fig.* 1. and carry the handles, *H, H*, by which men work the engine. When the piston moves, as shewn by the arrow in *fig.* 4. it produces a vacuum in chamber, *f*, and that part of the cylinder contiguous to it; the water in the pipe, *e*, then opens the valve, *m*, and fills the cylinder. The same motion forces the water contained in the other part of the cylinder through the valve, *q*, into chamber, *K*, and thence to the hose through the pipe, *w*; the piston being turned the other way, reverses the operation with respect to the valves, though it continues the same in itself. The pipe, *e*, is screwed by a flanch to an upright pipe, *P*, *fig.* 5. connected with another square iron pipe, fastened along the bottom of the chest of the engine; a curved brass tube, *G*, comes from this pipe through the end of the chest, and is cut into a screw to fit on the suction hose when it can be used; at other times a close cap is screwed on, and another brass cap at *H*, within the chest, is screwed upwards on its socket, to open several small holes made in it, and allow the water to enter into the pipe; in this case the engine chest must be kept full of water by buckets. The valves are made of brass, and turn upon hinges. The principal advantage of the engine is the facility with which it is cleaned from any sand, gravel, or other obstructions, which a fire-engine will always gather when at work.

The chambers, *f, g*, being so large, allow sufficient room to lodge a greater quantity of dirt than is likely to be accumulated in the use of the engine at any one fire, and if any of it accidentally falls into the cylinder, it is gently lifted out again into the chambers by the piston, without being any obstruction to its motion: to clear the engine from the dirt, two circular plates, *r, r*, five inches diameter, are unscrewed from the lids, *b, b*, of the chambers, *f, g*, and when cleaned are screwed on again: these screw covers fit perfectly tight without leather, and can be taken out, the engine cleared, and enclosed again in a very short time, even when the engine is in use, if found necessary.

The two upper valves, *p, q*, and chamber, *K*, can also be cleared with equal ease, by screwing out the air-vessel, *k, k*, *fig.* 1. which opens an aperture of five inches, and fits air-tight, without leather, when closed. The valves may be repaired through the same openings. The use of the air-vessel, *k, k*, *figs.* 1. and 2. is to equalize the jet from the engine during the short intermittance of motion at the return of the piston stroke; thus it does by the elasticity of the compressed air within it, which forces the water out continually, though not supplied quite regularly from the engine.

The engine from which our drawing was taken was made for the Sun Fire Insurance Company, in London, and from some experiments made by their agent, Mr. Samuel Hubert, appears to answer every purpose.

Fire-engine is also a name frequently given to a machine for raising water by steam, more properly called *steam-engine*, which see.

Fire-escape, a machine for escaping from windows when houses are on fire. Various machines of this kind have been invented by different persons; the following seems to be well adapted to the purpose for which it was designed. It was ori-

ginally invented by the late John Daniel Mafes, esq.; and B. M. Forster, esq. has communicated to the public a description of it, with some improvements by himself, in the Philosophical Magazine. The principal parts of this machine, which is called the "sling fire-escape," are as follows: 1. The suspension iron *A*, (*Plate XII. Miscellany, fig.* 12.), which is formed like a ram-head commonly used for slinging goods from warehouses, with this difference, the bottom hooks are turned up close to the upright part, to form two close rings or eyes; the length of this iron is about four inches and a half, thickness of the iron out of which it is hammered is about half an inch.

2. The rope *B*. This is made of flax, and platted in a peculiar manner, for which there was a patent taken out. It is sold by Armstrong, St. John's-square, Clerkenwell, and measures about three-eighths of an inch in diameter. The rope must be in length somewhat more than twice the height of the window from the ground.

3. The regulator *C*. This is an oblong piece of beech wood, six inches and a half in length, three inches and a quarter broad, and about seven-eighths of an inch thick; in this there are four holes pierced for the rope to pass through; one of these is open at the side; there is also a notch at the top of this piece of wood, and an oblong hole about seven-eighths of an inch from the bottom.

4. The upper belt *D* is a stout leathern strap, about four feet three inches long, and one and a half broad, with a buckle to it.

5. The lower belt *E* is a strap of the same sort as the other; but the end, after being put through the buckle, is sewed down: this is for the purpose of security, in case the tongue of the buckle should by accident break.

6. The union strap *F*, so called from its connecting the regulator to the other parts of the machine. This is leathern, and is about a foot and a half long, and an inch and a quarter broad; it has, like the others, a buckle to it. It is stained black, which distinguishes it from the other leathern straps.

The method of putting together all these parts of the machine is, first to pass one end of the rope through the holes in the regulator, then through the two lower rings of the suspension iron; the upper belt is then to be passed through a doubling of the union strap; after which the rope is to be tied to that belt, and the knot secured by a string from slipping (which string is to pass through two small holes in the leather); and at about a foot below the rope is to be tied to the lower belt in like manner. Next, the union strap is to be put through the oblong hole in the regulator, and buckled; by which the upper belt and the regulator will be connected. The other end of the rope may be kept wound on a wooden roller, to prevent it from getting entangled.

Persons who purchase these machines should have a very strong iron hook, with a spring-catch, fixed to some secure part of the window-frame, or elsewhere; on this hook the suspension iron is to be hung by the upper ring, when any one wishes to descend from the window. The next operation is to step into the lower belt with both feet, and draw it up sufficiently high, so as to form a kind of swing to sit in: the part of the strap which is through the buckle is to be laid hold of with the left hand; and the buckle, with the right hand, is to be slipped to its proper place, according to the size of the person; the tongue is then to be put into one of the holes, as in buckling common straps. After this is done, the upper belt is to be somewhat loosely buckled round the chest, and then the rope which is on the roller is to be thrown out of the window on the ground.

Now all being ready for descending, the person is to get out of the window, grasping tight with one or with both hands, the rope at some convenient part, taking especial care not to meddle with the suspension iron until quite out of the window; after which the rope below the regulator is to be laid hold of with the right hand, and to be let to run through the holes as fast as there may be occasion; for which purpose, if necessary, it may be easily slipped out of the open hole; it will then have the check of only three holes: if the motion is wanted to be retarded, the rope is to be put into the notch at the upper part of the regulator.

When one person has descended, and there is a necessity for a second immediately to follow, the union strap is to be unbuckled; when the regulator will be separated from the upper belt: the belts may then be very easily drawn up, having the friction of the suspension iron only, and the person above is to put on the belts as the other did, and is to be let down gradually, partly by the one below, and partly by managing the rope as the first did: in this case great care must be taken, as the check occasioned by the regulator is gone.

Observations and Cautions.

It is not easy to lay down exact rules for what number of holes the rope must pass through, as this must vary according to the weight of the person, and other circumstances. It would be well, before the person gets out of the window, to examine, first, (absolutely necessary,) whether the suspension iron is on the hook; then, that the three buckles are fast, the two knots tied, and that the rope is in the hole of the regulator which has the opening. Great care must be taken that there is not any impediment to the free running of the rope; for which the wall of the house must be examined, and any nails or hooks which may chance to be there removed; also iron scrapers, and every thing wherein the rope may be likely to hitch.

Mr. B. M. Forster has, in some respects, simplified Mr. Maseres's machine, particularly in substituting the ram-head suspension iron in the place of a more complicated, and, in his opinion, less secure piece of mechanism. (See *fig. 13.*) It consists of a solid metal (in the latter improved ones) grooved cylinder, round which the rope coiled two or three times, by which a considerable degree of friction was produced, and the rapid descent prevented, which would otherwise happen. The metal cylinder is supported on an iron frame, and suspended by a ring, which ring is moveable in the socket. A is the moveable ring in the upper part of the frame; B is the frame, enclosing a grooved cylinder; and C is a metal bar to hold the cheeks together.

FIRE, *Everlasting*, in *Pagan Theology*, is a kind of reputed sacred fire worshipped by the Gavers or Gabres in Persia. Dr. Mounsey, formerly physician to the czarina's army, has given the following account of it: this perpetual fire rises out of the ground in the peninsula of Absheron, about twenty miles from Baku, and three miles from the Caspian shore. The ground is rocky, over which is a shallow covering of earth. If a little of the surface be scraped off, and fire be applied to the hollow, it catches flame immediately, and burns without intermission, and almost without consumption; nor is it ever extinguished unless some cold earth be thrown over it, by which it is easily put out. There is a spot of ground, about two English miles in extent, which has this property, where the earth continually burns; but the most remarkable part of it is a hole about four feet deep, and fourteen in diameter. This fire is worshipped, and is said to have burnt many thousand years. The

cracks in the walls of the caravanfera, inhabited by the religious, are covered with flame, if a candle be held to them; and when there is occasion for a small light, no more is necessary than to stick one end of a piece of reed in the ground, and apply a lighted candle to the other; a flame will kindle at the top of the reed, and burn till it is extinguished by covering it. They burn stones into lime, by filling a hole in the ground with a heap of them, and bringing a lighted candle to the hole, upon which the fire kindles, and in about three days burns the stones sufficiently. The flame yielded by this fire, has neither smoke nor smell. This sacred and adored phenomenon is nothing more than an inflammable vapour, which issues in great quantity out of the ground in this place, and is supplied by the naphtha with which the adjacent country abounds. Phil. Transf. vol. xlv. for 1748, p. 296.

FIRE, *Extinguishing of*. The world has long been of opinion, that a more ready way than that in general use, might be found for extinguishing fires in buildings, and it has generally been attempted upon the doctrine of explosion. Zachary Grey was the first person who put this plan into execution with any tolerable degree of success. He contrived certain engines, easily manageable, which he proved before some persons of the first rank to be of sufficient efficacy, and offered to discover the secret by which they were contrived, for a large premium given either from the crown, or raised by a subscription of private persons. But this scheme meeting with no better success than things of this nature usually do, he died without making this discovery. Two years after this the people who had his papers found the method; and it was shewn before the king of Poland and a great concourse of nobility at Dresden, and the secret purchased at a very considerable price. After this the same person carried the invention to Paris and many other places, and practised it every where with success. The secret was this: a wooden vessel was provided holding a very considerable quantity of water; in the centre of this there was fixed a case made of iron plates, and filled with gun-powder; from this vessel, to the head of the larger vessel containing the water, there proceeded a tube or pipe, which might convey the fire very readily through the water to the gun-powder contained in the inner vessel. This tube was filled with a preparation easily taking fire, and quickly burning away; and the manner of using the engine was to convey it into the room or building where the fire was, with the powder in the tube lighted. The consequence of this was, that the powder in the inner case soon took fire, and, with a great explosion, burst the vessel to pieces, and dispersed the water every way: thus was the fire put out in an instant, though the room was flaming before in all parts at once. The advantage of this invention was, that at a small expence, and with the help of a few people, a fire in its beginning might be extinguished; but the thing was not so general as it was at first expected that it would prove; for though of certain efficacy in a chamber or close building where a fire had but newly begun; yet when the mischief had increased so far, that the house was fallen in, or the top open, the machine had no effect. This was the contrivance first discovered by Grey, and from which our chemist Godfrey took the hint of the machine, which he called the water-bomb, and would fain have brought into use in England. Act. Eruditor. ann. 1721. p. 183. (See *WATER-Bomb*.) Dr. Hales proposed to check the progress of fire by covering the floors of the adjoining houses with earth. The proposal is founded on an experiment which he made with a fir board, half an inch thick, part of which he covered with an inch depth of damp

damp garden mould, and then lighted a fire on the surface of the mould; though the fire was kept up by blowing, it was two hours before the board was burnt through, and the earth prevented it from flaming. The thicker the earth is laid on the floors, the better; however, Dr. Hales apprehends, that the depth of an inch will generally be sufficient; and he recommends to lay a deeper covering on the stairs, because the fire commonly ascends by them with the greatest velocity. Phil. Transf. vol. xlv. for 1748, p. 277.

Mr. Hartley made several trials in the years 1775 and 1776, in order to evince the efficacy of a method which he had invented for restraining the spread of fire in buildings. For this purpose thin iron plates are well nailed to the tops of the joists, &c. the edges of the sides and ends being lapped over, folded together, and hammered close. Partitions, stairs, and floors, may be defended in the same manner; and plates applied to one side have been found sufficient. The plates are so thin as not to prevent the floor from being nailed in the joists in the same manner as if this preventative were not used: they are kept from rust by being painted or varnished with oil and turpentine. The expence of this addition, when extended through a whole building, is estimated at about five per cent. Mr. Hartley had a patent for this invention, and parliament voted a sum of money towards defraying the expence of his numerous experiments. (14 Geo. III. cap. 85.) The same preservative may also be applied to ships, furniture, &c.

Lord Mahon (now earl Stanhope) has also discovered and published a very simple and effectual method of securing every kind of building against all danger of fire. This method he has divided into three parts, *viz.* under-flooring, extra-lathing, and inter-securing. The method of under-flooring is either single or double: in single under-flooring, a common strong lath of oak or fir, about one-fourth of an inch thick, should be nailed against each side of every joist, and of every main timber, supporting the floor which is to be secured. Other similar laths are then to be nailed along the whole length of the joists, with their ends butting against each other. The top of each of these laths or fillets ought to be at $1\frac{1}{2}$ inch below the top of the joists or timbers against which they are nailed; and they will thus form a sort of small ledge on each side of all the joists. These fillets are to be well bedded in a rough plaster hereafter mentioned, when they are nailed on, so that there may be no interval between them and the joists; and the same plaster ought to be spread with a trowel upon the tops of all the fillets, and along the sides of that part of the joists which is between the top of the fillets and the upper edge of the joists. In order to fill up the intervals between the joists that support the floor, short pieces of common laths, whose length is equal to the width of these intervals, should be laid in the contrary direction to the joists, and close together in a row, so as to touch one another: their ends must rest upon the fillets, and they ought to be well bedded in the rough plaster, but are not to be fastened with nails. They must then be covered with one thick coat of the rough plaster, which is to be spread over them to the level of the tops of the joists; and in a day or two this plaster should be trowelled over, close to the sides of the joists, without covering the tops of the joists with it.

In the method of double flooring, the fillets and short pieces of laths are applied in the manner already described; but the coat of rough plaster ought to be little more than half as thick as that in the former method. Whilst this rough plaster is laid on, some more of the short pieces of laths above-mentioned must be laid in the intervals between

the joists upon the first coat, and be dipped deep in it. They should be laid as close as possible to each other, and in the same direction with the first layer of short laths. Over this second layer of short laths there must be spread another coat of rough plaster, which should be trowelled level with the tops of the joists, without rising above them. The rough plaster may be made of coarse lime and hair; or, instead of hair, hay chopped to about three inches in length may be substituted with advantage. One measure of common rough sand, two measures of slacked lime, and three measures of chopped hay, will form in general a very good proportion, when sufficiently beat up together in the manner of common mortar. The hay should be put in after the two other ingredients are well beat up together with water. This plaster should be made stiff; and when the flooring boards are required to be laid down very soon, a fourth or fifth part of quick-lime in powder, formed by dropping a small quantity of water on the lime-stone a little while before it is used, and well mixed with this rough plaster, will cause it to dry very fast. If any cracks appear in the rough plaster-work, near the joists, when it is thoroughly dry, they ought to be closed by washing them over with a brush wet with mortar wash: this wash may be prepared by putting two measures of quick lime, and one of common sand, in a pail, and stirring the mixture with water till the water becomes of the consistence of a thin jelly.

Before the flooring boards are laid, a small quantity of very dry common sand should be strewed over the plaster-work, and struck smooth with an hollow rule, moved in the direction of the joists, so that it may lie rounding between each pair of joists. The plaster-work and sand should be perfectly dry before the boards are laid, for fear of the dry rot. The method of under-flooring may be successfully applied to a wooden stair-case; but no sand is to be laid upon the rough plaster-work. The method of extra-lathing may be applied to cieling joists, to sloping roofs, and to wooden partitions.

The third method, which is that of inter-securing, is very similar to that of under-flooring; but no sand is afterwards to be laid upon it. Inter-securing is applicable to the same parts of a building as the method of extra-lathing, but it is seldom necessary.

Lord Mahon has made several experiments in order to demonstrate the efficacy of these methods. In most houses, it is only necessary to secure the floors; and the extra-expence of under-flooring, including all materials, is only about nine pence per square yard; and with the use of quick-lime a little more. The extra-expence of the method of extra-lathing is no more than six pence per square yard, for the timber, side-walls, and partitions; but for the ceiling, about nine pence per square yard. But in most houses, no extra-lathing is necessary. Phil. Transf. vol. lxxviii. for 1778, part ii. art. 4c. p. 884, &c.

FIRE-flaire, in *Ichthyology*. See *RAJA Pafinara*.

FIRE-flies, in the *History of Insects*. See *LAMPYRIS*. Among the flies of Guiana, there are two species of fire-flies. The largest is more than one inch in length, having a very large head connected with a body by a joint of a particular structure, with which, at some times, it makes a loud knock, especially when laid on its back. This fly has two feelers, or horns, two wings, and six legs. Under its belly, is a circular patch, which, in the dark, shines like a candle; and on each side of the head, near the eyes, is a prominent, globular, luminous body, in size about one third larger than a mustard seed. Each of these bodies is like a rising star, emitting a bright, and not small light; since two or three of these animals, put into a glass vessel,

afford.

afford light sufficient to read without difficulty, when placed close to a book. When the fly is dead, their bodies will still afford considerable light, though less vivid than before; and if bruised, and rubbed over the hand and face, they become luminous in the dark, like a board smeared with phosphorus. They have a reddish-brown colour, and live in rotten trees in the day, but are always abroad in the night. The other kind are not more than half as large as the former, and their light proceeds from under their wings, and is seen only when they are elevated, like sparks of fire, appearing and disappearing every second. Of these the air is full in the night, though they are never seen in the day. They are common, not only in the southern, but northern parts of America, during the summer. In Siam, the trees on the banks of the river Main in summer are beautifully illuminated with swarms of fire-flies, which emit and conceal their light as uniformly as if it proceeded from a machine of the most exact contrivance.

FIRE, Line of; the direction in which balls, &c. are impelled from cannon and musketry, is called "the line of fire," and this again is divided, when speaking of the discharge of shots from cannon, against any fortified place, as in sieges, into two distinct branches; namely, the *plongant*, or direct fire, which plunges into a wall, &c. at right angles therewith; and the *razant*, or grazing fire, which strikes such wall at a greater or lesser angle, in proportion as the piece from which the shot proceeds, may be more or less obliqued from a direct fire. It scarcely need be pointed out, that the direct fire is by far the most destructive to that object against which it is peremptorily pointed; it is therefore a desideratum always to be able to take up such a position with the breaching batteries as may admit of this forcible mode of attack, the effects of which soon become visible. Nor can it be less obvious that the force with which a shot obliquely directed against any work, will gradually diminish according as the line of fire may approach to a parallel with the face to be battered; therefore the *grazing-fire* is suited only to particular purposes, such as where an enfilade cannot be made *direct*, that is, in the exact line with the platforms on the battery to be enfiladed, but rather in reverse; that is towards its rear.

Now it is evident that *grazing-shots* will do little service when they make an angle of less than 60° with the wall to be battered, especially if reveted with masonry. They will however, do great execution, provided they touch on the merlons above the cordon, and especially if they fall within the embrasure, which at such an angle must afford a front nearly at right angles with such otherwise *oblique* fire, and of course, owing to that obliquity, render it a *direct* one in such particular situations. This, however, will only happen in front of the merlon; in its rear the obliquity will be rather increased, whereby the shot will have still less power. But, as shown under the head of **ENFILADE**, such shots as may be thrown just over the epaulement at the angle of a bastion, &c. at an angle not exceeding five or six degrees, (or perhaps a little more,) in reverse, will generally do full as much damage, as when the enfilade proceeds from a direct line of fire; and this will be considerably aided by the parapet being reveted with masonry, from which, not only will splinters be knocked off, but the shots will be thrown in such direction as may suffice to render the battery untenable: unless, indeed, numerous buttresses, called *traverses*, be thrown up for the purpose of arresting the progress of all such enfilading visitors.

In viewing the exterior of a work, we generally consider each face or battery as having its line of fire directly at right angles with itself: that is, that the cannons should fe-

verally be brought as square to *genoulieres*, against which they rest, when brought forward to the embrasures. It is true, that, for the sake both of allowing greater scope to the direction of each piece, as well as for avoiding the shock which would attend the formation of narrow embrasures with parallel sides, they are made to diverge perhaps to the extent of 12° on each side, the line of fire may be inclined five or six degrees towards either side; but, in such case, the revetement would soon be destroyed: in safe revetements, not only would the percussion be felt, but flames soon make their appearance.

The defects attendant upon embrasures would long since have caused them to be exploded, were it not that the merlons afford so excellent a shelter for the men at the guns; in every other respect, parapets on a low construction, over which the muzzles of the several pieces can be laid, at the same angle of depression as the superior slope, have the preference; as they allow the *line of fire* to be changed full fifteen degrees towards either side of the *direct line of fire*; whence, especially in a tide's way, where a ship may be passing, the most important advantages may be gained. This kind of battery is best suited to situations not liable to be attacked by musketry, particularly from the poops and tops of shipping, nor within the ordinary reach of grape or cat-shot. Guns thus laid over parapets are said to be "en barbet."

FIRE-LOCK, in strictness applies to every species of fire-arms, which are discharged by means of locks containing springs, &c., that impel a flint fixed in a species of vice, at the head of that part called the cock, against a curved steel plate, called the *hammer*, so as to produce from their collision sufficient fire, in the form of sparks, or scintillations, which being by the action of the device directed into a hollow called the *pan*, before covered by the *hammer*, cause the gunpowder deposited in that hollow, and which is called the *priming*, (it being the first portion of that combustible to be ignited,) to take fire, and of course, by means of the *touch-hole*, which opens into the *pan*, to explode the *charge* that is rammed into the bottom of the barrel. The designation fire-lock was in consequence of this ingenious contrivance attached to all pieces acting upon the above principle, in contra-distinction to *match-locks*, which derive their appellation from the circumstance of the powder in their pans being ignited by the application of a match. See **FIRE-ARMS**, and **MATCH-LOCK**.

The fire-locks used by the British are rather shorter than those in general use on the continent; yet are the former somewhat the heavier; and that too, notwithstanding the French, in particular, brace their barrels to the stocks by means of brass collars, two, three, or even four in number, whereas we affix them merely by wire pins passing through eye-loops attached under the barrel.

The fire-lock consists of the following parts. The barrel, which is commonly about 40 inches in length, and carries a ball of fourteen to the pound. The charge being six drachms of powder; so that including the ball, the paper, and the twine, the entire weight of the cartridge should be 10z. 9dr. 11gr. This barrel is affixed to the stock, not only by the pins above described, but by a flat projection at its butt, about two inches long, through which a very substantial flat-headed screw passes into the more substantial part of the stock; which is mostly made from the best walnut wood; observing that the grain follows the curve of the stock where it bends between the gripe, that is where held by the right hand, and the straight part, which receives the butt and lock, and passes all the way under the barrel, to within about three inches of the muzzle. The stock

stock is furnished at its butt with a stout brass plate, a little concave, so as to sit easy in the hand, when the piece is shouldered. The part under the *trigger* is covered by a *guard* made of brass, which allows access to the finger, but serves to prevent the trigger from being adventitiously hitched by boughs, &c. The *lock* is fastened to the right side of the barrel, in a position not to obstruct the sight along the barrel, whereby aim is taken, and at the same time is in a convenient position for all the operations attendant upon priming, cocking, half-cocking, &c. The mode of fastening is by two screws, which having wood heads, pass under the butt of the barrel, from the left side of the stock, and are received by two female screws, formed in the main plate, on which the several parts of the lock are fastened. The *ram-rod*, which is of iron, and of the same length as the whole of the barrel, fits into three or four small brass tubes, fastened to the stock, called pipes, and tail-pipes: at its end it is turned into a male screw, for the purpose of fitting to a *worm*, by aid of which the charge may be drawn, and the piece cleaned. The bayonet fixed at the muzzle with great ease, being secured in its place, with sufficient firmness, by a strong stud on the upper line of the barrel, which, being used to direct the aim, is called the *sight*.

It being sometimes necessary for soldiers, and especially artillery-men, to be liberated from the handling of their arms, yet without totally relinquishing them, each *fire-lock* is furnished with a leathern *sling*, which affixes to two swivels placed under the fore-part of the guard, and the fore-part of the stock; this sling is easily braced up, so as to lie flat under the stock, when not required to be passed over the soldier's breast, in form of a belt passing over the left shoulder, and causing the piece to be suspended in an oblique direction over the back. The value of a fire-lock complete may vary from 15 to 40 shillings.

Fire-master, in our *Train of Artillery*, is an officer who gives the directions and the proportions of the ingredients for all the compositions of fire-works, whether for service in war, or for rejoicings and recreations. He has a mate to assist him.

His orders are given to the fire-workers and bombardiers, who are obliged to execute them.

Fire-office, an office of insurance from fire. See INSURANCE.

Fire-ordeal. See ORDEAL.

Fire-philosophers, or *Philosophi per ignem*, a fanatical sect of philosophers who appeared towards the close of the sixteenth century, and made a figure in almost all the countries of Europe. The distinguishing tenet from which they derived this appellation was, that the intimate essences of natural things were only to be known by the trying efforts of fire, directed in a chemical process. They were also called *Theosophists*, from their declaring against human reason as a dangerous and deceitful guide, and representing a divine and supernatural illumination as the only means of arriving at truth; they were likewise denominated *Paracelsists*, from the name of Paracelsus, the eminent physician and chemist, who was the chief ornament and leader of this extraordinary sect. It was patronized in England by Mr. Robert Flood or Fludd, who endeavoured to illustrate the philosophy of Paracelsus in a great number of treatises; in France; it was zealously propagated by Rivier; in Denmark, by Severinus; in Germany, by Kunrath, an eminent physician of Dresden; and in other countries by warm and successful votaries, who assumed a striking air of piety and devotion, and proposed to themselves no other end than the advancement of the Divine glory, and the restoration of

peace and concord in a divided church; accordingly they were joined by several persons eminent for their piety, and distinguished by their zeal for the advancement of true religion. One of the most celebrated of these was Daniel Hoffman, professor of divinity in the university of Helmstadt, who, availing himself of some unguarded passages in the writings of Luther, extravagantly maintained, that philosophy was the mortal enemy of religion; that truth was divisible into two branches, the philosophical and theological; and that what was true in philosophy was false in theology. Hoffman was afterwards obliged, by the interposition of Henry Julius, duke of Brunswick, to retract his invectives against philosophy, and to acknowledge in the most open manner the harmony and union of sound philosophy with true and genuine theology. Mosheim's *Ecl. Hist.* by Maclean, vol. iv. p. 17, 18. 8vo. edit. 1768.

Fire-places are contrivances for communicating heat to rooms, and also for answering various purposes of art and manufacture.

For the latter kind, see FURNACE and STOVE. The principal objects with regard to the former are lessening the charge of fuel, and augmenting the benefit of fire. The general properties of air and fire, on which their construction chiefly depends, are the following, *viz.* that air is rarified by heat, and condensed by cold; *i. e.* the same quantity of air takes up more space when warm than when cold; air rarified and expanded by heat is specifically lighter than it was before, and will rise in other air of greater density; so that a fire being made in any chimney, the air over the fire is rarified by the heat, becomes lighter, and immediately rises in the funnel, and goes out; the other air in the room, flowing towards the chimney, supplies its place, is rarified in its turn, and rises likewise; and the place of the air thus carried out of the room, is supplied by fresh air coming in through doors and windows, or, if they be shut, through every crevice with violence; or if the avenues to the room be so closed up, that no fresh supply of air can be obtained, the current up the funnel must flag; and the smoke, no longer driven up, float about in the room. Common fire throws out light, heat, and smoke; the light and heat move in right lines with great swiftness, but the smoke is but just separated from the fuel, and moves only as it is carried off by the stream of rarified air; and without a continual accession of air, will remain crowded about the fire, and stifle it. Heat may be separated from the smoke and light, by means of a plate of iron; and the greatest feasible heat is directly over the fire, where, besides the rays of heat shot upwards, there is a continual rising stream of hot air, heated by those rays that are shot round on every side.

The fire-places most in use are, 1. The large open fire-places, that were commonly used in former times, and are still continued in the country, and in kitchens. These require a large funnel, consume a great quantity of fuel, generally smoke, if the door be not left open, and contribute little to warm a room. Their spaciousness is their greatest convenience.

2. Instead of these old-fashioned chimnies, the modern fire-places, especially in towns, have been constructed with low breasts and hearths, narrowed by jambs. Fire-places of this contracted form will keep rooms generally free from smoke; but the funnel requires a considerable quantity of air, which rushes in at every crevice, so as to render the situation of persons continually exposed to it uncomfortable and dangerous. Many of the diseases proceeding from colds may be ascribed to strong drawing chimnies, whereby, in severe weather, persons are scorched before, while they

are frozen behind. These fire-places are of little use in warming a room; because the air round them, which is warmed by the direct rays of the fire, does not continue in the room, but is continually collected into the chimney, by the current of cold air coming behind it, and is presently carried off. Besides, the greatest part of the fire is lost, being absorbed by the back jambs and hearth, which are so dark and porous as to reflect very little, and the upright heat flies directly up the chimney. To remedy this inconvenience the Sieur Gauger, in his book entitled *La Méchanique de Feu*, published in 1709, and since translated by Dr. Defaguliers, (see CHIMNEY) proposed seven different constructions of, 3. A third sort of chimnies, in which there are hollow cavities made by iron plates in the back, jambs, and hearth, through which plates the heat passing, warms the air in those cavities, which is continually coming into the room fresh and warm. This construction had many obvious advantages; but the expence and difficulty attending it discouraged the propagation of the invention. However, the upright heat was almost wholly lost in these as in the common chimnies. 4. Another kind of fire-place is the Holland iron-stove, with a flue proceeding from the top, and a small iron door opening into the room. These serve to warm a room, save fuel, and produce a constant change of air. But the fire is not seen, and little use can be made of it besides that of warming the room. It is therefore rarely used in England, except in some work-shops.

5. The German stove is composed of five iron plates sewed together, and fixed so as that the fuel may be put into it from another room, or from the outside of the house. It is a kind of oven reversed, its mouth being without, and body within the room that is to be warmed by it. This stove warms a room with little fuel, and is attended with no danger from the irruption of cold air; but the fire is not seen, and there is no change of air in the room heated by it. For an account of the Chinese stove, see KANG.

6. Another kind of convenience for warming rooms is a charcoal fire kindled in pots and chaffing dishes. This is chiefly used in the shops of handicraftsmen. But the sulphureous fumes arising from the coals render this mode of giving heat disagreeable and dangerous, and in a close room sometimes fatal.

The ingenious Dr. Franklin, whose name we have had frequent occasion of recording in this work, having recounted the inconveniences and advantages of fire-places in common use, proposes a new contrivance for this purpose, called the Pennsylvania fire-place. 1 This machine consists of a bottom plate or hearth-piece (see *Plate XIV. Miscellany*, *fig. 2.*) with a rising moulding before for a fender, two perforated ears F, G, for receiving two screw-rods; a long air-hole *aa*, through which the outward air passes into an air-box; and three smoke-holes represented by dark squares in BC, through which the smoke descends and passes away; besides double ledges for receiving between them the lower edges of the other plates. 2. A back plate without holes, and furnished with a pair of ledges to receive 3. The two side-plates, each of which has a pair of ledges to receive the side-edges of the front plate, with a shoulder on which it rests; two pair of ledges to receive the side-edges of the two middle plates which form the air-box, and an oblong air-hole near the top, through which the air warmed in the box is discharged into the room, and a wing or bracket, as H, and a small hole, as R, for the axis of the register to turn in. See *fig. 3.* which represents one of these plates. 4. An air-box, composed of the two middle plates DE and FG, *figs. 4. and 5.* The first has five thin ledges or partitions cast on it, the edges of which

are received into so many pair of ledges cast in the other: the tops of all the cavities formed by these thin deep ledges are also covered by a ledge of the same form and depth cast with them; so that when the plates are put together, and the joints luted, there is no communication between the air-box and the smoke. In the winding passages of this box, fresh air is warmed as it passes into the room. 5. A front plate, which is arched on the under side, and ornamented with foliage, &c. 6. A top plate, with a pair of ears M, N, (*fig. 6.*) answerable to those in the bottom plate, and perforated for the same purpose. It has also a pair of ledges running round the under side to receive the top edges of the front, back, and side plates. The air-box does not reach up to the top plate by $2\frac{1}{2}$ inches.

All these plates are of cast iron; and when they are all in their proper places, they are bound firmly together by a pair of slender rods of wrought iron with screws, and the machine appears as in *fig. 6.* There are also two thin plates of wrought iron, *viz.* 7. The shutter, which is of such a length and breadth as to close well the opening of the fire-place, and serving to blow up the fire, and to secure it in the night. It is raised or depressed by means of two brass knobs, and slides in a groove left between the foremost ledge of the side plates and the face of the front plates. 8. The register, which is placed between the back plate and air-box, and furnished with a key; so that it may be turned on its axis and made to lie in any position between level and upright. The operation of this machine, and the method of fixing it, may be understood by observing the profile of the chimney and fire-places in *fig. 7.* M is the mantle-piece or breast of the chimney; C the funnel; B the false back, made of brick-work in the chimney, four inches or more from the true back, from the top of which a closing is to be made over to the breast of the chimney, that no air may pass into the chimney except that which goes under the false back, and up behind it; E the true back of the chimney; T the top of the fire-place; F the front of it; A the place where the fire is made; D the air-box; K the hole in the side-plate, through which the warmed air is discharged out of the box into the room; H the hollow, formed by removing some bricks from the hearth under the bottom plate filled with fresh air, entering at the passage I, and ascending into the air-box through the air-hole in the bottom plate near G, the partition in the hollow, designed to keep the air and smoke apart; P the passage under the false back, and part of the hearth for the smoke; and the arrows in the figure shew the course of the smoke. The fire being made at A, the flame and smoke will ascend, strike the top T, and give it a considerable heat; the smoke will turn over the air-box, and descend between it and the back plate to the holes near G, in the bottom plate, heating in its passage all the plates of the machine; it will then proceed under and behind the false back, and rise into the chimney. The air of the room contiguous to the several plates, and warmed by them, becomes specifically lighter than the other air in the room, and is obliged to rise; but, being prevented by the closure over the fire-place from going up the chimney, is forced out into the room, and rising by the mantle-piece to the ceiling, is again driven down gradually by the steam of newly-warmed air that follows; and thus the whole room becomes in a little time equally warmed. The air, also, warmed under the bottom plate and in the air-box, rises and comes out of the holes in the side plates, and thus warming and continually changing the air of the room. In the closing of the chimney a square opening for a trap-door should be left open for the sweeper to go up: the door may be made of slate or

tin, and so placed, that by turning up against the back of the chimney when open, it closes the vacancy behind the false back, and shoots the foot that falls in sweeping out upon the hearth. It will also be convenient to have a small hole about five or six inches square, cut near the ceiling through into the funnel, and provided with a shutter, by occasionally opening which, the heated air of the room and smoke of tobacco, &c. may be carried off without incommoding the company. For a farther account of the manner of using this fire-place, the advantages attending it, answers to objections and directions to the bricklayer in fixing it, the curious reader may consult Franklin's Letters and Papers on Philosophical Subjects, p. 284—318. edit. 1769. For a farther account of improved fire-places, see CHIMNEY.

FIRE-pots, in the *Military Art*, are small earthen pots into which is put a grenade, filled with fine powder till the grenade be covered; and then the pot is covered with a piece of parchment, and two pieces of match laid across and lighted. This pot being thrown where it is designed to do execution, breaks and fires the powder, and thereby fires the powder in the grenade, which ought to have no fuze, that its operation may be the quicker.

FIRE, Razant, or *rasant*, is a fire from the artillery and small arms directed in a line parallel to the horizon, or to those parts of the works of a place that are defended.

FIRE, Running, is when a rank or ranks of men drawn up fire one after another; or when the lines of an army are drawn out to fire on account of a victory; in which case each squadron or battalion takes it from that on its right, from the right of the first line to the left, and from the left to the right of the second line, &c.

FIRE-ship, is a vessel fitted up with combustible apparatus, so arranged as to appear suddenly in a blaze, at any given time, or situation. It is observed by Anderson in his History of Commerce, vol. i. p. 432, that some English vessels, filled with combustible matter, and sent among the Spanish ships composing the Invincible Armada in 1588, are said to have given rise to the terrible invention of fire-ships. However, Livy informs us, that the Rhodians had invented a kind of fire-ships which were used in junction with the Roman fleet in their engagement with the Syrians, in the year before Christ 190; candelrons of combustible and burning materials were hung out at their prows, so that none of the enemy's ships durst approach them: these fell on the enemy's gallees, struck their beaks into them, and at the same time set them on fire. Liv. lib. xxxvii. cap. 30. tom. iii. p. 322. Ed. Crevier.

There is nothing peculiar in the construction of a modern fire-ship, except the apparatus by which the fire is instantly conveyed from one part to another, and from thence to the enemy: for this purpose the fire-room, in which the combustibles are inclosed, is built between decks, and extends from the Bulk-head at the forecastle to a bulk-head raised behind the main-mast. The train inclosed in this apartment is contained in a number of wooden troughs which intersect each other in different parts of the ship's length, being supported at proper distances by cross pieces and stanchions. On each side of the ship are cut out six or seven port-holes, in size about fifteen by eighteen inches, with their lids opening downward, and close caulked up. Against each port is fixed an iron-chamber, which, when the ship is fired, blows out the port-lid and lets out the flame. Under the main and fore shrouds is fixed a wooden funnel, one end of which communicates with a fire-barrel, and designed to convey the flames to the shrouds. Between the funnels, called also fire-trunks, are two scuttles or small holes in the upper deck, serving also to let out the flames. Both fun-

nels and scuttles must be stopped with plugs, and have sail-cloth or canvas nailed over them, to prevent any accident happening from above to the combustibles below. The port-holes, funnels, and scuttles, serve not only to communicate the flames to the outside and upper works of the ship and her rigging, but likewise to open a passage for the inward air confined in the fire-room, so that it may expand itself without blowing up the decks. On each side of the bulk-head behind is cut a hole big enough to receive a trough of the same size as the others; leading troughs whose foremost ends communicate with other troughs within the fire-room, extend obliquely from these openings to sally-ports cut through the ship's side: the decks and troughs are well covered with melted rosin. When either of the leading-troughs is fired, the flame is immediately conveyed to the opposite side of the ship, and both sides burn together.

The cabins of the lieutenant and master are behind the fire-room, one on the starboard and the other on the larboard side. The captain's cabin is separated from these by a bulk-head.

Of these fire-ships we have two sorts, *viz.* the *conflagrating* and the *exploding*. The former have been long in use, but the latter appears to be of rather later adoption. The vessels employed may be from 60 to 200 tons, or more; their size being usually adapted to the service they are to perform. The following detailed account of the preparations and proportions of the requisite materials will give our readers a precise idea of this horrible contrivance.

Proportion of combustible Stores for a Fire-Ship of 150 Tons.

Fire-barrels, filled with composition	-	8
Iron chambers to blow open the ports	-	12
Composition for priming	- barrels	3½
Quick match	- ditto	1
Curtains, dipped	-	48
Reeds, long, single dipped	-	150
Ditto, short,	{ Single dipped	- 75
	{ Double dipped	- 75
Bavins, single dipped	-	250

The fire-barrels are about 2 feet 4 inches high, and 1 foot 6 inches in diameter. Each barrel must have 4 holes of about 6 inches square cut in its sides; and these holes must have a square piece of canvas nailed over them quite close. They are then filled with the same composition as for carcasses; and 4 plugs of about 1 inch in diameter and 3 long, and well greased, are thrust into the top, and then left to dry. When dry, the plugs are taken out, and the holes filled with safe composition, with quick-match at the top. After this, the whole is smeared over with melted powder, mixed with spirits of wine. When dry again, a sheet or two of brown paper is laid over the top, and then one of the canvas covers, which is made secure by the upper hoop of the barrel.

The composition for dipping reeds, bavins, and curtains, consists of

Rosin	-	120 lb.
Common sulphur	-	90
Swedish pitch	-	60
Tallow	-	30
Mixed powder	-	12

This will dip about 100 reeds and 25 bavins.

Each curtain contains 1 square yard of barrage; and each cover for fire-barrels, 1 square yard of facking. Immediately that the curtains, covers, &c. are dipped, they are to be strewed over with fine brimstone, before the composition grows cold. The iron chambers for blowing open the

F I R E.

ports, hold from 9 to 11 ounces of powder. They are fixed in such manner as to prevent their recoil, and to insure the ports being blown open. The vents are usually corked up, and covered with a piece of barras, till required to be primed, for which the following composition is prepared:

Saltpetre pulverized	-	22½ lb.
Resin ditto	-	2
Sulphur ditto	-	18
Mealed powder	-	45
Linseed oil	-	1 pint.

The ship should not be primed when fitted out, but only when intended to be fired. The mode of fitting out is this: The whole breadth of the fire-room is to be divided into nine parts; and troughs, about 4 inches wide and as many deep, are laid both along the whole length of that room, and across; so as to form a general communication, and to insure that the whole of the combustibles may be ignited nearly at the same moment. The eight fire-barrels are ranged along the two sides; and over them are two fire-scuttles, or openings with fire-trunks, by which the flames are directed upwards towards the rest of the apparatus. The reeds and bavinns are tied down to the troughs, to prevent their rolling out of their places, as the ship may roll or pitch; and the curtains are nailed up to the beams, equally throughout the fire-room.

When the vessel is about to be fired, all the reeds and bavinns are to be taken up, and a little of the priming composition sprinkled in the bottoms of the troughs: the reeds, &c. are then to be lightly tied down as before. Quick match, of six or eight threads, doubled, must be laid along on the tops of all the reeds, &c. and abundance of priming composition strewed over it, as well as over all the fire-room. The covers of all the fire-barrels must be cut open, and made to hang down on the sides of the apertures. Leaders, of strong quick-match, must be laid from the reeds to the barrels, and to the iron chambers; tying them to the several vents, to insure their not falling off. Strong leaders of quick-match, four or five times doubled, must be laid from the reeds to the sally-ports; and these last must be connected by quick-match, that the whole may take fire at once.

The following mode is now in use for producing an external fire, in addition to that kindled within. Fire-boxes, filled with carcase-composition, are distributed in the following manner in a ship with three masts:

	Boxes.
1 box is suspended from each of the cat-heads and davits, on each side of the bow, in all	} 4
8 slung across the bowsprit	8
4 across each of the out-riggers abaft	8
2 from the gratings of each of the lower yard-arms	12
1 from the dead-eyes on each side of the tops	6
1 from the middle of the inside of the fore, main, and mizen shrouds	} 6
Total boxes of composition	44

These boxes are suspended by chains and hooks; but those thrown across the bowsprits and out-riggers are fixed by staples. The two inner ones are laid with leaders of quick-match, which fire instantly; or else with port-fires, cut to burn a given time: they communicate with the outer ones by reeds tied down on the bowsprit and out-riggers. The boxes that hang from the dead-eyes and shrouds are fired by curtains suspended from the shrouds; the lower ones hanging immediately over the large fire-barrels. The

two boxes on each yard-arm are hung the one over the other; the upper one having a leader of quick-match carried along the yard from the shrouds: this in burning will doubtless fire the lower one. Besides the boxes, there are fire-barrels arranged as follows: Two half-barrels on the fore-castle; two abaft the main-deck, and four on the main-deck; two in each top, placed against the masts; and four large fire-barrels, under fire-trunks, to convey fire to the curtains on the shrouds.

All these fire-barrels and boxes are to be fired by separate leaders of quick-match or port-fire, so that every part of the ship may be fired, and envelope her in smoke during her approach to the enemy; while the residue need not be ignited until the crew may be quitting to escape in their boats. This is certainly a very hazardous duty; the attention of the enemy being always attracted by such fire-ships as appear likely to take effect: hence the boats are manned, and every endeavour is made by long poles, like boat-hooks, to get hold so as to tow away into a contrary direction; or long-boats, &c. are moored with chains extending upon the surface of the water, for the purpose of arresting the progress of the flaming visitor. Whether it be from a refined idea, or from the most determined resentment towards those who act in fire-ships, may be difficult to judge; but there is rarely any quarter given to such as fall into the enemy's power. However, under ordinary circumstances, the evacuation is not attended with much difficulty, unless there be much swell, by which the boat's return may be greatly impeded, thereby subjecting the crew to a heavy fire from every quarter. When we understand that two men, furnished with lighted port-fires, can set fire to the whole of the leaders on the deck, &c. in less than a minute, we may collect that after once the vessel has got into a proper direction, within a few minutes sail of the enemy, no occasion for remaining in her, so as to risk the crew, need ever exist. In general, the fire becomes universal in the course of five minutes; the ports being blown open by the chambers, and allowing the flames to rush out in the most awful manner:—in such a manner as to preclude the possibility of approach in boats, which cannot act when the fire has become general.

Exploding fire-ships are constructed on a similar principle; adapting it to the explosion, at a given time, of an immense trough of powder running the whole length of the vessel, for the purpose of bursting her to pieces, and of destroying whatever vessels may be within reach of the shock.

Fire-stone is a coarse, harsh, dull free-stone, of a moderately compact texture, of a pale greyish colour, nearly white, with a very slight greenish tinge. This stone is moderately hard and heavy, and slightly colours the hands; it is composed of a small fine angular grit, cemented by an earthy sparry matter, intermixed with numerous small spangles of a silvery mica: it will not strike fire with steel, and in the fire changes to a slight reddish hue. It is called also *Ryegate-stone*, from the place whence it is chiefly brought; it bears the fire and a high degree of heat, without melting or exfoliating; and is much used for chimnies, hearths, ovens, stoves, &c.

It does not bear the weather, and is therefore unfit for building.

The best fire-stone that England affords, is perhaps that obtained from the mill-stone grit strata, from a bed with globular ochry stains in it, and which is used for lining the iron furnaces of Derbyshire and other districts; it is dug at the Rooks quarry, in Ashover, on Stanton Moor, and other places. Of late years a good fire-stone has been used at Butterly furnace, by Mr. Jessop, junior, from the fine micaceous

aceous grit-stone in the shale, (shale free-stone) at Bull Bridge, near Crich. The lowest and most silicious beds of the chalk strata answer the end of a fire stone, for which purpose they are dug at Ryegate, Godstone, and other places on the southern skirt of the North Downs, in Surry, for the use of the metropolis: the celebrated free-stone at Tottenham, in Bedfordshire, is of this stratum, and makes a tolerable fire-stone.

FIRE-water, a name given to alkaleft. See *IGNIS aqua*.

FIRE, wild, is a kind of artificial or factitious fire, called by the Greeks the liquid, or maritime fire, which burns even under water, and that with greater violence than out of it.

It is composed of sulphur, naphtha, pitch, gum, and bitumen; and it is only extinguishable by vinegar, mixed with sand and urine, or by covering it with raw hides.

Its motion or tendency is said to be contrary to that of natural fire, and always following the direction in which it is thrown, whether it be downwards, sidewise, or otherwise. For the annoyance of the enemy, it was employed with equal effect by sea and land, in battles or in sieges. It was either poured from the rampart in large boilers, or launched in red-hot balls of stone and iron, or darted in arrows and javelins, twisted round with flax and tow which had deeply imbibed the inflammable oil: sometimes it was deposited in fire-ships, and was most commonly blown through long tube of copper, which were planted on the prow of a galley, and fancifully shaped into the mouths of savage monsters that seemed to vomit streams of liquid and consuming fire.

The French call it *Greek fire*, or *feu Grecois*, because first used by the Greeks about the year 660, as is observed by the Jesuit Petavius, on the authority of Nicetas, Theophanes, Cedrenus, &c.

The inventor according to the same Jesuit, was an engineer of Helinopolis, in Syria, named Callinicus, who first applied it in the sea-fight commanded by Constantine Pogonates against the Saracens, near Cyzicus, in the Hellespont; and with such effect, that he burnt the whole fleet therewith, wherein there were thirty thousand men.

But others will have it of a much older date; and hold Marcus Gracchus the inventor; which opinion is supported by several passages, both in the Greek and Roman writers, which shew it to have been anciently used by both these nations in the wars. See Scaliger against Cardan.

Constantine's successors used it on divers occasions, with equal advantage as himself; and what is remarkable enough is, that they were so happy as to keep the secret of the composition to themselves, as the palladium of the state, though their galleys and artillery might occasionally be lent to the Romans, so that no other nation knew it in the year 960.

Hugh, king of Burgundy, demanding ships of the emperor Leo for the siege of Frefne, desired likewise the Greek fire. Chorier, *Hist. De Dauph.*

By various precautions, the secret was confined above 400 years to the Romans of the East, and at the end of the 11th century, the Pisans, to whom every science and every art were familiar, suffered the effects, without understanding the composition of the Greek fire. It was at length either discovered or stolen by the Mahometans, and in the holy wars of Syria and Egypt, they retorted an invention contrived against themselves, on the heads of the Christians.

F. Daniel gives us a good description of the Greek fire, in his account of the siege of Damietta, under St Louis. Every body, says that author, was astonished with the Greek fire which the Turks then prepared, and the se-

cret whereof is now lost. They threw it out of a kind of mortar; and sometimes shot it with an odd sort of cross bow, which was strongly bent by means of a handle, or winch, of much greater force than the bare arm.

That thrown with the mortar sometimes appeared in the air of the size of a tun, with a long tail, and a noise like that of thunder. It came flying through the air, says Joinville in his "Histoire de St. Louis," like a winged, long-tailed dragon, about the thickness of an hog's head, with the report of thunder and velocity of lightning; and the darkness of the night was dispelled by this deadly illumination. The use of the Greek, or, as it might now be called, the Saracen fire, was continued to the middle of the 14th century, when the scientific or casual compound of nitre, sulphur, and charcoal effected a new revolution in the art of war and the history of mankind. Leonard da Vinci, in his MSS., published by Venturi, describes the composition of the Greek fire as formed by mixing over the fire, the charcoal of willow, nitre, brandy, rosin, sulphur, pitch, and camphor. A woollen cord is then plunged in the mixture, and made into balls, which may afterwards be provided with spikes. These balls, being set on fire, are thrown into the enemy's vessels. A similar composition has been given by Baptista Porta, in his "Mag. Natur. l. xii. c. 2." The modern discoveries respecting combustion have disclosed the whole secret of compositions which burn without access to the atmosphere, but by means of oxygen afforded from nitre. The balls described by Fuzier, (*Des Faux d'artifices*) which shine on the surface of water are nothing else but the Greek fire.

FIRE-works, or *artificial fires*, are preparations made of gunpowder, sulphur, and other inflammable and combustible ingredients, used on occasion of public rejoicings, and other solemnities.

The principal of these are rockets, serpents, stars, hail, mines, bombs, garlands, letters, and other devices. See *ROCKETS, STAR, BOMB, &c.*

The invention of fire-works is by M. Mahudel attributed to the Florentines and people of Sienna; who found out likewise the method of adding decorations to them of statues, with fire issuing from their eyes and mouths.

The art of preparing and managing fire-works is called *Pyrotechny*.

The making or selling of fire-works, or squibs, or throwing them about in any street, is, on account of the danger that may ensue to any thatched or timber buildings, declared to be a common nuisance, by 9 and 10 W. III. cap. 7. and punished by a fine of 20*l.*

FIRE-workers, were formerly subordinate officers to the fire-masters, who commanded the bombardiers, but they are now second lieutenants to the royal regiment of artillery.

These receive the orders from the fire-masters, and see that the bombardiers execute them.

FIRE, Island, in *Geography*, a small island in the Indian sea, near the coast of Africa; S. lat. 17° 50'.

FIRENZUOLA, AGNOLO, in *Biography*, an Italian poet, born at Florence in 1493, was son of Bastiano de' Giovanni, a person of considerable note in his own country. He studied at Sienna and Perugia; and in the latter place he contracted an intimacy with the famous Peter Aretin, whom he accompanied to Rome. He was intended for the profession of the law, and exercised the duties of an advocate, which he at length quitted to enter the congregation of monks of Vallombrosa, with the expectation of attaining some preferment in the church. He died at Rome about the year 1545, having passed much of his life in ill health. H.

writings rank among the lighter productions of Italian literature. They have been frequently printed; and were collected in three volumes at Florence in the year 1763. These consist of works in verse and in prose; of novels; amorous discourses; a piece against the new letters introduced into the Italian by Trissino; discourses in natural history; two comedies; a translation of the Golden Ass of Apuleius, adapted to himself and the circumstances of his own time. In almost all his pieces he exhibits a cultivated and elegant taste, but is often more free in his manners than became the clerical character. Moreri.

FIRGOS, in *Geography*, a town of the island of Samos; 3 miles W. N. W. of Cora.

FIRING, in the *Manege*, denotes a kind of correction or discipline of the whip, used by horse-dealers; and which they cruelly practise in order to terrify a horse, and thus to rouse his mettle, that he may appear to the best advantage. Whereas this object is most honestly and most effectually attained by a moderate use of the whip.

FIRING, in the *Military Art*, denotes the discharge of the fire-arms; and its object is to do the utmost execution to the enemy.

The present method of firing by platoons is said to have been invented by Gustavus Adolphus, and first used about the year 1618; the reason commonly given for this method is, that a constant fire may be always kept up. There are three different ways of platoon firing; *viz.* standing, advancing, and retreating. But previous to every kind of firing, each regiment or battalion must be told off in grand divisions, subdivisions, and platoons, exclusively of the grenadiers, which form two subdivisions, or four platoons, of themselves. In firing standing, either by divisions or platoons, the first fire is from the division or platoon on the right; the second fire, from the left; the third, from the right again; and so on alternately till the firing comes to the centre platoon, which is generally called the colour platoon, and does not fire, remaining as a reserve for the colours. Firing advancing is performed in the same manner, with this addition, that before either division or platoon fires, it advances three paces forward. Firing retreating varies from either of the former methods; for, before either division or platoon fires, if they are marching from the enemy, it must go to the right about, and after firing, to the left about again, and continue the retreat as slow and orderly as possible.

In hedge-firing the men are drawn up two deep, and in that order both ranks are to fire standing. Oblique firing is either to the right and left, or from the right and left to the centre, according to the situation of the object. The Prussians have a particular contrivance for this purpose; if they are to level to the right, the rear ranks of every platoon make two quick but small paces to the left, and the body of each soldier turns one-eighth of a circle, and *vice versa*. Parapet firing depends on the nature of the parapet over which the men are to fire, and also upon that of the attack made to possess it. This method of firing is sometimes performed by single ranks stepping on the banquettes and firing; each man instantly handing his arms to the centre rank of the same file, and taking his back in the room of it; and the centre rank giving it to the rear to load, and forwarding the arms of the rear to the front rank; by which means the front rank men can fire six or seven rounds in a minute, with exactness. Parapet firing may also be executed two deep, when the banquettes is three feet broad, or in field works, where no banquettes are made. Square firing is performed by a regiment or body of men drawn up in a hollow square, in which case each front is

generally divided into four divisions or firings, and the flanks of the square, being the weakest part, are covered by four platoons of grenadiers. The first fire is from the right division of each face; the second from the left division of each face, &c. and the grenadiers make the last fire. Street firing is practised in two ways; either by making the division or platoon that has fired to wheel by half-rank to the right and left outwards from the centre, and to march in that order by half divisions down the flanks on each side of the column, and to draw up in the rear, and go on with their priming and loading; or, to make the division or platoon, after firing, to face to the right and left outwards from the centre, and one half rank to follow the other; and in that order to march in one centre file down on each side of the column into the rear, and there draw up as before.

FIRING iron, in the *Manege*, is a piece of copper or iron, about a foot long, one end of which is made flat, and forged like a knife; the back of it being half an inch thick, and the fore-edge about the fifth or sixth part of this. When the farrier has made his firing-iron red hot in his forge, he applies the thinnest part to the horse's skin, and so gives the fire to the hams, or such places as stand in need of it.

The utility of firing, or of applying the actual cautery in strains is doubtful. Mr. Lawrence tried it without success. Its use is said to be to disperse swellings by promoting absorption, and by contracting the skin to form a constant bandage round the sinews, both during the cure, and even afterwards: when the pastern-joints are exceedingly full and swelled, the legs gorged, the tendons enlarged, and, indeed, the parts indurated, blistering and firing seem to be absolutely necessary, when no other measures will be sufficiently useful. In the Veterinary college, it is the practice, in this operation, to draw the lines vertically round the affected limb; the contraction of the skin in that direction forming the most effectual and uniform bandage on the part. See SPRAIN, RINGBONE, &c.

FIRKIN, an English measure of capacity, for things liquid, containing the fourth part of the barrel.

The firkin of ale contains eight gallons; and that of beer, nine; two firkins of beer make the kilderkin; two kilderkins the barrel; and two barrels the hoghead. In the country a firkin of ale and beer is $8\frac{1}{2}$ Winchester gallons.

The firkins of herrings, soap, and butter are on the footing of the firkin of ale; *viz.* a gallon per firkin less than that of beer.

FIRLAYENKA, in *Geography*, a town of Poland, in the palatinate of Lemberg; 48 miles E. N. E. of Lemberg.

FIRLOT, in *Agriculture*, is a term which is generally applied to a dry measure of grain in the northern parts of the kingdom; but which differs in size, according to Mr. Somerville, in the proportion of 21, 25 to 31. There is therefore a *small* and a *large* firlot. Wheat, rye, beans, and peas are usually sold by the small firlot; but malt, barley, and oats by the large firlot. Four small firlots are, according to the same writer, 4,687,276 Winchester bushels; four large ones 5,962,63 Winchester bushels. Four firlots make a boll. See WEIGHTS and MEASURES. The firlot is likewise distinguished into the *oat* and the *wheat* kind. The oat firlot, which contains twenty-one and a quarter Scotch pints, is nineteen and a half inches in diameter, both at the top and bottom, being of a perfectly cylindrical form, and seven and a half inches in depth. The wheat firlot contains about 2211 cubical inches, and that for barley thirty-one standard pints; it seems therefore that the Scotch wheat

first exceeds the English bushel, by thirty-three cubical inches.

FIRMAMENT, (from the Latin *firmamentum*.) This word has been used with great latitude by sacred writers, by astronomers, by poets, and other writers. When Ptolemy of Egypt endeavoured to reconcile the phenomena of the celestial bodies with the prevailing philosophy of the times, he supposed that the earth was immoveably fixed in the centre of the universe, and that the moon, mercury, venus, the sun, mars, jupiter, and saturn, were carried round the earth by different spheres of solid but transparent matter. Beyond them he supposed the existence of an eighth sphere whereon the fixed stars were situated, and this he called the *firmament of the fixed stars*; and beyond this firmament he placed the *primum mobile*, and the *cælum empyreum*. In process of time the absurdity of this astronomical hypothesis was clearly demonstrated, in consequence of which the Ptolemaic spheres were utterly disregarded; yet the word firmament still remained in use; its meaning, however, became less limited; so that sometimes it was used to express the region of the fixed stars; at other times it denoted a peculiar region; or some peculiar regions of the heavens, as may be deduced from the expressions, *the middle firmament*; *the various firmaments*. It has also been used to signify the sky, or the whole expanse of the heavens. Derham says (in his *Astro. Theol.*) "what an immense space is the firmament, wherein a great number of stars are seen with our naked eye?" Dr. Keill, in his *Astronomical Lectures*; says, "a spectator therefore living in the sun, when he looks towards the heavens, will observe its surface to be spherical-concave, and concentrical to his eye, in which surface he will observe an innumerable multitude of stars, which we call fixed, every where dispersed throughout the whole heavens, which like so many gilded studs, with a bright lustre, adorn the firmament."

In various parts of the scripture, the middle region of the air is called the firmament.

It is curious to observe that whilst most writers, ancient no less than modern, seem to consider the firmament as something aerial, or fluid; others, with Ptolemy, have considered it as solid and transparent like crystal. Indeed, upon the least reflection, this last idea seems to be more consonant with the nature of the word, which suggests the idea of something firm and substantial, a sort of foundation fit to support great, heavy, and magnificent objects. In fact, some writers of note have used it in this sense, and entirely independent on astronomy. Thus Bacon (in his *Advancement of Learning*) speaking of the principles of every subject, which human industry always endeavours to find out, says, "The mind of man doth wonderfully endeavour, and extremely covet this, that it may not be penile; but that it may light upon something fixt and immoveable, on which, as on a firmament, it may support itself its swift motions and disquisitions."

Considering that striking circumstance of the fixed stars constantly preserving their relative situations; it must be allowed, that Ptolemy was, not without apparent reason, induced to consider the firmament of the stars, as something solid and permanent. Previous to the very recent most accurate observations, which have shown that very slight alterations of distances do actually take place among the stars, it was not even suspected that any such thing existed; and the daily movement which they were observed to have, was considered as the common movement of them all, or rather of their firmament, which appeared to revolve round the earth once in each 24 hours.

Besides this apparent daily motion, it is to be remarked

that the sun returns to the equinox every year before it returns to the same point in the heavens, hence the equinoctial points have a retrograde motion, which, though very small, in process of time amounts to something considerable, and it will complete a whole revolution, so as to return to the same point, after a great number of years. (This is called the *PRECESSION of the equinoxes*, which see; and the whole revolution round the starry firmament is called the great year, or *annus magnus*.) This circumstance did not escape the notice of ancient astronomers, and their calculations respecting the quantity of the annual precession, or of the whole revolution, were not much less accurate than those of latter times. Ptolemy reckoned the *annus magnus*, or the grand revolution of his starry firmament, equal to 36,000 ordinary years. Hipparchus came to the same conclusion, Tycho Brahe reckoned it equal to 25,412 years. And the more modern astronomers, though not quite agreeing among themselves, generally reckon it equal to about 26,000 years.

FIRMAN, in the East Indies, and particularly in the territories of the Great Mogul, is the passport, or permit, granted to foreign vessels, to trade within their jurisdiction.

FIRMICUS, MATERNUS, JULIUS, in *Biography*, an ecclesiastical writer, flourished about the middle of the fourth century. He is said to be a Sicilian by birth; to have practised for some time as an advocate in the Forum at Rome; and, in his old age, to have become a convert from heathenism to Christianity. He was author of a treatise, "*De errore profanarum Religionum*," which was addressed to the emperors Constantius and Constans. It is a learned and well-written performance, and sets forth, by way of contrast, the reasonableness and excellence of the Christian system, in comparison with the absurd and immoral tenets of the Gentile creed. It had been well had he been satisfied with demonstrating by argument the superior excellence of his religion; but unfortunately he called upon the civil power to propagate it by force, and by severe edicts to crush and overwhelm the abettors of error. This work has often been reprinted; and in the year 1666 it was published at Paris, at the end of Cyprian's works; and it is inserted in the 4th volume of the "*Bibliotheca Patrum*." A mathematical, or, perhaps, more properly, an astronomical treatise, entitled, "*Astronomicorum libri de Mathesi, lib. viii.*" is ascribed to Firmicus, though not without dispute. It was first published at Venice, in 1497, in folio, from a copy brought by Pescennius Niger from Constantinople; and has been frequently reprinted since, together with the works of Manilius, and the astronomical pieces of Ptolemy. It treats of the power and influence of the stars, according to the doctrine of the Egyptians and Babylonians; and contains a curious mixture of mathematical science with the reveries of judicial astrology. Moreri.

FIRMIAN, an eminent Christian bishop, who flourished in the third century, was descended from an honourable family in Cappadocia. He was ordained bishop of Caesarea about the year 233, and was held in the highest estimation for learning and for the excellence of his moral character by his contemporaries. In all the important ecclesiastical matters that were agitated in his time, the opinion of Firmian was looked up to with profound respect and veneration. He was present at the council of Iconium, held in 235; at the council of Antioch, in 251, convened on the subject of Novatian's schism; he was also president of the council held, some years after, at the same place, to examine into the opinions of Paul of Samosata. He was again invited to the

the council held at Antioch, in the year 270, by which Paul was condemned and deposed; but died at Tarsus, on his journey, about the end of the year 269. This was an unfortunate event for Paul, who had already been saved by his influence, and who would probably have again experienced his kindness in this new attack on his principles and character, had he lived to argue the matter in council. Firmilian was not much distinguished as an author; yet his merits, moderation, and candour, entitle his memory to the respect of posterity. Theodoret characterized him as "an illustrious person, equally master of human and divine knowledge." He was united in strict friendship with Origen, whom he invited into his own country, and to whom he paid several visits, for the sake of improving by his instructions in divine knowledge. He took the part of St. Cyprian, in the dispute about baptizing heretics that returned to the catholic church; and wrote a long letter to St. Cyprian on the subject, in which he exposed the inhumanity, pride, and insolence of Stephen, bishop of Rome. St. Basil mentions with respect the works of Firmilian, but without expressly naming them. He was a man zealously attached to the truth, but candid and liberal to those who differed from him, and anxiously desirous that they should never be molested on account of their opinions. Moreri. Lardner.

FIRMIN, THOMAS, was born at Ipswich, in Suffolk, in the year 1632, where he was educated under the eye of his parents, who were strictly religious; and with regard to this world's goods, they were respectable but not rich. "God gave them," says the friend and biographer of Firmin, the wish of Solomon, "neither poverty nor riches, but that middle estate and rank, which contains all that is valuable and desirable in wealth, without the parade, vanity, and temptations that generally adhere to riches." When Thomas was of a proper age, he was bound apprentice to a tradesman in London. In this situation he was remarkable for his diligence and activity, as well as for his amiable and obliging manners. With his master he usually attended the sermons of the celebrated Arminian preacher, Mr. John Goodwin: by this he became an early convert from Calvinism, in which he had been brought up, to the principles of Arminius. At the expiration of his apprenticeship he entered into business on his own account, with a capital of 100*l.* only, which in 1665 was increased by an addition of 500*l.* that he received with a citizen's daughter whom he married. By skill and industry he soon acquired property; but, what was of infinitely more importance, he became eminently known for the excellence of his disposition, the integrity of his dealings, his solicitude to promote the happiness of others, and his kind and constant exertions for alleviating the distresses of the poor and unfortunate. He was, from his first commencement in business, desirous of obtaining the friendship of persons eminent for moral worth, foreigners as well as his own countrymen, and particularly of the clergy of different denominations. From these connections he, in future life, was enabled to derive essential assistance in promoting the benevolent and useful designs for which he afterwards became so eminently distinguished. Among other persons, he was intimately acquainted with Mr. John Biddle, who confirmed him in his Arminian sentiments, and made him a profelyte to Unitarianism, for the sake of which Biddle himself was persecuted and banished. (See BIDDLE.) Firmin was not to be diverted from his kind intentions, because the tyranny of Cromwell fell heavily upon him: he shewed him every attention while here; and when he was sent, by the protector, a prisoner to the Scilly isles, he procured for him a pension,

which Cromwell had virtue enough to allow him to receive during his banishment. Mr. Firmin enrolled among his intimate friends Dr. Whichcote, Dr. Worthington, Dr. Tillotson, and Dr. Wilkins. By the intercourse which he thus maintained with the clergy, and the great confidence placed in his judgment to recommend men of abilities and worth to situations for which they were adapted, he was enabled to serve the interests of many promising young preachers and scholars, who were candidates for lectureships, schools, &c. In the year 1664, Mr. Firmin, being a widower, married again; and with his wife he had a very considerable fortune. In 1666, his house was destroyed by the great fire of London; but his character as a tradesman was now so well known, that by the increase of business he soon repaired the loss which he sustained by that event, and might have amassed much property, had not his heart prompted him to devote a great proportion of his profits to benevolent and humane purposes. In the year 1676, he erected large premises, and established a linen manufacture, for the sake of affording employment to a number of poor children, who were useless to and a burden on, the community. Here he found constant work for many hundreds, who were either acquainted with the different branches of the business, or were willing to be instructed in them. The returns proved, as he expected, very inadequate to the expences incurred; yet, from his own funds, and from the assistance which he obtained from well-disposed persons, he was enabled to bear the loss, and to give away occasional sums of money, more than their earnings, and to distribute fuel and clothing among the poor manufacturers in severe seasons. In the year 1678, he published "Proposals for employing the Poor, especially in and about the City of London, and for the Prevention of Begging, &c. in a Letter to a Friend." In this tract he describes the progress and good effects of his institution, and makes a number of valuable observations relative to the most proper means of providing for the necessities of the poor. After this he attempted to set up a woollen manufacture; but the losses which he sustained, through the ignorance of the persons employed, obliged him to relinquish his project. He erected a large warehouse on the banks of the Thames, in which he deposited corn and coals, purchased in the cheapest seasons, to be sold at prime cost, in times of scarcity, to the poor. Mr. Firmin was signalized by the zeal and activity which he displayed in liberating poor debtors from prison, and in providing for the more comfortable subsistence of others whom he was unable to redeem. He was, however, the means of opening the prison doors to many, whose families were ready to perish for want; and his recommendation and influence are said to have had great weight with some leading members of parliament, in the passing of certain acts of grace in behalf of poor debtors. Mr. Firmin was one of the governors of St. Thomas's hospital, and extremely active to render it as useful as possible: he was also a governor of Christ's hospital, of which he proved himself a great benefactor and constant superintendent. When the French protestants fled into England, to escape the persecution of Louis XIV., Mr. Firmin was active in providing for their relief; and several thousand pounds were entrusted to his care and management, for the benefit of the refugees. He was equally zealous in behalf of those who fled from Ireland to England, to escape the persecutions of James II. He was, in short, a most assiduous assertor of the civil and religious liberties of mankind; and in no instance did he stand by to witness oppression, without endeavouring to assert the rights of the oppressed. By the distribution of publications written in
defence

defence of public freedom, he endeavoured to rouse his countrymen to a vindication of their rights, in opposition to the king (James II.); and he may be regarded as a zealous promoter of the revolution in 1688. After that event, he gave evidence that his benevolence was attached to no party, but was active in relieving those who were suffering for conscience sake. The high character which this excellent man sustained attracted the notice of the queen, who expressed a deep concern that so good a man was not orthodox in his religious sentiments; and intreated archbishop Tillotson to endeavour to convince him of his error. The prelate replied, that he had already made the attempt; but that Mr. Firmin had been too early and too deeply impressed with Unitarian principles, to admit now of contrary impressions. After this, Dr. Tillotson published some sermons on the points in dispute, and sent one of the first copies to Mr. Firmin; who immediately drew up an answer to them, which he presented to the archbishop: still, however, their friendship for one another did not abate. With Dr. Compton, bishop of London, Mr. Firmin was equally in favour: and it must not be forgotten, that the annual collections for the poor, which are made in and about London at Christmas, under the authority of the king's letter, were set on foot by Mr. Firmin, who had the direction of the business several years. This excellent man died, December 20th, 1697, in the 66th year of his age. He was interred, according to his own desire, in the cloysters belonging to Christ's hospital, where the following inscription was erected to his memory.

“Under that stone, near this place, lyeth the body of Thomas Firmin, late citizen of London, a governor of this and Saint Thomas's hospital; who, by the grace of God, was created in Christ Jesus to good works, wherein he was indefatigably industrious, and successfully provoked many others thereto; becoming also their almoner, visiting and relieving the poor at their houses, and in prisons, whence also he redeemed many. He set hundreds of them at work, to the expending of great stocks. He rebuilt, repaired, and added conveniences to hospitals, weekly over-seeing the orphans. The refugees from France and from Ireland have partaken largely of his charity, pains, and earnest solicitation for them. He was wonderfully zealous in every good work, beyond the example of any of our age. Thus shewed he his faith by his works, and cannot reasonably be reproached for that which brought forth such plenty of good fruits.” *Life of Firmin in Unitarian Tracts*, vol. v. 1806.

FIRMIN, in *Geography*, a town of France, in the department of the Rhone and Loire; 5 miles W. of St. Etienne.

FIRMIN, *St.*, a town of France, in the department of the Higher Alps, and chief place of a canton, in the district of Gap: the place contains 851, and the canton 4477 inhabitants, on a territory of 222½ kilometres, and in 9 communes; 13 miles N. of Gap.

FIRMITZ, a town of Bohemia, in the circle of Leitmeritz; 8 miles N.W. of Leitmeritz.

FIRMNESS, FIRMITAS, in *Philosophy*, denotes the consistence of a body; or that state, wherein its sensible parts cohere, or are united together, so that the motion of one part induces a motion of the rest. In which sense, firmness stands opposed to fluidity.

Some authors confound firmness with density; as thinking the same state or property of body implied by both; or at least, that firmness follows density: but this is a mistake. For mercury, the densest body in nature excepting gold, is

yet one of the most fluid; and even gold itself, with all its density, when fused, wants firmness, or cohesion.

Many of the Cartesians, and others, hold firmness to consist in the mere quiet of the particles of the body, and their mutual immediate contact; urging, that a separation of parts can only arise from some matter interposed between them, which is excluded by the motion of contiguity.

But the insufficiency of this hypothesis is evident: for mere simple rest has no force, either to act or resist; and consequently two particles only joined by rest and contiguity, would never cohere so as that a motion of the one should induce a motion of the other. This is obvious in the case of two grains of sand, which, however contiguous, and at rest, will never constitute a firm coherent body.

The firmness of bodies, then, depends on the connexion or cohesion of their particles. Now, the cause of cohesion, sir I. Newton, and his followers, hold to be an attractive force, inherent in bodies, which binds the small particles thereof together; exerting itself only at, or extremely near, the points of contact, and vanishing at greater distances.

The firmness of bodies, therefore, follows the laws of the cohesion of bodies. See COHESION.

Hence, firmness in all bodies must be as the surfaces and contacts of the component parts: thus a body, whose parts are by their peculiar shapes capable of the greatest contacts, is most firm; and that, whose parts are capable of the least contact, will be most soft.

In the former, the greatest requisite is to be as near to cubes as possible, and in the latter to spheres. And in the same manner are to be accounted for, not only all the intermediate degrees between the most firm and the most soft bodies, but those different consistencies, which are distinguished by other names, as friable, tenacious, glutinous, and the like; for the greater are the solidities of the component parts of any body, in proportion to their surfaces, though that body, by the aptitude of the contacts, may be what we call *very hard*; yet it will be most friable or brittle. And where the surfaces of the component particles are much extended upon a small quantity of matter, the bodies they compose, though they may be light and soft, yet they will be tenacious or glutinous; for although the flexibility of their compounding parts admits of their easy changing of figure by any external force, yet by their touching one another in so many points, they are very difficultly separated.

The former is the case in crystallized salts, resins, and the like; the latter in turpentine, gums, and all of that sort.

FIRM-ORE, a kind of lead-ore.

FIRMUM, in *Ancient Geography*, *Fermo*, a town of Italy, in Picenum, nearly S. of Potentia; situated at some distance from the sea. In the course of the Punic war, it sent succours to the Romans against Hannibal. It was taken by Totila, in the year 544.

FIROSAPOUR, in *Geography*, a town of Hindoostan, in Mewat; 13 miles W. of Cottilah. See also FEROSAPOUR.

FIROUSABAD, a town of Persia, in the province of Meeran; 60 miles N.W. of Ermajal.

FIROUZABADI, IBRAHIM ABOU ISHAK, in *Biography*, a Persian doctor of high reputation for knowledge of the principles of the Mahometan law, who flourished in the eleventh century of the Christian era, and was born at Firouzabad, a town near Shiraz. Here and at Bassora he received the fundamental principles of his education. From

Bassora

Raffera he repaired to Bagdat, at that time the imperial city and residence of the caliphs, where he placed himself under the ablest instructor, and was afterwards invited by the illustrious Nezam Molk, grand-vizier, to undertake the direction of the since celebrated college, which had just been erected at his expence. The duties of this important office, which at first he would gladly have declined, he performed with honour to himself, and to the great advantage of those who were committed to his charge, till his death in the year 1083, when he was in the 82d year of his age. His loss was so generally regretted, that his disciples went into mourning for his death; and the college over which he had presided was ordered to be shut up for a whole year, in testimony of the public sorrow which was universally felt. He was author of a work, which is highly esteemed by the Mahometans, entitled, "Al Tanbih," or "General Information;" in which the principal rites and observances of the Mussulman law are fully treated of and explained. Gen. Biog.

FIROZABADI, MEGDEDDIN ABOU THALER MOHAMMED BEN JACOB, a learned Oriental lexicographer, was born in the year of the hegira 729, or in 1328 of the Christian era. He had the high honour of being noticed, on account of his great learning, by the most celebrated potentates of his time, particularly by Ben Abbas, Tamerlane, and Bajazet, first emperor of the Turks, who at different times made him many valuable presents. He died at the age of 88, in the year 817 of the hegira. His works are a dictionary of the Arabic language, entitled, "Camus," or "the Ocean;" it consisted of two volumes. He was author likewise of a work entitled, "Ahasan al Lathail," which is a collection of pleasantries and witty sayings; and of another, "On the Means of being happy." Moreri.

FIROZABAD, in *Geography*, a town of Hindooistan, in the foubah of Agra; 16 miles E.S.E. of Agra.

FIROZAPOUR, a town of Hindooistan, in the circar of Sumbul; 5 miles N.E. of Sumbul.

FIRST MOVER, in the *Ancient Astronomy*. See PRIMUM MOBILE.

FIRST-FRUITS, *Annates* or *Primitia*, the profits of a benefice for the first year after avoidance. See ANNATES and PRIMITIA.

The first-fruits were formerly estimated according to a rate or *valor* made under the direction of pope Innocent IV. by Walter bishop of Norwich, in 38 Hen. III. and afterwards advanced in value by commission from pope Nicholas III. A.D. 1292, 20 Edw. I. which valuation of pope Nicholas is still preserved in the exchequer; and the tenths or *decime* were the tenth part of the annual profit of each living by the same valuation: claimed by the holy see on the authority of the precept recorded in Numb. viii. 26. These papal usurpations were first introduced into this kingdom by Paulus the pope's legate, during the reign of king John and Henry III. in the see of Norwich, and afterwards attempted to be made universal by the popes Clement V. and John XXII. about the beginning of the fourteenth century. These claims were often opposed by the English parliament; but they continued till the reformation in the reign of Henry VIII. at which period it was computed, that in the compass of 50 years, 800,000 ducats had been sent to Rome for first-fruits-only. This revenue was annexed to the crown by 26 Hen. VIII. cap. 3. confirmed by 1 Eliz. cap. 4. and a new *valor beneficiorum* was then made, by which the clergy are at present rated. By these statutes all vicarages under ten pounds a-year, and all rectories under ten marks, are discharged from the payment

of first-fruits; and if the incumbent lives but half a year, he shall pay only one quarter of his first-fruits; if one whole year, half of them; if a year and a half, three quarters; and if two years, the whole. By stat. 27 Hen. VIII. cap. 8. no tenths are due to be paid for the first year; and by other statutes of queen Anne, in the fifth and sixth years of her reign, if a benefice be under fifty pounds *per annum*, clear yearly value, it shall be discharged of the payment of first-fruits and tenths. Queen Anne granted her royal charter, confirmed by stat. 2 Ann. cap. 11. whereby the whole revenue of first-fruits and tenths is vested in trustees for ever, to form a perpetual fund for the augmentation of poor livings, usually called queen Anne's bounty. Blackst. Comm. vol. i. p. 284, &c. See AUGMENTATION.

FIRST-FRUITS, *Office of*, is kept in the Temple, under the direction of a remembrancer, receiver; and comptroller, and their deputies and clerks.

FIRUZABAD, FIROUS-ABAD, or *Giaur*, in *Geography*, a town of Persia, in the province of Farfistan; 65 miles S.S.W. of Schiras. N. lat. 28° 40'. E. long. 51° 58'. — Also, a town of Persia, in the province of Irak; 12 miles W.N.W. of Nchavend.

FIRUZINUS COLOR, a term that frequently occurs in some of the old writers on gems, and has been mistaken by many to mean a rusty brown: and by others, black; but these are not colours to be sought after among the gems, and yet it is to those that this epithet is usually applied. We find it used for a blue kind of jasper by some authors, the same with the jaspis boreas of Pliny and Dioscorides, and by others for the sapphire, which some of the ancients, particularly Theophrastus, having called it *μελανω*, that is, black in its deepest colour, authors have been led to suppose that this word stood for black; but as there are not, nor ever were, any black sapphires, it is certain from this, as well as many other instances, that the ancients used this word, *μελανω*, for a deep blue, and in that sense, firuzinus color does signify the same thing; it being the acrimus color of the ancients, or what we call sky colour, or a fine blue: such as the colour of the finest sapphires.

FIRUZKOH, in *Geography*, a fortress of Greater Bucharia, on the mountains that separate Balk from Segeilan, taken in 1404, by Timur Bee; 30 miles S. of Gaur.

FIS, GERMAN, a sharp in music.

FISA, in *Geography*, a town of South America, in the province of Tucuman; 25 miles N. W. of St. Fernando.

FISANELLE, in *Ornithology*, a name given by the Venetians to a water-fowl of the colymbus kind, called by authors the colymbus major, or great diver. Very common in the markets of Italy. See COLYMBUS.

FISC, FISCUS, in the *Civil Law*, the treasury of a prince, or state; or that to which all things due to the public do fall.

The word is derived from the Greek *φισκος*, a great basket, used when they went to market.

By the civil law, none but a sovereign prince has a right to have a fisc, or public treasury. See FISCARIUM.

FISCAL, something relating to the pecuniary interest of the king, the public, or a private person.

The emperor Adrian erected the office of fiscal advocate in the Roman empire.

FISCARD, or FISHGARD, in *Geography*, is a small market and fishing town in the hundred of Cemmas, Pembrokeshire, South Wales, distant from London 150½ miles,

miles, and by the returns made under the population act, contained, in 1801, 344 houses, and 1505 inhabitants. The town is situated on the declivity of a high cliff, near where the river Gwayne, which separates the hundred of Commaes from the hundred of Pebidiog, falls into the sea, forming a convenient road with good anchorage, vessels lying safely in five and six fathom water. The church is remarkable for little, but being destitute of a steeple. In the town are two other places of worship, one for baptists, and another for methodist dissenters. There are very few good houses, and the narrow, unpaved, filthy streets are strongly contrasted, by the cottages being wholly white-washed, both walls and roofs. The town is however in an improving state, and lately it has received the advantages of a post office, and a weekly market held on Fridays, which is well supplied with corn and other provisions, cloth, flannels, stockings, &c. Yet still its public accommodations are so few and indifferent, that Mr. Malkin's advice to travellers, "that they should aim to avoid passing a night here," is still eligible. A road cut through a rock, forming a communication between the upper and lower parts of the town, opens a fine view to the bay. The harbour, having been recently assisted by the erection of a pier, is of great advantage to the Irish trade, as Fishguard is the only port on this part of the Welsh coast, unimpeded with those dangerous sands, denominated bars; and its situation to the north of Milford renders it a safe retreat for ships in blowing weather, unable to get round St. David's head. The port has a small coaling trade, which employs about fifty vessels, from 20 to 100 tons burthen in the conveyance of butter and corn. A manufacture of coarse cloth is carried on in the town, but the principal part of the inhabitants is occupied in the herring-fisheries, quantities of which in the season are caught and cured here, particularly what are termed red herrings, by the process of smoking. Several smoking-houses are in the vicinity, and from fern being used for the purpose of drying, the fish are esteemed for their superior flavour. From the north-east wall of the church is a remarkable echo, which repeats sentences distinctly three times. In a dingle below the church is a strong chalybeate spring, celebrated for its sanative virtues: and between the church and the river is a vast stone, calculated to weigh more than nine tons, flat at top, measuring nine feet in diameter, and resting upon three others placed in the ground, evidently one of those British Druidical monuments, denominated cromlecheu.

This place was brought into general notice a few years since, by the circumstance of two hostile frigates appearing off the port, and afterwards landing at Llanano, in the neighbourhood, 1400 French invaders, who, after alarming the whole kingdom, and keeping possession of this part of the country a few days, were opposed by the sea-fencibles, and a troop of yeomen cavalry, amounting to 606 effective men, under the command of lord Cawdor, to which inferior force, after a small resistance, they surrendered, and were marched prisoners to Haverfordwest. A curious incident on that occasion deserves notice. To the speedy and favourable termination of this, at first, formidable aggression, it appears the females contributed. Numbers assembled upon the surrounding heights, clad in their scarlet *tabittles*, (long mantles), and drawn up in ranks, the enemy took them for additional forces.

FISCEL, a town of Spais, in Arragon; 15 miles N.W. of Ainsa.

FISCELLUS Mons, *Mount Fiscallo*, a mountain of Italy, between the country of the Sabines and Picenum.

FISCHAMUND, a town of Austria, situated at the

junction of the river Fischa with the Danube; 12 miles E.S.E. of Vienna.

FISCHAUSEN, a town of Prussia, in the Frisch-hoff, anciently the residence of the bishop of Samland; 5 miles W. of Konigsberg. N. lat. 54 45'. E. long. 20° 2'.

FISCHBACH, the name given to several towns of Germany, in the bishopric of Bamberg, in the territory of Nuremberg, and in the principality of Bayreuth.—Also, a town of Swabia, in the county of Limburg.

FISCHBACH, or *Visp*, a town of Switzerland, in the Vallais; 27 miles E. of Sion.

FISCHBRUN, a town of Germany, in the territory of Nuremberg; 4 miles N.E. of Herbruck.

FISCHER, JOHN CHRISTIAN, in *Biography*, the most pleasing and perfect performer on the hautbois, and the most ingenious composer for that instrument that has ever delighted our country during full sixty years, that is to say, since Batista San Martini ceased to be heard. Fischer was born at Friburg, and brought up at one of the common reading schools in a village in Bohemia, where all the children learn music, with reading and writing, as a thing of course. The first instrument put into his hands was the violin, but after he had made some progress in it, taking up the hautbois in sport, he fancied he could express his feelings better with the reed than the bow; he therefore attached himself to that instrument, and became, early in life, so excellent a performer on it, that he was appointed one of the king of Poland's celebrated band at Dresden. Here he remained till his dissolution, when he went to Berlin, without any intention of continuing there; however, arriving at a critical time, he was retained, and had the honour, during a month, to accompany his majesty, Frederic the late king of Prussia, alone, four hours every day. This circumstance was occasioned by an offence having been given by C. Ph. Em. Bach, who, in going with the rest of the band from Potsdam to Sans Souci in winter, had been so frightened by the badness of the road, as to exclaim to one of the household on his arrival, in rather strong terms; "tell our master, sir, that no honour or profit will be a sufficient compensation to us for such dangerous service: and unless the roads are rendered safer, we" (speaking in the name of the whole band), "can come hither no more." It is true that the roads were very bad, and it is as true that Bach was extremely frightened in passing them. But cowardice sometimes is desperate; situations give a courage in remonstrance, of which the greatest heroes are not in possession; for Bach's holdness in this particular not only surpassed that of all his brethren, but of the most intrepid generals, and great captains in the Prussian army; none of whom, however they might have wished it, had the audacity to complain of this dangerous passage ere they could arrive at Sans Souci. But a court is at all times, and in all countries, of difficult access! The consequence of the transport that had escaped Bach was temporary disgrace and banishment from court; and this accounts for Fischer being the only musician allowed to accompany his Prussian majesty in his retirement and rural recreations. From Berlin he went to Mannheim, to hear and be heard, and thence to Paris, where he performed at the "Concert Spirituel;" and of the sensation which his performance produced there, an enthusiastic account is given in the *Mercur de France*. As Fischer, like Abel, was obliged to work his way hither by concerts, as soon as he had a little replenished his purse, he came over to England, where it was always his intention to settle, and where, as soon as he had been once heard in public, at a benefit concert, no other concert, public or private, was thought complete without his performance; and being engaged to play a concerto every night at Vauxhall, he drew thither all lovers of

music, but particularly professors, among whom the elder Park, who played the hautbois at Drury Lane theatre, used to quit his post, and forfeit half his night's salary in order to run to Vauxhall to hear him; which he did not unprofitably, for no tone approaches so near to that of Fischer, in richness and power, as that of the elder Park. When the queen's band was formed, Fischer was appointed one of her majesty's chamber musicians; and when Bach and Abel, uniting, established a weekly subscription concert at Harover-square, where, for a long time, no music was heard but that of these excellent masters, Fischer was allowed to compose for himself, and in a style so new and fanciful, that in point of invention, as well as tone, taste, expression, and neatness of execution, his piece was always regarded as one of the highest treats of the night, and heard with proportionate rapture. Here Cramer, Cresslil, Cervetto, and other eminent professors, established their reputation, and by every new performance mounted still higher in the favour of the public.

In all musical performances at the universities, the triennial meetings at Worcester, Hereford, and Gloucester, at Salisbury, Winchester, and other provincial towns, Fischer's concertos were eagerly expected and heard with rapture. Fischer's tone was not only uncommonly sweet, but so powerful, that Giardini, who never could praise a German but through the medium of abuse, used to say that he had such an *impudence* of tone as no other instrument could contend with. Then his execution was quite as much as the instrument would bear to produce an agreeable effect. His taste and chiaro-scuro were exquisite, and he had his reed under such command, as more seldom to canard or caekle like a duck, than any player we ever heard. And as to his composition, though it was insinuated by Bach and Abel that he had not studied regularly, and was no very profound theorist, he was always to original, interesting and pleasing, that he may be pronounced one of the few intuitive musicians who had powers which he knew not how he acquired, and talents at which study alone can never arrive. A certain musical traveller has drawn a parallel between the performance of Fischer and Berozzi of Dresden, nephew to the two celebrated Berozzis of Turin, on hearing him play a very difficult concerto on the hautbois in a very pleasing and masterly manner; owning, at the same time, that the less he thought of Fischer, the more he was delighted with Berozzi. However, he tried to discriminate, and to discover in what each differed from the other; and first, Fischer seemed the most natural, pleasing, and original writer of the two for the instrument, and was the most certain of his reed; which, whether from being in less constant practice, or from the greater difficulty of the passages, he knew not, failed Berozzi, in rapid divisions, more frequently than Fischer; however, Berozzi's swell, or *mezza di voce*, was prodigious; indeed he continued to augment the force of a tone so much, and so long, that it was hardly possible not to fear for his lungs.

His taste and ear were exceeding delicate and refined; and he seemed to possess a happy and peculiar faculty of tempering a continued tone to different bases, according to their several relations: upon the whole, his performance was so capital, that a hearer must be extremely fastidious not to receive from it a great degree of pleasure.

Fischer left England in 1786, and in the beginning of the next year had not been heard of. His majesty enquired several times, with some solicitude, whether he had written to any of his friends in England, and was answered in the negative; one of them understood, by report, that he was at Strasburg. He returned, however, at the end of 1787, and continued in England during the rest of his life. About

the year 1777 he had married a daughter of the admirable painter, Gainsborough, an enthusiastic lover of good music and performance, and of none so much as Fischer's; indeed he enchanted the whole family with his strains, which were beyond measure captivating, and he stood so well at his instrument, that his figure had all the grace of a Tibian at the altar of Apollo. But, alas! something else besides a fine figure and fine music are necessary to constitute domestic happiness. The marriage was not auspicious; the minds were not in tune together, the temperaments were dissonant, and the coincidence too infrequent to produce harmony. But we wish not to "draw their frailties from their dread abode;" she had external beauty, grace, and accomplishments; but he, with a good person, and superior genius for his art, was extremely deficient in colloquial eloquence, and in all those undefinable charms of conversation which engage the attention, and endear the speaker. He had not a grain of sense but what he breathed through his reed; he never spoke more than three words at a time, and those were negatives or affirmatives. But peace to his ashes. Though he had few charms for a friend or companion, he delighted the public at large in a higher degree than is allowed to any but gifted mortals. This admirable musician was seized with an apopleptic fit during the performance of a solo at the queen's house, at his majesty's concert. Prince William of Gloucester, observing his situation, supported him out of the apartment, whence he was conveyed to his residence in Compton-street, Soho, where he expired about an hour afterwards.

FISCHER, JOHN ANDREW, a physician of Erfurt, was born on the 28th of November, 1667, his father was a celebrated apothecary of that place. He graduated in the university of his native city, in April, 1691. He was appointed professor extraordinary in the faculty of Erfurt in 1695, and professor of logic in the Evangelical College in 1699; but he relinquished both these appointments in 1718, in order to assume the duties of the professorship of pathology and of the practice of medicine, to which he had been nominated three years before. Fischer acquired considerable reputation at Erfurt, and in the courts in the vicinity of that city. He had been ten years physician to the court of Mayence, when he died on the 13th of February 1729. He has left several essays in the form of inaugural theses; which were published between the year 1718, and that of his death; but he was also author of some more important works: *viz.* 1. "Consilia Medica, quæ in usum practicum et forensium, pro scopo curandi et renunciandi adornata sunt." Three volumes of this work were published successively at Francfort, in the years 1704, 1706, and 1712.—2. "Ilias in nucæ, seu Medicina Synoptica," Erfurt, 1716.—3. "Responsa Practica," Lipsiæ, 1719.—Eloy.

FISCHER, in *Geography*, a town of the duchy of Carinola; 17 miles S.E. of Stein.

FISCHERLIN, in *Ornithology*, a name given by many of the northern nations to a small species of the larus or gull, called by Mr. Ray *larus piscator*, by Linnæus *larus minutus*, and in the English, the lesser sea-swallow. See LARUS.

FISCHGEYER, a name given to the *fulco rufus*; which see.

FISCHIARE, *Ital.* to hiss. *Fischista*, hissed.

FISCHETTO, *Ital.* a whistle, a hiss, a cat-call.

FISCHOUTER, in *Zoology*, a name given by Ridinger to the *myx. lutra*; which see.

FISGARD. See FISCARD.

FISH, in *Zoology*, a class of animals which have either a naked or scaly body, always having fins, but without feet. For a further description of the characters of this class, and

of the different orders into which it is distributed; see PISCES. See also ICHTHYOLOGY.

FISH, or FISHES, *Anatomy of*, has engaged much of the attention of physiologists, on account of its affording many examples of organs on a simple plan, or palpable scale, which in other animals possess either an obscure or minute structure. The brain, the ear, the organ of smelling, the digestive and absorbent systems, have been especially studied in this class, with the view of illustrating their anatomy and functions in other creatures.

The continual rest and progression of fishes in so dense a medium as water, necessarily occasion remarkable peculiarities in their organs of motion, as well as a different mode of exposing the blood to the influence of the air, and consequently a different arrangement of the circulating vessels than is usually met with in other animals; these parts of the anatomy of fishes are instructive both to the natural historian and to the physiologist.

The very extraordinary property which some fishes possess of communicating an electric shock, forms one of the most interesting subjects in the history of the animal economy.

In composing the present article, we have drawn our information, as far as our opportunities permitted, from actual dissection and observation; frequent references to the writings of other anatomists are therefore not introduced. It is necessary, however, to acknowledge, that we have derived great assistance from the comprehensive system of M. Cuvier, particularly with respect to the anatomy of the rare and exotic species of fishes; and that we are indebted for several interesting facts to the very valuable, though compendious work, of professor Blumenbäch on comparative anatomy, translated by Mr. Lawrence.

Organs concerned in the exercise of the vital functions.

The mouth and its contained parts.—The position of the mouth of fishes is somewhat various. It may be stated generally, that it is situated under the snout in the *chondropterygii*, in the *sturgesons* (*acipenser*), and the *pogonius*. In other fishes it is placed at the end of the snout.

The *orifice* of the mouth in fishes has usually the appearance of a transverse slit, as in mammalia; but in several species, particularly amongst the *abdominal* fishes, the aperture of the mouth is made by a fissure passing obliquely downwards and backwards. In the *lamprey* (*petromyzon*) the mouth is nearly round, and resembles a sucker.

Fishes cannot, with propriety, be said to possess *lips*. Many of them have some folds of the integuments, which overlap and conceal the edges of the jaws and teeth; but these parts possess neither the structure, nor perform the functions, of the lips in mammalia. In several fishes with large scales no soft parts are discoverable about the edge of the mouth.

The *cavity* of the mouth of fishes is usually very great, in proportion to the size of the animal; a circumstance highly necessary to them on account of the manner in which these animals take their prey: for the same reason also, the mechanism of the jaws is such as to allow the mouth to be protruded or pushed forwards, and opened to a great extent. In some species the mouth is capable of being opened sufficiently wide to take in a body even larger than that of the fish to which it belongs. The great capacity of the mouth, and the peculiarity in the motions of the jaws, depend upon the number of bones or cartilages which enter into the composition of the face of fishes, and upon the existence of certain muscles. These parts will be described along with the other organs of motion.

The *internal surface* of the mouth in fishes bears con-

siderable resemblance to the common skin; it is, however, divested of scales, and is generally white, although in some fishes it partakes of the colour of the surface of the body; in the *mackerel* (*scomber scombrus*) for instance, it is of a silver hue, tinged with blue.

Every part of the mouth is covered with a very tenacious slime, or mucus; the glands which secrete it are not in general easily seen, and do not commonly appear to be congregated in particular parts of the mouth or pharynx, as in mammalia.

As fishes do not chew their food, they do not require an extensive motion of the *tongue*; in most species this organ performs no movement, except what is dependent upon the parts with which it is connected. Cuvier has described two muscles of the tongue in the *conger eel* (*muraena conger*) analogous to *hyoglossi*, and some transverse fibres extending from the edges to the middle of the tongue in the same fish. We have not discovered any muscles corresponding to these in some other species we have examined. If the tongue of fishes were generally provided with muscles it usually forms but an inconsiderable projection into the cavity of the mouth that it could not serve as an organ of mastication; in many species it is scarcely to be distinguished from the other parietes of the mouth, and in the *ray* genus there is, properly speaking, no tongue, the place of the lingual bone being supplied by a mere rim of cartilage.

Salivary glands do not appear to exist in the class of fishes, with the exception of the *carp* (*cyprinus*), in which there is a glandular body of considerable size placed under the base of the cranium, exactly before the grinding teeth; the gland is of an uniform structure and a yellowish red colour, it adheres firmly to the membrane of the palate which covers it. In this genus the teeth of the pharynx are constructed for dividing or triturating the food.

In the *skate*, *thornback*, and others of the *ray* genus, there are many glandular bodies, about the size of pins' heads, lying under the membrane of the palate, upon the muscles for depressing the lower jaw: their internal structure is cellular, and they appear to secrete the mucus with which the mouth of these fishes is so abundantly supplied.

The *teeth* of fishes are very remarkable, whether we consider them with respect to the number, situation, or figure.

In those instances where the teeth are sufficiently large to be distinctly seen, some hundreds have been reckoned in a single fish; the *white shark* has upwards of two hundred around the aperture of the mouth, and when the teeth are minute and closely set, as in many of the osseous fishes, their number exceeds all calculation.

The *situation* of the teeth in fishes is extremely singular; they are not confined to the jaws, but are sometimes on the palatine arches, on the bone analogous to the *maxilla*, which descends from the cranium to form the middle of the roof of the mouth, on the lingual bone, on the internal or concave surface of the arches which form the pharynx, and upon those bones which are placed in the pharynx or commencement of the oesophagus. Some fishes, as the *salmon* and *pike* have teeth in all these situations. The *salmon* *draco*, and *perch* want them on the tongue; the *uranoscopus* has them on the tongue and maxilla. The palatine and buccal teeth are absent in the *carp*, the *grass gadus*, the *gurnards* (except the *torpedo*), the *carp*, *turbot*, *sole*, and *dog*. The genus *lacustris* has only the maxillary, branchial, and pharyngeal teeth. The *dog* *fish* has teeth without all, except the branchial and pharyngeal, and the last kind of teeth only are found in the *carp*. The *ray* and *skate* genera have the maxillary alone. The *dog* *fish* is perhaps the only fish which is entirely deprived of teeth.

The *shape* of the teeth in fishes is very various. Cuvier

has, however, established four principal forms to which he thinks all the others may be referred: the first are the *hook-shaped* teeth, which have sharp points bent towards the back part of the mouth; these are usually of a small size, and are very numerous, they are by far the most common: most fishes have them in some part of the mouth. The second kind of teeth are truly *conical* in their form; the anterior teeth of the *anarrhichas lupus* afford the best examples of these. The third sort have the *crowns* either *flat* or *blunt*, and *rounded*; the pharyngeal teeth of the *carp* (*Cyprinus carpio*) are broad and flat, like plates, and as instances of those with round crowns may be mentioned, the posterior teeth of the *dorado* and others of the genus *sparus*. The fourth division of Cuvier includes the teeth with a *cutting edge*, or the *wedge-shaped*; these may either have the edge plain, as in the *plaïse* (*pleuronectes plaïssa*), or denticulated, as in the *teuthis*.

Different species of teeth frequently exist in different parts of the mouth in the same fish; thus, the genera *teuthis*, *ostracion*, and *balistes*, have hook-shaped teeth posteriorly, and incisive in the front of the mouth. In the *anarrhichas lupus*, and some of the genus *sparus*, there are hook-shaped teeth behind; plates or flat-crowned in the middle of the mouth, and conical teeth before; the *sparus fargo*, and some others, have the front teeth incisive, the middle flat-crowned, and the posterior hook-shaped.

Cuvier has given a description of the form and situation of the teeth in most of the principal genera of fishes; but, as much minuteness or detail on this subject cannot prove interesting in an anatomical point of view, we shall confine ourselves to the more striking varieties in the teeth of fishes.

In the genus *raja* the jaws are beset with a number of teeth arranged in the manner of a pavement; these are usually of the same size, and disposed in squares closely set to each other. In some species, especially in the foreign *rays*, the middle teeth are the largest, and run in bands across the jaws: in some of these also this pavement of teeth is prolonged towards the palate; in the *torpedo*, and some other species of *raja*, each of the teeth is elevated in the middle into a spine or sharp point.

In the *shark* genus (*squalus*) there are several rows of teeth; those of the front row are the largest and oldest, and stand up on the jaw; the succeeding rows are of later growth, and are laid down with their points turned towards the mouth; the number of the rows that are turned inwards varies even in the same species. The form of the teeth in this genus is usually that of a triangular plate; they are attached at their base, and the other edges are more or less denticulated or grooved.

Amongst the *branchiostegi* there is very considerable variety. The genera *balistes* and *ostracion* have eight teeth upon each jaw; in the former they are wedge-shaped, broad, and flat, and with oblique edges; in the latter they are compressed upon the sides. The pharynx of the *balistes* is furnished above and below with two rows of fine, conic, close-set teeth.

The *lump fish* (*cyclopterus lumpus*) has one or two rows of small pointed teeth upon the jaws and the pharynx.

The *frog-fish* (*lophius piscatorius*) has two rows on each jaw, a small one on each side of the palate, and the four plates of the pharynx furnished with tolerably strong hooked teeth.

In the *spatularia* there are a number of very minute teeth upon the jaws and lateral parts of the palate.

In the *sturgeon* (*acipenser*) there are no teeth of any kind found.

In the *chimara* the lower jaw furnishes two naked projections, which are striated and sharp-edged, and the upper

jaw has two others of nearly a square figure, which correspond to these. In the palate there are two triangular ctesseous plates.

Cuvier thus describes the singular formation of the jaws, which supplies the place of teeth, in the genera *diodon* and *tetraodon*.

The lower jaw of a *diodon* presents two eminences, which are used for mastication, *i. e.* the border of the jaw, which is parabolic, and a round disk in the middle.

A large canal runs in the interior of the bone, and separates the mass of the disk from that of the border, and transmits to both these parts their nerves and blood-vessels. The triturating surface of the disk exhibits some transverse and parallel striæ; on cutting it in a vertical direction each of the striæ is perceived to be the termination of a plate or lamina, which ascends a little posteriorly from the canal to the disk. These laminae are all laid one upon the other, and by this position the superior laminae are most exposed to friction, and consequently the shortest. They are evidently also the oldest; they are hard and consolidated together, in proportion as they descend they are softer and more separate from each other. The lowest do not reach the triturating surface, but are covered by the bone of the jaw; these are quite distinct from each other, and shew the original and proper structure of the plates.

Each of these laminae is divided by a fissure in its middle. The inferior and posterior surface is tolerably smooth, but the opposite one exhibits, when viewed through the microscope, an extremely fine net work of little canals; this is occasioned by the impressions left by vessels which have run upon it, and which came from the large canal where the bases of the laminae rest; in fact, the parietes of the canal are preceded by an infinite number of small holes, which lead into the intervals between the laminae.

The border is also furnished with laminae which increase in an opposite order to those of the disk; the anterior laminae being inferior and of the latest growth. The laminae also are parallel with the surface of the masticating border. The first lamina which is used presents its flat surface, and is consequently entirely worn before the one which succeeds it.

The description here given of the lower jaw of the *diodon* applies equally to the upper jaw, provided the names of the laminae are changed according to their different position, as superior for inferior, and *vice versa*.

The genus *tetraodon* resembles the *diodons*, in having the laminated borders, but wants the triturating disks. Each of their jaws is divided into two pieces by a denticulated suture.

Fig. 1. Plate I. *Anatomy of Fishes*, exhibits the lower jaw of a *diodon*, cut through longitudinally; *a*, the central plate, or triturating surface; *b*, the section of the laminae, the edges of which constitute the triturating surface; *c*, the large canal through which the vessels and nerves of the laminae are transmitted; *d*, the border of the jaw; *e*, the laminae which form it; *f*, a smaller canal for accommodating their vessels and nerves.

Amongst the *apodal* fishes, the *anarrhichas lupus* has the teeth of the front of the jaws very strong, and conical in their figure; those of the side, and on the vomer, form large hemispherical tubercles; the internal row of each palatine arch is similar to the second, and the external to the first; the pharynx is set with small conic teeth.

The *murena belena* has the teeth compressed, with thin edges, and sharp-pointed; those of the common *eel* and the *conger* (*murena anguilla* and the *conger*) are small, straight, strong, blunt, and close set; the first teeth of the vomer in the *belena* is at a distance from the others, which it also much exceeds in size.

F I S H.

The *jugular* order of fishes also exhibits considerable varieties in the form and number of the teeth.

The *blennius superciliosus* has a very regular close row on each jaw of long narrow teeth: the *blennius ocellaris* has besides a strong hooked tooth placed at the back part of each jaw.

The *trachinus draco* possesses teeth in all the different situations except the tongue; they are very minute and close-set, resembling the pile of velvet.

The *uraoscopus scaber* has twelve or fourteen teeth, of a hook shape, on the lower jaw, and numerous minute teeth on the upper jaw and pharynx, and two little lateral plates on the fore-part of the vomer.

In the *thoracic* fishes there is perhaps still greater variety than in the preceding orders; the individuals of the same genus often differing from each other.

The *flying gurnard* (*trigla volitans*) has only some small blunt tubercular teeth upon the jaws; the *armed gurnard* (*trigla cataphracta*) has some close-set teeth, like villi, upon the branchial arches and vomer, and none at any other place. The *common gurnards* have fine teeth upon the jaws and branchiæ, and a little plate on the anterior part of the vomer.

The *dory* (*zeus faber*) has some small hooked teeth upon each jaw, the vomer, and the branchial arches. The *zeus vomer* has on the lower jaw only a row of teeth, so fine as scarcely to be felt.

In the genus *pleuronectes* there is considerable variety with respect to the form and situation of the teeth.

The *chetodons* have upon the jaws long, fine, setaceous teeth, like the bristles of a brush.

The pharyngeal teeth of the genus *labrus* are broad and hemispherical, and are disposed exactly like pavement; the anterior teeth vary in the different species.

The *labrus niloticus*, however, differs remarkably from the rest of the genus; the jaws are furnished with several rows of long, slender teeth, which have two or three points; the teeth of the pharynx are straight, slender, sharp, and very long.

In the genus *sparus*, the lateral teeth of the jaws are arranged in the manner of a pavement, in two or more rows. In some species two of these teeth are distinguished from the rest by being larger, and of a more flattened oval figure; the anterior teeth vary much with respect to their form.

The *perches*, and the genus *holocentrus*, in general have numerous minute teeth, like villi, upon the two jaws, the anterior part of the vomer, each side of the palate, the tongue, and the pharynx.

The jaws of the genus *scarus* are naked, and project somewhat like the beak of a parrot; each mandible is divided by a middle suture; the border is furnished with some little short cutting teeth, which are very closely applied to each other.

In the genus *cepola* there is a single row of teeth to each jaw. Those of the lower jaw are remarkably spread out.

In the *abdominal* order of fishes, the genera *silurus* and *salmo* exhibit great variety with respect to their teeth; in the latter genus particularly the differences are very remarkable.

The *silurus clarias* has the teeth of the upper jaw straight, slender, and sharp, but those of the lower jaw are bent into the form of an overturned italic *o*; they are long, compressed, and terminated by a point.

The *common salmon* and *trouts* (*salmo salar*, and *salmo fario*) have hook-shaped teeth in all the parts of the mouth

where they are met with in other fishes, and likewise upon the arches which form the extensile lip of fishes.

The *salmo dentex* has ten or twelve large hook-shaped teeth upon the jaws; those of the pharynx are fine, like villi.

The *salmo nefasch* has the maxillary teeth setaceous, like those of the *chetodon*, but forked at the extremity, and the pharynx covered like velvet.

The maxillary teeth of the *nilotic salmon* are thick and truncated, and have the crowns furnished with two or three conic tubercles, like the molar teeth of some quadrupeds.

The *ferra salmo* of La Cépède has ten or twelve teeth on each of the jaws, in the form of sharp wedges, with three or five notches on the edge.

The jaws of the *salmo rhomboides* have very small, short, flexible, setaceous teeth.

None of the last mentioned five species have the interior of the mouth furnished with teeth in the same manner as the *common salmons* and *trouts*.

The whole of the genus *cyprinus* possess only teeth in the pharynx. The superior pharyngeal bone presents a single plate; and the two inferior bones of the pharynx are each furnished with very thick, strong teeth, which vary in number and form in the different species.

The *carp* (*cyprinus carpio*) has four or five of these teeth; the three or four posterior and superior of which are flat-crowned and transversely grooved; the one most anterior is round, with a little point in the middle.

Some other species of *cyprinus*, as the *auratus*, the *bipunctatus*, the *bream*, *tench*, and *rud*, have the teeth compressed, and their edge applied obliquely to the superior pharyngeal bone.

The *barbel* (*cyprinus barbuis*) has nine pharyngeal teeth, four below, three in the middle, and two above; they are club-shaped, and end in points a little bent.

The *cyprinus dobula* has seven teeth in two rows, all pointed, and a little like hooks.

The *cyprinus nesus* has twenty-one compressed teeth.

In the *nilotic carp* there are eleven of these, the points of which are worn down by friction against the plate of the superior pharyngeal bone.

The genus *esox* are well supplied with teeth. The *common pike* (*esox lucius*) has teeth in all the parts of the mouth where they are found in other fishes; those of the vomer are tubercular, the others are hook shaped; the *esox belone* has the maxillary teeth strong, hook-shaped, and in one row; it wants the lingual teeth.

There are three different *structures* to be observed in the teeth of fishes.

The first kind of structure exists in the conic and hook-shaped teeth, which are generally found in the osseous fishes; their teeth are implanted in alveoli, as the teeth of mammalia; they consist of osseous substance, covered externally by a layer of enamel: after the eruption of the crown or external part, the roots of their teeth become ankylosed with the bone which contains them so firmly, that they cannot be separated without a fracture of the latter. The growth of the teeth situated in sockets is effected by the development of internal osseous layers.

The second kind of structure is found in the teeth of the genus *squalus*. These are not immediately connected with the jaws, but are contained in the gums, or soft parts covering them. They increase in the manner of the epiphyses of bones: their osseous part is at first soft and porous, and afterwards acquires throughout the density and hardness of ivory.

The third sort of structure belongs to the flat or blunt teeth,

teeth, which are arranged in the manner of a pavement, as they are on the jaws in the ray genus, and in the palates of several other fishes. They are composed of a number of minute osseous tubes, arranged in the direction of the teeth, intimately connected together, and covered upon their external extremities by a common layer of enamel. From this structure Casier has distinguished these teeth by the term *compound*. They are not implanted in the substance of the bone, but adhere to the membrane which covers it; they evidently, however, consist of two parts corresponding to the root and crown; the former is marked by regular and close furrows, and contains a number of pores, which receive and transmit the nerves and blood-vessels of the teeth; the tubes of the crown are more dense in their structure than the rest of the teeth.

The jaws of the *anarrhichas lupus* are furnished with a number of dentiform eminences, which are composed of osseous tubes, or fibres that run from the base to every point of the surface. The base adheres to the jaw by its circumference only; this circumference exhibits many foramina, through which the vessels and nerves pass to the tubes when in a state of growth. All these eminences are placed upon a substance much more spongy than the rest of the jaw, which serves as the medium by which they are united. On the middle of each eminence a little tooth grows, but is cast off very early, so that, except when the fish is young, the dentiform eminences alone seem to supply the place of teeth. *Fig. 2.* of *Plate I.* of the *Anatomy of Fishes*: *a* is the dentiform eminence; *b*, the small teeth on it. *Fig. 3.* of *Plate I.* shows the surface on which the eminence is fixed.

The triturating surfaces of the jaws in the genera *diodon* and *tetraodon* might be considered as compound teeth; the laminae are analogous to the tubes, and are covered, like them, by enamel.

The mode of *succession* of the teeth of fishes varies according to their structure. Those that grow in sockets are replaced by others which form at their roots, when the root of the old tooth becomes consolidated with the socket which contains it; it is nourished like the rest of the bone, and acquires a cellular structure, which it did not originally possess. In proportion as the new tooth increases, the substance of the jaw grows into the cavity of the old one, which it fills up to the crown. This then separates from the rest of its root by a regular fracture which exhibits some radiated lines.

The new teeth in many species penetrate the cellular osseous substance, which fills up the cavity of the root, and exactly occupies the situation of the tooth that is cast off. In the large, pointed teeth, such as those of the genus *fox*, &c. the eruption of the new tooth is on the side of the one that is shed.

In the *anarrhichas lupus*, not only the teeth are shed, but those singular eminences on which they grow are also cast off, and replaced by others. These eminences appear to resemble in structure and mode of growth the horns of the *deer*; they are shed precisely in the same manner; those which succeed grow on the side of the eminences they replace, and do not, until they increase in size, fill the vacancy left by the latter.

When the first teeth of the *rays* are lost they appear to be replaced by others, which grow in the same situation.

The cutting teeth of the *sharks*, as already mentioned, are in several rows, the anterior of which only is used by the animal; the posterior rows are of successive growths, and are designed to supply the place of those in the front row, in the same manner as the venomous teeth of *serpents* are succeeded by those of a later growth situated behind.

The laminae which compose the triturating surface of the jaws of the *diodons* and *tetraodons* are replaced in a manner analogous to the cutting teeth of the *shark*; these laminae grow and come into use successively, by which means the masticating surface is always preserved.

In the genus *scarus* the teeth are replaced by others growing from behind, but which do not make their appearance until they are wanted. On examining the jaws of one of this genus, a number of tubercles are observed on the fore-part, which are the remains or roots of the teeth that have been worn down; and if the jaw be divided, a multitude of the germs of teeth will be discovered internally, which are afterwards to come into use.

The mechanism of the jaws, the small size and immobility of the tongue, the want of salivary glands, and the usual form and position of the teeth, in fishes, all conspire to point out the manner in which these animals take their food, and that they do not, but with very few exceptions, masticate it, or even in any degree divide it previous to its being received into the stomach.

Pharynx and œsophagus.

The pharynx of fishes is rather distinguished from the rest of the œsophagus by analogy of situation, and for the convenience of description, than from any resemblance it bears to the pharynx of mammalia.

The passage from the posterior part of the mouth into the œsophagus is diminished by the existence of certain bones, which are attached to the bases of the branchial arches, and enter into the composition of the palates of the commencement of the alimentary canal.

These are very properly called the *pharyngeal bones*; they are usually beset with teeth, as already mentioned; the last branchial arches and the pharyngeal bones can be approximated by certain muscles, so as nearly, if not entirely, to shut up the communication between the mouth and œsophagus: immediately behind the branchial arches and pharyngeal bones there is a very strong sphincter muscle, which surrounds the origin of the œsophagus, and appears to be the continuation of those fibres which close the branchial arches. This muscle seems to have the power of perfectly shutting the pharynx. The design of this mechanism is evidently to enable the fish to convey its prey, without any preparation, and while it is still alive, into the stomach. The teeth situated on the pharyngeal bones, and on the inside of the branchiæ, are well calculated for assisting in this operation: to understand the effect of the teeth of a fish in the act of deglutition, it is only necessary to introduce the hand into the back part of the mouth, even after the animal is dead, when it will be found that the retreat of the hand is opposed by the points of a number of teeth at all sides. The construction of the interior parts of the mouth and pharynx appears to be entirely subservient in fishes to the performance of deglutition.

In *Plate I.* of the *Anatomy of Fishes*, *fig. 4.* exhibits a view of the back part of the mouth or pharynx of the *carp* (*cyprinus carpio*); *a*, the inferior pharyngeal bones beset with strong grinding teeth; *b*, the superior pharyngeal bones with flat surfaces; *c*, the superior palates of the mouth; *d*, the tongue; *e e*, the branchial arches of each side; *f*, the aperture left between these parts which leads into the œsophagus.

The *œsophagus* of fishes is commonly very short; in some instances the mouth might almost be said to open into the stomach; it is by no means unfrequent, on separating the jaws of a fish extensively, to bring into view the contents of that cavity.

The œsophagus is generally very wide, often of the same capacity as the stomach itself. A free passage into the stomach becomes necessary to those animals, on account of the size of the fishes they prey upon, and their voracity in catching them. Fishes rush upon whatever appears to be their prey impetuously, and sometimes without discrimination. In this manner they sometimes swallow other substances along with, or in place of, their proper food. We lately took a large stone out of the stomach of a *dory* (*zeus faber*), which bore all the marks of having resided there some time: it was from a knowledge of the rapacious habits of this fish, that the story of St. Peter's taking the tribute money out of its mouth probably originated.

The œsophagus is covered internally, as in other animals, by cuticle, which terminates abruptly at the stomach in some fishes; this however is not perceptible; in which cases it is difficult to determine exactly the limits of these two portions of the alimentary canal. The internal membrane is usually white and smooth, and forms some longitudinal wrinkles, folds, or spiculæ. In several of the *ray* and *shark* genera this structure is very evident, although Cuvier describes the internal surface of the œsophagus and stomach in these fishes to be alike. In the *maid* (*raja clavata*) the distinction between the structure of the œsophagus and that of the stomach is strikingly plain. In the *dog-fish*, the laminæ of the internal membrane of the œsophagus are numerous, prominent, and terminate in points which are directed backwards. These diminish the capacity of the canal, and thus serve to detain any fish the animal may swallow; but the most remarkable contrivance of this sort is that lately discovered by Mr. Home in the *basking shark* (*squalus maximus*). In this fish, in addition to the spiculæ observed in the other species of *squalus*, the œsophagus produces, around its termination in the stomach, a number of fringed processes, very much resembling shoulder-knots; these appear to be muscular internally, and probably are capable of entirely closing the entrance of the œsophagus into the stomach. In *fig. 5.* of *Plate I.* of the *Anatomy of Fishes*, the stomach and œsophagus of the *basking shark* (*squalus maximus*) is represented upon a very reduced scale: *a* shews the spiculated part of the œsophagus; *b b*, the fringed termination of that canal.

In the *spatularia*, the parietes of the œsophagus have three strong longitudinal rugæ, and some others between them of a smaller size. In the *sturgeon*, the internal membrane produces spines like those of the dog-fish; which, when minutely examined, are seen to be reticulated upon the surface. The *sgnathus pelagicus*, and *sparus sfganus*, have large longitudinal folds in the œsophagus. The latter has likewise an œsophagus of some length: at the place where it joins the stomach, it forms a caecal process or cul-de-sac of a conical figure, the end of which is turned forwards.

In the *ostracion orbicus*, and some other fishes, there is a circular fold of the internal membrane, which clearly marks out the termination of the œsophagus; in other instances, this part may be distinguished from the stomach by the strength and arrangement of its muscular fibres, but in every instance, if the blood-vessels of these parts have been previously injected with a coloured fluid, there will be no difficulty in determining which is the œsophagus and which is the stomach, the former being always less vascular.

The œsophagus in fishes is particularly well supplied with mucus, to facilitate the passage of any body through it; this mucus is furnished by follicular glands, which are situated behind the internal membrane; they are more numerous in some fishes than others: we have found them very plain and arranged in clusters round the œsophagus of the *mullet*.

There is on the œsophagus of the *torpedo* a very remarkable glandular apparatus for the secretion of mucus.

Of the Abdominal Cavity.

The abdomen of fishes is a distinct cavity containing only the viscera proper to that part; it differs therefore from the common cavity of the body in birds and reptiles: it however usually occupies the greater part of the trunk in fishes in which it does not resemble the abdomen of mammalia. Its parietes are chiefly composed of the portion of the great lateral muscles which are spread upon the sides of the body, the ribs being too short in fishes to form a frame for the abdomen; the cavity is every where covered with peritoneum, except next the spine, where that membrane is reflected across the air-bladder and kidneys, leaving those parts on the outside of the peritoneum. The reflections of this membrane, which embrace the different abdominal viscera, are very thin, but the part which lines the abdomen is sufficiently strong. In the *moon fish* (*tetraodon melis*), and in many other tetraodons, it is stated by Cuvier to be thick, soft, and as it were gelatinous; although in the *sturgeon*, and others of the *branchiostegi*, its texture is firm and tendonous looking.

The portion of peritoneum which lines the muscular parietes of the cavity very frequently partakes of the colour of the external surface of the body, in consequence of there being a pigment placed behind it. In the *plaise* (*pluronotus plateja*) the two sides are of different colours, corresponding to the brown and white sides of the body in that fish.

In some fishes there are processes of the peritoneum which go on each side of the inferior spinous bones of the tail under the lateral muscles; these form sacs for containing usually the organs of generation and part of the kidneys, and in some instances a convolution of the intestines: thus the bag which goes out on the dark side of the *sole* receives a long coil of the intestinal canal.

There are some very remarkable circumstances to be noticed in the abdomen of the *ray* kind and the *sturgeon* (*acipenser*): there have long been observed in the former two foramina, one on each side of the anus, which lead by a short oblique canal into the cavity of the abdomen; they are wide enough to admit a goose-quill in a large skate, but contain within them a semilunar fold, which acts as a valve in obstructing the passage of the water into the abdomen, but does not prevent fluids to pass out of this cavity. Doctor Monroe, who assumed the discovery of these foramina, was inclined to suppose that the sea water occasionally was admitted by them: he says, "the great quantity, and evidently salt taste of the liquor of the abdomen, lead him to look for passages by which the sea water might get into the cavity." In one instance, he had the fluid analysed, when he found that it contained about one seventy-eight part of salt, which however, he admits to be not a fifth the quantity that exists in common sea water. "Further," he says, "I discovered that in the *skate*, the bottom of the pericardium is lengthened into the shape of a tunnel, which divides into two branches which are tied closely to the lower part of the œsophagus, and open into the cavity of the abdomen: from the obliquity of these branches, and the intimate adhesion to the œsophagus, either air or water can be forced into them from the abdomen. Hence, unless we suppose that in the living animal they take up the fluid from the abdomen, in the way our pupils have said, up the tube, which is highly improbable, we must conclude that they serve to convey the liquor of the pericardium into the cavity of the abdomen." *Monroe's Physiology of Fishes*, p. 25.

In the *sturgeon* (*acipenser sturio*) Doctor Monroe has also described

described and figured two openings near the anus, similar to those found in the *skate*, and further, he discovered in the *surgeon* a large membranous funnel, situated upon each kidney, into the middle of the pelvis of which its bottom opens by a wide orifice. "We can have little or no doubt," he says, "that the liquor of the abdomen of the *surgeon* passes into the pelvis of the kidney, for we cannot suppose that the urine passes through the holes described into the cavity of the abdomen, as the pelvis has large openings into the common cloaca, as in other fishes." (Monroe, loc citat.) He concludes by expressing his opinion, that the design of the holes on the side of the anus is to admit the sea water, and that the funnels connected with the kidney are for the purpose of discharging it again. From the circumstance of the water of the abdomen containing so much less salt than sea water, and even less than that found within the cranium of fishes, which is a shut cavity, he is disposed to admit that it is in part a secretion from the arteries. In our opinion, it appears more reasonable and consistent with general analogy to suppose, that all the fluids moistening the cavities of these fishes are produced in the usual way, and that the openings are merely for carrying the superabundant liquor out of the body, than to imagine that an extraneous fluid should be admitted to supply the place of a peculiar secretion; considering the matter in either point of view, however, the anatomical fact of a communication between the interior cavities of the body and the external element, is not only highly curious, but without example in any other class of animals.

Stomach.

This cavity is commonly situated immediately behind the septum which separates the heart and branchiæ from the abdominal viscera to which it is attached, as well as to the surrounding parts by reflections of peritoneum.

The form which the stomach of fishes most commonly possesses has been very aptly compared to the head of the chemical vessel, called an alembic, supposing it to be inverted and a little elongated; the large opening corresponds to the œsophagus; the small or lateral part to the contracted portion, which ends at the pylorus, and the bottom to the cul-de-sac of the stomach. The most common deviations are produced by the bottom of the cul-de-sac, or cæcal portion of the stomach, being either longer or shorter than what has been proposed as the standard shape. There are also other varieties in the figure of this viscus which will be noticed in the following description.

The muscular coat of the stomach varies very much in thickness, and likewise with respect to the distinctness and arrangement of its fibres.

Between the muscular and internal coats there is often found a layer of mucous follicles.

The internal membrane varies very much as to thickness, and its surface is either smooth, reticulated, or plicated.

The structure of the stomach in fishes does not correspond with any natural classification of these animals, and therefore does not admit of a systematic description.

The *rays* have the stomach nearly of the common form. There are some folds of the internal membrane; in the *maid* (*raja clavata*) it is a thick spongy mass, which peels off easily after maceration. The irregularities of the surface look like the rugæ of the human stomach, they are not however produced by the folding of the coat, but by the thinness or actual deficiency of some parts of it, we observed very thinly scattered over it those small round depressions which Mr. Home has conceived to be the glands for secreting the gastric juice; in this as well as other instances

these glands bear no sort of proportion to the quantity of the fluid which physiologists have hitherto supposed requisite for digestion.

The stomach in the *sharks* consists of two portions; the first is much longer and wider than the second, which is straight, and has the appearance of an intestine; the two portions communicate by a small opening, which will only permit substances to pass into the second stomach, that are reduced into a smooth and fluid state. There are well marked longitudinal rugæ in the first stomach, but those in the second are but little apparent.

In the *basking shark* (*squalus maximus*) the first stomach is reticulated at the beginning, and toward the pylorus has very prominent, longitudinal folds, and there is a globular cavity interposed between the pylorus and the intestine, which communicates with each by a very contracted aperture.

In the *greater dog-fish* (*squalus canicula*) the muscular fibres of the stomach are mostly longitudinal; they are numerous at the cardiac and pyloric extremities, but not well marked elsewhere. The muscles of the stomach are much stronger in the *greater cat-fish* (*squalus stellaris*) than in many other species; they are extended over the whole of both portions; their course is longitudinal. The internal membrane in this species forms large and numerous folds, which have different directions; behind the internal membrane of the large portion of the stomach there is a glandular layer of a greyish colour and some thickness.

The *squain nasus* has two sorts of rugæ in the first stomach; the one are longitudinal, and lie parallel to each other; the second are transverse, and perpendicular to the first.

The internal membrane of the first portion of the stomach in the *saw shark* (*squalus pristis*) has twelve or fourteen very large longitudinal and parallel folds, which are grooved transversely; the second stomach in the same fish is perfectly smooth.

The stomach of the *lamprey* (*petromyzon marinus*) is not to be distinguished from the other parts of the alimentary canal, except from its situation.

In the *surgeon* (*acipenser sturio*) the structure of the stomach is singular; after being prolonged for some way as a simple tube, it is bent so as to make a complete turn, it becomes contracted on this side of the pylorus, and then again forms an enlargement of a pyriform figure, the base of which corresponds to the pyloric opening; this enlargement is produced by a very thick muscle, the fibres of which run obliquely from without inwards; the pyloric orifice is really very small, and bounded by a circular fold. The internal membrane is smooth and without villi, except at the part corresponding to the enlargement, at which place there are thin, long folds of a pyramidal figure, the bases of which touch the pylorus, and are covered with a network, similar to that in the œsophagus of this fish.

The stomach of the *spatularia* is very wide, and fills a great part of the abdominal cavity; it has a round figure, and forms a cul-de-sac which is not as usual in the direction of the œsophagus, this canal and the intestine opening near each other. The internal surface of the stomach is smooth; there is a circular valve at the pylorus.

In the *signathus pelagicus* the alimentary canal proceeds from the mouth to the anus, as in the *lampreys*, without forming any convolution: the part which corresponds to the stomach is, according to Cuvier, the one-seventh of the whole; it is distinguished from the rest by a slight contraction, and by two layers of muscle: the external layer is formed of circular fibres, which surround the stomach; the internal layer

layer is longitudinal. The internal membrane has some large longitudinal folds.

The stomach in the genus *halisætes*, and in the *ostracions*, bears considerable resemblance to that of the *fygnathus*. It has thick parietes plicated internally, and is distinguishable from the other parts of the canal by its thick muscular coat; in the *halisætes* there is a denticulated valve interposed between the stomach and intestines. In the *ostracion cubicus*, the part corresponding to the stomach may be known by its form; its parietes are thin, transparent, and wider than the rest of the canal; its internal membrane is smooth, except next the œsophagus, where it produces some waving folds; from that place the canal gradually diminishes, its coats become thicker, and the internal surface villous and plicated.

The form of the stomach in the *oblong tetraodon* is very different from the usual one in fishes. It is the shape of a globe, a little extended at the œsophageal and pyloric orifices, which are situated exactly opposite to each other; the one before and the other behind. The coats of the stomach are thin and weak, and apparently without muscular fibres: the internal surface does not present any inequalities, and the orifices are unfurnished with any valve.

Cuvier describes the stomach of the *lophius piscatorius* as a bag, having the same capacity and direction as the œsophagus, and extending nearly the whole length of the abdominal cavity. The internal membrane is confounded with the cellular coat, is very thick, soft, and pulpy, and forms a great number of thin processes and large irregularly shaped rugæ; the first are particularly remarkable around the cardia, where they seem to produce many glandular masses, some of which extend into the œsophagus. There are further to be observed some little orifices of cells equally small, placed in the substance of the internal membrane, which appear to be designed for the secretion of mucus. The aperture of the pylorus is much contracted; it is surrounded by a very thick circular border, which projects considerably into the intestine. The muscular coat of the stomach is very strong at every part, its fibres are longitudinal.

In the *lump fish* (*cyclopterus lumpus*) the figure of the stomach is nearly that of two ovals united at their ends; the angle formed by their junction corresponds to the cæcal portion of the stomach in other fishes, and the other ends receive the œsophagus and the intestine; the stomach is smooth upon the internal surface, except near the pylorus, at which place there are some plicæ; it exhibits a number of opaque spots, which are occasioned by the union of very small lenticular cells situated between the muscular and internal coats. They have each a small orifice in the centre, and appear to be destined to secrete the mucus of the stomach; the muscular coat is confined to the second oval part of the stomach, and near the cardiac orificæ; the parietes are in other places thin and transparent.

In the *eel* the cæcal portion of the stomach is very much elongated, and of a taper or funnel-shape; the pylorus is situated very near the œsophagus, and appears to be formed by two portions; one from the œsophagus, and the other from the elongated part of the stomach, from which it would appear that all the food does not in this fish pass through that part; the internal membrane produces some longitudinal plicæ at the pylorus, which become less eminent and waving towards the bottom of the funnel part of the stomach. The fibres of the muscular coat are circular; although they are longitudinal on the œsophagus; there is a tubercle of the internal membrane, which constricts the aperture of the pylorus.

The *conger* has very nearly the same sort of stomach as the *common eel*; the prolonged part is, however, less taper, the

muscular fibres are more curved, and the pylorus is bordered by a broad lamina; the internal membrane is firm and white, and forms a few long folds which extend from the œsophagus to the bottom of the cul-de-sac, or cæcal portion.

The *jugular* order of fishes afford many examples of the usual or proper figure of the stomach.

In the *trachinus draco* the stomach varies but little from the standard form; it is somewhat larger than the œsophagus, and its parietes are thrown into a few irregular and oblique folds, which are visible even on the external surface.

The genus *gadus* does not afford much singularity in the formation of the stomach. The *cod* (*gadus morrhua*) has the cæcal portion very short, or, in other words, the part which goes to end in the intestine runs near the bottom of the stomach.

The *bake* (*gadus merluccius*) has this part placed forwards, and the *whiting* (*gadus merlangus*) has it still more so.

The *king* (*gadus molua*) has the cul-de-sac much elongated, but without any alteration in its capacity. In all these fishes the part which ends in the intestine is much contracted.

Amongst the *thoracici* we observe the following varieties of structure in the stomach.

In the *father lobster* (*cottus scorpius*), and *bull head* (*cottus gobio*) the stomach is very muscular and of an irregular shape. The cæcal portion is considerably larger than the œsophagus; the part which ends in the intestine is situated near the entrance of the œsophagus. In the *goby* of the Nile (*cottus niloticus*) the cæcal portion is smaller than the other parts of the stomach, and the intestine arises far from the œsophagus.

The stomach of the *scorpana horrida* resembles that of the *nilotic goby*.

In the *lyre* (*callionymus lyra*) the cul-de-sac is formed immediately at the commencement of the stomach, which is at first globular, and is afterwards contracted posteriorly to nearly the size of the œsophagus; on the right side of the dilatation, the part which ends in the intestine goes off anteriorly; the valve of the pylorus is produced by the projection of that part of the stomach into the intestine.

In the *remora* the right part of the stomach has not, as in general, a small bowel arising from the side of the cul-de-sac, but a short prolongation of that part which is bent forwards, and forms an angle posteriorly. The muscular coat is very strong, and the internal furnished with very prominent longitudinal rugæ.

The figure of the stomach differs very much in the different species of the genus *pleuronectes*.

In the *turbot* (*pleuronectes maximus*) the middle portion of the stomach is a little enlarged, but the cul-de-sac is very short; the pylorus being nearly at the bottom of the stomach; neither the figure given by Cuvier of the *turbot's* stomach, nor that contained in Blasius Anatomie Animalium, is correct.

In the *pleuronectes lineatus* the stomach is wide, irregularly round, with thin coats, and smooth on the internal surface.

The stomach of the *sole* (*pleuronectes solæ*) has a bent figure like a portion of an S; there is a slight dilatation at the greatest curvature, which takes the place of the usual cul-de-sac. There is no contraction of the canal at the pylorus; the distinction between the stomach and intestine, however, is marked both on the outside, and internally, by a whitish line; the inner surface is thrown into some irregular longitudinal folds.

Cuvier describes the stomach of the *plaice* (*pleuronectes platessa*) as forming a continuous canal with the œsophagus and intestine; there is, however, always a degree of dilatation at one side of the stomach, which varies according as it may be distended by food; this corresponds to the com-

non cul-de-sac; the parietes of the stomach are thin and smooth on the internal surface; at the pylorus there is a funnel shaped valve, which projects into the cavity of the intestine for some distance.

The stomach of the *flounder* (*pleuronectes flossus*) resembles that of the *plaice*, except that it is contracted at the pylorus, which gives it a conical figure.

In the *John dory* (*zeus faber*) the stomach is round and very capacious; in one instance we found it contain eight moderate sized *flounders*. Cuvier describes the internal membrane as being irregularly rugous, but we have observed that the surface is covered with small meshes; each of which contains within it a still finer reticulation; the mesh-work is wanting, however, upon that part of the internal membrane which lies between the entrance of the œsophagus and the pylorus; the pyloric orifice is abridged by a circular projection of the internal coat.

The form of the stomach in the *chetodon zebra*, as described by Cuvier, is singular: it follows the same direction as the œsophagus from before backwards, but is distinguished from it by having a greater capacity; it dilates suddenly, and presents on the side of the cardia very short cul-de-sac, of which the bottom is turned forwards, and the cavity is separated from the cardiac orifice by an internal projection; the stomach is slightly contracted before its termination, and its coats, which were before thin and transparent, acquire considerable thickness, more particularly the muscular tunic; the termination of the stomach at the intestine is marked by a considerable projection. The internal coat is without rugæ.

The *chetodon ciliaris* has a large stomach bent into an arch.

The *chetodon arcuatus* has the stomach at first continued for some way as a large canal, in the same direction of the œsophagus, it then bends to form a right angle, and becomes dilated into a considerable oval sac, of which the opposite extremity opens into the intestine by a very contracted orifice; the parietes of the first portion are thin and transparent; those of the sac are more muscular; the internal surface is smooth in both divisions.

In the *teuthis* the stomach at first forms a canal, with thick coats, the internal of which is plicated throughout its length; it then bends from behind forwards to join a second portion, which is wider, and of which the coats are thin and transparent, but become more substantial towards the other extremity; the part of the stomach which forms the curve is elongated, and corresponds to the cul-de-sac of other fishes.

In the *holocentrus fogo*, the stomach is an elongated bag, with the bottom contracted; the parietes are moderately strong, the internal coat produces seven or eight broad rugæ, which disappear in the portion which goes off very near the bottom to form the pylorus.

There is considerable variety in the form of the stomach in the genus *sparus*. The *sparus spinifer* has a very large stomach, which occupies a great part of the abdomen; it resembles a round bottle or flask, with a wide neck, which corresponds to the œsophagus; the intestine, compared with the stomach, is very small, and arises abruptly from the lower part of the neck, and consequently very far from the bottom of the stomach; the parietes of the bag are thin, and the internal surface of it quite smooth. The *sparus siganus* has a conical shaped dilatation where the œsophagus joins the stomach, the bottom of which is turned forwards. This, which is wider than the œsophagus, passes first from before backwards, then bends from behind forwards; the curvature produces a considerable cul-de-sac. The portion which succeeds it is longer and less wide than the first part of the stomach.

Cuvier states the stomach of the genus *labrus* to possess the ordinary form and structure. In the *gibbous wrasse* (*labrus tinca*) however, we have found the œsophagus, stomach, and first or small intestine, to make a continuous canal, without any material difference in capacity or in structure; each of these parts is reticulated upon the internal surface.

In the *perches* (genus *perca*) there is nothing in general very peculiar to remark; the chief deviations from the common structure appear to be with respect to the length and form of the cul-de-sac; this part is conical in the *perch* of the Nile (*perca nilotica*); it is deep in the *sea-perch*. Blasius gives a figure of the viscera of the *perch*, in which the intestine appears continuous with the œsophagus, and the cæcal portion of the stomach is like a long bag, with a contracted neck.

In the *stickleback* (*gasterosteus pungitius*) the stomach is an oval figure, and without curvature.

The *red gurnard* (*trigla cuculus*) has the portion which ends in the intestine considerably enlarged.

The *piper* (*trigla lyra*) has the pylorus situated very near the œsophagus, which is straight. The body of the stomach is nearly of an oval shape, and the bottom of it forms a very short cul-de-sac, less in diameter than the œsophagus.

In the *scomber sunfish* the portion which arises from the body of the stomach to terminate in the intestine is an oval figure, and so large in proportion to the rest of the cavity, that it seems like a second stomach; its muscular coat is very strong, and the internal one has some thick longitudinal folds.

The *abdominal* fishes exhibit some more remarkable varieties in the structure of the stomach than the preceding orders.

In the *carps* (*cyprinus*) the stomach forms a continuous canal from the œsophagus to the intestine. In the *sea pike* (*esox belone*) also it cannot be distinguished from the adjoining parts of the alimentary canal; the stomach of the *common pike* (*esox lucius*) forms no cul-de-sac, the intestine going off at its bottom; but the situation of the pylorus is plainly marked by an annular contraction externally, and by a circular fold of the internal membrane. The figure of the stomach is that of a very elongated bag, somewhat wider in the middle than the other parts; its muscular coat is strong; the internal membrane furnishes at first some distinct longitudinal folds, which become numerous, and covered with papillæ in the lower part of the bag.

In the *herring* (*clupea harengus*) the stomach at first passes backwards, like the continuation of the œsophagus; it is then reflected forwards, so as to form an acute angle with the first portion; the outside of this curvature produces a long, conical cul-de-sac: these portions are distinguishable by their structure, as well as their form: the first has thick parietes, and the internal surface plicated; the second has thin coats, and is smooth internally; the pylorus, which is the termination of the reflected portion, is much contracted.

The stomach forms a cul-de-sac in the genus *salmo*, which, however, varies much with respect to its depth. In the *smelt* (*salmo eperlanus*) it is long and pointed, as in the *herring*. In the *common salmon* and *trout* (*salmo fario*) the cæcal portion of the stomach is very inconsiderable. There is a kind of *trout*, found in the western part of Ireland, which, from the great strength and thickness of the muscular coat of its stomach, is commonly called the *gillaroo* or *gizzard trout*. It is not generally supposed to be a distinct species, but a variety of the *salmo fario*. Hunter stated the parietes of its stomach to be two-thirds thicker than those of the *common trout*; he did not, however, consider its stomach as serving the

the purposes, or as deserving the name of a gizzard; the internal surface is soft and villous, and therefore not fit for grinding the food; the contractions of the stomach are however sufficiently powerful to break the shell-fish on which this trout subsists, with the assistance of round, smooth stones, which are swallowed for the purpose. The common trout likewise takes stones into its stomach, with a similar design.

The stomach of the *silurus bagre* is an oval, or rather the shape of a flask, with a very wide mouth; its parietes are hard, strong, and thick; the portion which leads to the pylorus is short, and arises from about the posterior third, which occasions a considerable cul-de-sac.

There is no cæcal portion of the stomach in the genus *anableps*; that of the *anableps tetraophthalmus* is a canal curved upon itself, before it ends in the intestine, from which it is separated by a slight contraction, and a circular valve; the left side of the internal surface of the stomach exhibits thick folds, which form a net-work, apparently of a glandular structure; the other parts of the internal membrane are covered with fine villi.

Cuvier describes the cæcal portion of the stomach, in the genus *mormyrus*, as being wide and short; we should rather say that the stomach is dilated into a bag, which lying transversely across the direction of the œsophagus, resembles, in some degree, the form of this cavity in mammalia.

The most singularly constructed stomach in the whole class of fishes is met with in the mullet (genus *mugil*), of which Cuvier has given an imperfect description, and bad figure. In the common species (*mugil cephalus*), the stomach may be divided into three parts; the first resembles in form and direction the œsophagus, from which it commences; it leads to the back of a large muscular mass, into which it opens; the same canal is afterwards continued for a considerable way backwards, and is gradually contracted in capacity, until it finishes in a pointed blind extremity. The muscular mass has a figure not quite spherical, but such as would be produced by the application of two disks to each other; the largest diameter of it measures about an inch: the tubular part of the stomach opens into the centre of one disk; the intestine commences exactly opposite, or at the centre of the other; a straight canal leads directly through the muscle, which therefore corresponds to the pyloric portion of the stomach. It has, however, been considered by some anatomists as an example of the true gizzard stomach in fishes, and not without foundation; the muscular fibres which compose the interior part of it are short, closely applied to each other, and interwoven so as to produce a mass nearly of a homogeneous structure; the fibres are more distinct on the external surface; they pass from the centre to the circumference, where they seem to coalesce with each other, and with a layer of muscle, which passes round the mass like a ring: this arrangement of the muscular fibres bears some resemblance to that of the gizzard in birds, and certainly shews that the apparatus in the mullet is capable of exerting an extraordinary degree of force. It should further be added, that the internal part of the muscular mass is lined with a cuticular coat of some strength: this is very easily detached by maceration, and is found to be confined, as in birds, merely to the grinding surface. As arguments against the supposition of the muscular apparatus in the mullet performing the functions of a gizzard, it may be stated that the cavity it contains is too small to serve as a reservoir for any quantity of food; that the cuticle is too weak to sustain the friction with hard bodies, and that the food must be in a great measure digested in the tubular portion of the stomach, before it passes into this. These

objections we are disposed to allow to a certain extent; but that the aliment undergoes a further comminution and admixture, while moving through the muscular portion of the mullet's stomach, we cannot entertain a doubt, both from the contemplation of the structure of the part, and of the intestines which succeed it, and from actual observation made upon its contents, immediately after the death of the animal.

Cuvier describes the stomach of the white mullet (*mugil albula*) as differing only from that of the *mugil cephalus* with respect to the shape of the cul-de-sac, and the muscular portion; the first has the proper form of a bag, being wider at the lower part than above; the latter is the figure of a globe, instead of being compressed or levelled on the inferior and upper surfaces.

The figures which illustrate the form and structure of the stomach are contained in Plates I. and II. of the *Anatomy of Fishes*. Fig. 5. of Plate I. exhibits a view of the stomach of the *basking shark* (*squalus maximus*) laid open on one side; *c*, the portion of the stomach next the œsophagus, the inner surface of which is reticulated; *d, d*, the succeeding parts of the stomach, with longitudinal laminæ or folds, which are particularly prominent near the pylorus; *e*, the perfed, or contracted opening into the second stomach; *f*, the second stomach, partially seen behind the other; *g*, the commencement of the intestine; *h*, the biliary ducts, passing as a band to the intestine; *i i*, the spleen.

Fig. 6. of the same plate shews the globular cavity, or second stomach, and its communication with the first stomach and intestine; *a*, the external surface of the pyloric portion of the stomach; *b*, the intermediate cavity laid open, to bring into view the contracted aperture leading into the principal stomach, and the one into the intestine; *c*, the cavity of the first part of the intestine exposed; *d*, the commencement of the spiral valve; *e*, the projection into the intestine, upon which the small aperture of the second stomach is seen; *f*, the papilla, by which the biliary ducts terminate in the intestine; *g*, a portion of the spleen; *h*, twelve or thirteen biliary ducts, forming a single fasciculus, which proceeds to the intestine.

Fig. 7. of the same plate represents a portion of the stomach and œsophagus of the *raja clavata*; *a*, the inner surface of the œsophagus; *bb*, the internal coat of the stomach, which is thick, soft, unequal, and, as it were, raised upon the surface of the other coats; the depressions seen upon it are produced by the deficiency of the internal coat itself; some small foramina are scattered over the surface, which are the glands supposed to furnish the gastric juice by Mr. Home, but which by others are commonly described as mucous glands.

In Plate II. of the *Anatomy of Fishes*, fig. 1. represents the stomach of the *tetraodon oblongus*; *a*, the œsophagus; *b*, the beginning of the intestine; *c*, the stomach, of a globular figure. Fig. 2. shews the stomach of the eel (*murena anguilla*); *a*, the œsophagus; *b*, the cul-de-sac, or cæcal portion of the stomach of an elongated taper form; *c*, the intestine. Fig. 3. exhibits the stomach of the sole (*pleuronectes solea*) which describes an S like curve; *a*, the slight dilatation which corresponds to the cul-de-sac. Fig. 4. represents the stomach of the plaice (*pleuronectes platessa*); *a*, the œsophagus; *b*, the inconsiderable dilatation which marks the situation of the stomach; *c*, the pylorus; *d d*, the two short pyloric cæca; *e*, the single cæcum from the first portion of the intestine, as far as it is known, peculiar to this fish. Fig. 5. shews the stomach of the *chætodon zebra*; *a*, the œsophageal extremity; *b*, the pylorus; *c*, the portion of the stomach, corresponding to the cul-de-sac, which, in

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this species, is turned forwards. *Fig. 6.* is the stomach of the *Sparus spinifer*; *a*, the œsophageal extremity; *b*, the intestine, of a small size, arising near the œsophagus; *c*, the body of the stomach, which forms a perfect bag. *Fig. 7.* is the stomach of the mullet (*mugil cephalus*); *a* is the part continued from the œsophagus; *b*, the funnel, or cul-de-sac; *c*, the muscular portion, which has been compared to a gizzard, on which the arrangement of the muscular fibres is seen; *d*, the intestine; *eee*, pyloric cæca. *Fig. 8.* shews the same stomach, with the muscular part cut through longitudinally; *a*, the œsophageal extremity; *b*, the funnel seen behind; *c*, the muscular portion, in the centre of which appears the opening, through which the food passes to the intestine; *d*, the cuticle lining this passage, puckered or folded on itself.

Intestines.

There are, properly speaking, but two intestines in fishes; the first corresponds to the *small*, the second to the *great*; these terms, however, are not applicable to the divisions of the canal in this class of animals, unless they were reversed, as that which would be called the *great* is often less capacious than the other. Cuvier has called the second portion of the intestines in fishes *rectum*, to which part it is certainly

more analogous than to the *colon*, or *cæcum*, although sometimes it experiences a considerable and sudden enlargement. The first and second portions of the canal are commonly distinguished from each other by an annular projection of the internal coat, which is generally thick and rounded on the edge, and appears to contain some circular muscular fibres, which, by their contraction, will increase the valvular obstruction to the passage of substances from one intestine into the other; these parts are further indicated by a difference of structure in the internal membrane, and commonly, also, by a different arrangement of the fibres in the muscular coat. The capacity of the second intestine, as already mentioned, is almost always either smaller or larger than the preceding part of the canal; most commonly it is smaller. The internal structure, characteristic of each intestine, is most strongly marked in the one next the pylorus, and in the other towards the anus.

The variation with respect to the form, length, and structure of the intestines of different fishes, do not accord with the natural divisions of this class of animals; remarkable deviations being often found amongst individuals of the same genus, and even sometimes in varieties of the same species, as will appear by the following table, and in the description of these parts in the principal genera.

TABLE of the proportional Lengths of the Intestinal Canal in Fishes, Extracted from Cuvier's
Leçons d'Anatomie comparée, tom. 3.

Names.	Length of the body, from the end of the snout to the extremity of the tail, without including the caudal fin.	Length of intestinal canal, from the pylorus to the valve of the rectum.	Length of the rectum, or second intestine.	Total length of the intestinal canal.	Relation of the length of the body to that of the intestinal canal.
Lamprey	0,148			0,08c(a)	1,8 : 1
Ray	0,300(b)			0,200	1,5 : 1
Shark	2,759	0,351	0,189(d)	0,540	5 : 1
Sturgeon	2,273			1,200	1,8 : 8
Spatularia	0,114(e)			0,024	4,8 : 1
Balistes	0,130			0,270	1 : 2
Tetraodon mola	1,000			3,572	1 : 3,5
Tetraodon oblongus	0,140			0,090	1,5 : 1
Murena helena				0,230	
Common eel	0,720			0,254	2,6 : 1
Whiting	0,290			0,240	1,2 : 1
Cottus infidiator	0,360	0,279	0,060	0,339	1 : 1
Plenronectes limanda	0,150			0,200	3 : 4
Chetodon arcuatus	0,105	0,545	0,055	0,600	1 : 5 : 7
Perch	0,210			0,160	1 : 1,3
Perca labrax	0,923			0,703	1,3 : 1
Sparus	0,190			0,730	1 : 3,8
Barbel	0,390			0,015	1 : 2,6
Rud	0,210			1,366	1 : 1,8
Cyprinus dobula	0,290			0,400	1 : 1,4
Tench	0,280			0,340	1 : 1,2
Esox brasiliensis	0,130			0,090	1,3 : 1
Common pike	0,840	0,608	0,140	0,820	1 : 1,4
Polypterus Niloticus	0,510			0,275	1 : 1
Mormyrus	0,260			0,160	1,6 : 1
Mullet	0,250			0,950	1 : 3,8
Silurus bagre	0,320	0,720	0,080	0,800	1 : 2,5

(a) Measure of the alimentary canal, from the posterior parts of the mouth to the anus.

(b) Length, measured from the border of the lower jaw to the anus.

(c) Length taken from the end of the muzzle, but not including the leaf.

(d) Length measured from the end of the spiral valve to the anus.

In the *lampreys* (*petromyzon*) the alimentary canal passes to the anus without any sensible dilatation or convolution; the abdominal cavity is however of considerable extent. The inner surface of the intestine is covered with fine longitudinal plicæ; the reflection of peritonæum, which corresponds to the mesentery, completely encompasses the greatest part of the intestine, by being coiled upon it, in consequence of which it is allowed great latitude of motion in the abdomen.

The intestines of the *ray* and *shark* genus make no material convolutions, and appear remarkably short for the fish; the length, however, lost by this circumstance, is amply supplied by the structure of the first intestine; the internal membrane of which is converted into a spiral valve, which nearly fills up the canal from the pylorus to the commencement of the second intestine; the food, therefore, instead of passing speedily to the anus, traverses a considerable circuit. The spiral membrane is tolerably smooth upon its surface, but is extremely vascular; an injection of the blood vessels will render this part of a vivid red, and scarcely shew any effect upon the other parts of the alimentary canal. The valvular portion of the intestine in the *squalus maximus* terminates at the rectum in a foliated appearance, resembling a rose, by which the passage of the food is obstructed.

The second intestine of these fishes usually makes one or two slight curves; it has a smaller diameter and thinner coats than the preceding; the inner membrane is villous at the commencement. Cuvier has described a layer of a greyish, glandular substance, as being interposed between the muscular and internal coats; this has not been observed by us.

There is a remarkable glandular body connected by a slender tubular foot-stalk with the rectum which is only met with in the *ray* and *shark* genera; in the former it is somewhat of the figure of the seed of a stone fruit, with the lesser end towards the intestine. We have observed it in the *dog-fish* to be long, round, and pointed at the free extremity. Its substance is very dense and unyielding, resembling a good deal the texture of the human uterus; it contains a small cavity, which appears to have a smooth surface, but, if accurately examined, exhibits some cells or depressions, which would seem to be the orifice of mucous glands. In the *squalus maximus*, Mr. Home found this gland deeply reticulated in the inner surface, and to contain a dark coloured glairy fluid. Doctor Monroe, in his *Physiology of Fishes*, called this body, from analogy of situation, *appendix vermiformis*, and supposed it to be designed to perform the same functions of that part in the human intestine. Cuvier, on the other hand, describes it amongst the anal glands of animals, to which class of organs he thinks it most analogous. It appears to us to be a gland destined to supply the rectum with mucus.

In the *sturgeon* (*acipenser*) all the parts of the intestine are extremely muscular; the internal surface is reticulated throughout the greatest portion of the canal; at the beginning the meshes are so deep as to produce cells; at some distance from the pylorus there arises a spiral valve, which

is lost at nearly the same distance from the anus; its turns are much less frequent than those of the valve in the *ray* and *dog-fish*. In the *sturgeon* it is sustained by a strong pillar which runs in the centre of the tube of the intestine, and which seems to be composed of muscle internally; the valve resembles stairs placed around a pillar, except that it is not uninterruptedly attached to the centre, but rather coils upon it, leaving in some places the internal border at liberty; it does not seem, therefore, necessary for the alimentary substances to pass around all the turns of the valve. In the *sturgeon* there is interposed between the reticulated membrane and the muscular coat a thick layer of a glandular substance, which is close in its texture, a greyish colour, and in which may be seen some small white branches. The last portion of the intestinal canal has neither valve, reticulation, nor glandular substance; its coats are thin, and its diameter diminished.

Cuvier describes the intestinal canal of the *spatularia* as being short, but contrived to retard the passage of the alimentary substances through it. It is very wide for two-thirds of its length, and is then suddenly contracted into a small canal; it next becomes dilated a second time, and forms an oval pouch, the cavity of which is divided by six circular valves: the successive enlargements and contractions produced by these are visible on the external part of the intestine; the pouch opens into a short and contracted canal, which is analogous to the rectum. The first portion of the intestine of this fish is most muscular, and exhibits a network on the internal surface, similar to that of the *sturgeon*; the meshes of which are, however, not strongly marked, except in the first two thirds of the intestine. The parietes of the pouch, containing the valves, are thin, but the short canal, immediately succeeding, has an evident muscular coat, and the internal surface longitudinally plicated.

In the *sygnathus pelagicus* the alimentary canal is without convolutions, as already mentioned, and preserves nearly the same diameter throughout its whole length; the first or small intestine has thin and transparent coats, and the inner surface is covered with longitudinal plicæ, waving and ramified together; it is separated from the second intestine, or rectum, by a circular valve; the latter canal has strong parietes, and upon the internal surface thick rugæ running longitudinally, serrated upon their edge, undulating, and sending branches to each other. The *sygnathus acus* differs from the *pelagicus* in wanting the rugæ in the second intestine, which is smooth and covered with fine cuticle.

The *ostracion cubicus*, in which the intestine is without convolution, has the first portion slightly plicated internally; and in the second more eminent rugæ dispersed longitudinally and parallel to each other. This part of the intestine is likewise more muscular, and separated from the first by a circular valve.

In the *balistes* the first intestine is, for about two thirds of its length, thin, uniform in size, and smooth internally; at the commencement of the last third it exhibits some dilatations, and towards the end becomes much enlarged, at which place the internal coat acquires a beautiful vitreous appearance; a contraction of the parietes, and an annular projection internally, serve to distinguish the commencement of the second intestine, which is short and longitudinally plicated on the inside.

In the genus *tetraodon* the intestines make two or three convolutions, but preserve nearly the same diameter throughout; a fold of the inner membrane is placed at the beginning of the second intestine, which has stronger coats than the first.

first, and deeper longitudinal folds of the internal surface.

The intestinal canal is longer in the *moon-fish* (*tetraodon mola*) than in the other species, and forms numerous convolutions. The first intestine is capacious, and has a strong muscular coat, which exhibits on the internal part of the gut very distinct longitudinal fasciculi; the intestine diminishes in wideness, and the thickness of its coats as it proceeds. There is also a thick white glandular layer between the internal and muscular coats, which disappears on approaching the second intestine; in which, however, it is again formed. The internal surface of both intestines is covered with villous processes, that are at first coarse, but become fine towards the commencement of the second intestine, in which they re-appear.

The intestinal canal of the *sea devil* (*lophius piscatorius*) has but little variation in its capacity from one end to the other; the folds of the internal membrane take a lozenge figure.

In the *lump fish* (*cyclopterus lumpus*) the first intestine is distinguished from the second by a circular valve, which projects into the latter; the muscular coat of the first is also less thick and has the fibres circular, while in the second they are considerable, and are arranged upon the external part of the intestine longitudinally; both intestines are plicated on the inner surface, but the second has the folds larger and less regular.

In the *anarrhichas lupus* the second portion of the intestinal canal has thick coats, and an external layer of longitudinal muscular fibres; the two parts are indicated by the interposition of a circular valve, but the internal surface of both is covered by a number of fringed plicæ arranged in different directions.

The several parts of the intestinal canal in general have little variation with respect to their capacity. In the genus *murena*, the *conger* (*murena conger*) has the second intestine wider than the first; it has also, particularly at the commencement of the canal, a glandular structure of the internal coat, similar to that already described in the *sturgeon*. In all this genus the distinction of the two portions of the intestines are marked by a similar valve.

In the *uranoscopus feaber* the first and second intestines are not distinguished by any valvular projection of the internal surface, but by the structure of their coats. They are at first thick and the canal small, soon afterwards the intestines become much enlarged, thin, and transparent, which structure is continued to near the anus; the internal membrane produces in the first division of the canal fine longitudinal plicæ, touching each other in a zig-zag manner; these gradually decline, and in the part corresponding to the rectum become strictly longitudinal and parallel, with small rugæ arising alternately on the sides. The canal experiences many convolutions.

The first intestine of the *weaver* (*trachinus draco*) is reticulated upon the inner surface; the second portion is thin.

In the genus *gadus* the first and second parts of the intestinal canal are distinguished both by a difference of structure and a valvular projection; the first intestine of the *hake* (*gadus merluccius*) has upon the inner surface fringed plicæ, which gradually diminish towards the rectum. In the *cod* (*gadus morhua*) the canal is smooth internally, except at its first convolution. In the *ling* (*gadus molva*) the first intestine is plicated longitudinally; and in the *whiting* (*gadus merlangus*) the intestinal canal appears smooth on the inner surface; the rectum is very short, and wider than the first intestine.

In the *remora* (*echeneis remora*) the first intestine is rugous, the second smooth.

In the genus *cottus* there is a valve at the origin of the second intestine. In the *cottus niloticus* there is a glandular substance situated behind the internal membrane, reaching for some way from the pylorus, that increases the bulk of that part of the gut, the diameter of which is also very wide; the canal, after proceeding for a considerable distance, becomes again dilated at the small portion corresponding to the rectum. The whole extent of the small intestine exhibits internally a net-work, which has very deep meshes; in the rectum the same structure is observed, but the meshes are wide and shallower.

The intestinal canal forms three convolutions in the *scorpena horrida*. The internal membrane is slightly plaited and villous, and the parietes thin in the first intestine; the rectum is somewhat larger, and has internally waving longitudinal folds.

In the *dory* (*zeus faber*) the two intestines are divided by a conical valve. The first is reticulated upon its inner surface; when viewed with a magnifying glass, we have observed each mesh to inclose a finer net-work within it, and the projections of the membrane, which form the reticulation, to end in delicate villous laminae; probably the same structure would be found to exist in the intestines of many other fishes, the rectum in the *dory* is without reticulation, and thin in its parietes.

There is some variety with respect to the structure of the intestines in the *flat fishes* (*pleuronectes*.) The *plaise* (*pleuronectes platessa*) has the canal wide for some way from the pylorus, after which it gradually diminishes to a moderate size, and continues of the same magnitude to the anus; the inner surface is covered with well marked plicæ arranged longitudinally, and others connecting them transversely; in the wide part of the intestine the plicæ are so prominent that they float in the cavity, the border is plaited like the ruffle of a shirt, and altogether they produce one of the most beautiful surfaces we have observed in the intestines of fishes. This plicated structure becomes gradually less evident in the course of the canal, and is nearly lost on approaching the rectum. That portion of the intestine possesses also reticulated plicæ, but they are indistinct; the intestine becomes thick and fleshy near the anus. Cuvier asserts, that its diameter is twice as great as that of the preceding part of the canal; but in those instances we have examined, if any difference could be observed, the rectum was less than the adjoining part of the intestines. There is a circular valve at the commencement of the rectum.

In the *turbot* (*pleuronectes maximus*) the internal membrane of the first intestine produces fringed laminae, which are close together and reticulated; they gradually decline, and in the rectum, the origin of which is marked by a valve and a sudden dilatation, the laminae or plicæ become very remarkable, floating in the cavity of the intestine. The canal is most muscular, from the first convolution to the pylorus, and in the rectum.

The first intestine of the *brill* (*pleuronectes rhombus*) is plicated internally, it is at first large and then becomes contracted. The rectum is smooth and considerably wider than the part of the canal immediately adjoining it.

In the *sole* (*pleuronectes solea*) the diameter of the intestinal canal is nearly the same throughout, although Cuvier asserts the contrary. The internal surface of the first portion looks as if it were grooved, the folds projecting very little, and being closely applied to each other; they pass in a waving

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manner in the longitudinal direction; near the pylorus, however, the folds are more prominent and puckered or plaited upon the edges. The parietes of the rectum are thin; the internal membrane forms in it slight, incompact, longitudinal folds. The two parts are distinguished by an annular projection.

In the *pleuronectes limanda*, Cuvier states the intestine to be very wide at the commencement, and after diminishing to be enlarged again a little in the rectum. The internal membrane has slight rugæ arranged in a lozenge figure near the pylorus, but farther on it becomes smooth.

In many of the genus *chetodon* the intestinal canal is very large; in the *chetodon arcuatus* and *chetodon zebra* the parietes of the intestine are thin, delicate, and transparent, and dilated in some places for containing the excrements. The internal membrane of the first intestine has the plicæ disposed in a zig-zag manner near the anus, their coats become thickened and rugous internally.

In the genera *labrus* and *sparus* the structure of the intestine varies in the different species; in the *labrus molops* the rectum is so wide, according to Cuvier, as to resemble a sac, into which the first intestine is inserted; a valve is situated at this place. In other species the sudden enlargement of the rectum also exists, but the valve is wanting in the *gibbous corasse* (*labrus tinca*); the first intestine is of the same diameter as the stomach, with which it appears to be continuous; it is villous and reticulated on the inner surface; the rectum is very short and twice the width of the first intestine; its internal membrane exhibits a cellular appearance from the meshes of the net-work being so deep.

The coats of the intestines in the *sparus spinifer* are thin, and the internal surface is without villi or plicæ.

In the *perch* the first intestine is a little enlarged at the commencement, afterwards it diminishes, and again acquires bulk; the second portion or the rectum exceeds in size every part of the canal. The internal coat of the first intestine furnishes numerous laminae, forming many-sided areolæ, which gradually become longitudinal and parallel to each other. There is a prominent funnel-shaped valve at the origin of the second intestine; as usual, this part of the gut has longitudinal fibres in its muscular coat. In this fish the structure of the rectum is singular, its longitudinal folds are denticulated upon the edge, and are crossed by other transverse plicæ in a zig-zag manner; the folds which compose the angles that are directed towards the anus are more prominent than the rest and concave, so as to produce little cups or sacs. The *bass* (*perca labrax*) has loose, plaited, longitudinal laminae on the internal surface of the first intestine, exactly resembling those of the small intestine of the *snake*; the second intestine has remarkable thick coats, and is perfectly smooth on the inner surface.

In the *stickleback* (*gasterosteus aculeatus*) the intestine is very wide at its origin, it soon, however, becomes small, and continues so to the end of the canal.

In the *mackerel* (*scomber scombrus*) the internal membrane of the first intestine is nearly smooth, but that of the second is plicated.

Cuvier describes a very remarkable cæcal process, or cul-de-sac, which is situated at the origin of the rectum in the *piper* (*trigla lyra*), it passes for a short distance on the side of the first intestine, from which it is separated by a semi lunar valve; it resembles, in form and position, a good deal the cæcum in mammalia, of which no other fish affords a similar example.

In the *teuthis hepatus* the inner surface of the intestine is slightly villous; the two portions are not distinguished by a

valve as usual, but near the anus the canal becomes greatly enlarged, and again diminished before its termination.

The intestinal canal in the genus *cyprinus* forms no dilatation or internal valvular projection, but usually diminishes in its course from the œsophagus to the anus, both in diameter and the strength of its coats.

In the *carp* (*cyprinus carpio*) the intestines make three convolutions and one-half; the internal membrane at the beginning of the first portion of the canal produces a reticulation, of which the intervals are very deep, resembling the cellular appearance of the intestine described in the *surgeon*. This net-work gradually diminishes in the *carp*, until near the anus, where it again increases.

In the *barbel* (*cyprinus barbatus*) the internal membrane furnishes plicæ which go longitudinally in a zig-zag manner, and are finely villous; towards the end of the canal the villi are less thick, and the plicæ more compact and smaller, so as to give the appearance of a grooved surface.

In the *rud* (*cyprinus rutilus*) the inner coat furnishes beautiful plicæ passing in zig-zag transversely; they are larger and closer at the commencement of the canal than in the succeeding parts; near the anus the edges of the folds have a fringed appearance.

The inner surface of the intestine in the *cyprinus dobula* is villous in every part, but there are no zig-zag plicæ.

In the *tench* (*cyprinus tinca*) there are irregular zig-zag laminae, with fringed edges.

In the genus *clupea* the diameter of the intestinal canal is nearly the same throughout; the coats are thin and weak, the intestine are also usually short, they do not form any convolution in the *herring* (*clupea harengus*), and only two turns in the *anchovy* (*clupea encrasicolus*.)

In the *mullet* (*mulga cephalus*) the intestinal canal is singularly long, and forms convolutions one around the other, somewhat in the manner of the intestines of several water birds; these coils are much more numerous than they are represented by Collins in his anatomy; we have counted eleven turns of the intestine, which were all visible on first opening the body; the convolutions are pressed together, and the interspaces filled with fat, so that the whole forms one mass which almost occupies the whole abdomen of this fish. The diameter of the canal varies but little throughout its whole extent; the internal membrane is without folds, but furnished with villous processes, which are thick, long, and distinct in the first convolutions, but as usual gradually decline afterwards.

In the *gar fish* (*esox belone*) the intestine extends from the mouth to the anus without any convolution: it should be remarked, however, that the abdominal cavity is very long in this fish. Cuvier states the structure of the intestine to be the same throughout its whole length, and that the inner surface of it is smooth, and without villi; but we find in our notes that the internal membrane is villous, and, if minutely examined, is likewise reticulated; and that the villous structure is extended in two stripes upon the inner surface of the second intestine, and thus disappears.

The parietes of the intestinal tube in the *common pike* (*esox lucius*) are thick, and the origin of the rectum is marked by a valve, and also by an increase of volume; the internal surface of the first intestine is villous, and appears grooved; in the second the villi are very long and fringed.

In the *salmon* (*salmo salar*) the internal membrane forms in the beginning of the intestinal canal very long villi, which float into the cavity; these gradually diminish, and in the last part of the gut there are broad transverse folds, which become larger and more distinct as they approach the anus. The

intestine

intestine of the *trout* (*salmo fario*) wants the villi, but the transverse plicæ are more regularly placed than in the salmon.

Cuvier describes the intestinal canal of the *bichir* (*polypterus niloticus*, Geoff.) as being similar to that of the *surgeon*. There is a spiral valve that commences immediately beyond the pylorus, and forms eight turns, which are approximated and prolonged posteriorly; this valve does not extend to the anus, and the interval which wants it, Cuvier considers as the rectum; between the internal and muscular coats there is, at the commencement of the canal, a glandular layer, which increases the parietes, for the distance of a decimeter to double their size, after which it is scarcely to be perceived in this part of the intestine. The internal coat forms a network, as in the *surgeon*, of which the meshes become shallower as they recede from the pylorus, and are almost entirely effaced beyond the gland. The parietes of the rectum are very thin, and its inner coat shews some slight longitudinal folds.

In the *anableps tetropthalmus* the internal membrane of the first intestine produces a fine and apparently glandular reticulation, and the parietes of the second intestine are very thick, and the inner surface plicated longitudinally.

Cuvier describes a curious structure in the intestine of the *silurus lagre*; the beginning of the canal is wide, it then contracts and continues for some way of the same size; about the middle, the intestine is suddenly enlarged, and its coats become thin, and there is a kind of insertion of the first half of the canal, which opens into the second by a small orifice, bordered by a circular valve; at some distance beyond this place the parietes acquire thickness, and the diameter of the tube becomes small as before; and finally, this intestine terminates in the rectum, which is large and distended at this place. The valve of the rectum is very prominent, its parietes are remarkably strong and muscular, the inner membrane has longitudinal folds; a similar appearance exists on the inner surface towards the end of the first intestine, but they are ramified nearer the pylorus.

The intestinal tube in the genus *mormyrus* has an uniform diameter, is smooth internally, and unprovided with a valve at the commencement of the rectum.

From the preceding description it will be perceived that the intestines of fishes possess a more complicated and beautiful structure of the internal membrane than exists in any other class of animals; the alimentary canal of fishes, for this reason, as well as the nature of their food, is generally found to be short; the last division of it, which in mammals very properly receives the name of the *great* or *large* intestine, is, as before observed, often the shortest and most contracted part of the canal in fishes. The rectum in this class rarely serves as a reservoir for fæces: its internal surface is often as well fitted for forming and absorbing the chyle as the first portion of the gut, and sometimes even more so: it may, therefore, be said of fishes that the whole tract of their alimentary canal performs, in a greater or less degree, the functions of the small intestines in other animals.

In *Plate II.* of the *Anatomy of Fishes*, *fig. 9.* shews the valvular portion of the intestine of the *skate* (*raja batis*) which is dried in order to render the turns of the valve more distinct. *Fig. 10.* exhibits a piece of the valvular part of the intestine of the *surgeon* (*axipenser sturio*); *a*, the central portion; *b*, the coiled part; *c c*, the internal surface of the parietes of the canal. *Fig. 10.* of *Plate III.* of the *Anatomy of Fishes*, gives a view of the internal surface of the first intestine of the *surgeon*, where the cæca are connected with it; *a*, the surface of the gut deeply reticulated or cellular.

Fig. 11. of *Plate II.* is a portion of the first intestine of the *dory* (*zeus faber*) on which the mesh-work and intermediate reticulation of the internal membrane are represented. In *fig. 12.* of the same plate, the internal surface of the intestine next the pylorus is displayed in the *turbot* (*pleuronectes maximus*); *a*, the laminated appearances of the internal membrane of the intestine in this fish. *Fig. 13.* exhibits a portion of the first intestine in the *plaise* (*pleuronectes platessa*) laid open to expose the puckered plicæ of the internal membrane. *Fig. 14.* of the same plate represents the abdominal viscera of the *mullet* (*mugil cephalus*) as they appear on opening the stomach; *a*, the œsophagus; *b*, the liver, concealing the stomach; *c*, the numerous coils formed by the intestinal canal in this fish; *d*, some of the pyloric cæca, nearly of the same size of the intestine. *Fig. 15.* is a piece of the intestine of the *mullet* laid open, by which the villi of the internal surface are seen.

In *Plate III.* of the *Anatomy of Fishes*, *fig. 1.* exhibits a part of the intestinal canal, with the gland attached to the rectum in the *dog-fish* (*squalus catulus*); *a*, the rectum; *b*, the glandular body, of an elongated figure in this species; *c*, a portion of the valvular part of the intestine left. *Fig. 2.* shews this gland in the *skate* (*raja batis*) magnified and laid open; *a*, the fundus; *b*, the neck of the gland; several irregular depressions are seen upon the inner surface. *Fig. 3.* represents the rose-formed termination of the valvular intestine of the *squalus maximus* in the rectum, described by Mr. Home. *Fig. 4.* exhibits the inner surface of the rectum in the *turbot* (*pleuronectes maximus*); *a*, a portion of the first intestine, with slight, waving, longitudinal folds; *b*, the commencement of the rectum, marked by a valve; *c*, the internal surface of the rectum, forming very prominent, floating laminae; *d*, the anus. *Fig. 5.* shews the form of the rectum, and its connection with the first intestine, in the *pimelodus lagre*; *a*, the origin of the rectum, which is enlarged, and receives the first intestine in the way of insertion; *b*, the rectum becoming again enlarged. *Fig. 6.* exhibits the cæcal process in the *piper* (*trigla lyra*); *a*, the first intestine; *b*, the part analogous to a cæcum; *c*, the rectum.

Liver.

The situation of this viscus is generally the same in fishes as in the preceding classes; *i. e.* it immediately precedes the stomach, which it covers more or less by its lobes. In the genus *pleuronectes*, however, and some other fishes which have the abdominal cavity short and round, the liver lies between the side of the stomach and first convolution of the intestine; to the former of which it is more immediately connected.

The liver is retained in its position by means of reflections of its peritoneal covering, which are attached to the septum that sustains the pericardium, and to the œsophagus, and likewise by the large veins that come from the liver to the junction of the subclavian veins.

The magnitude of the liver is in general very considerable in proportion to the size of the fish.

The colour of the liver varies; it is generally paler than in other animals; often an ash-colour, and sometimes milk-white.

Its form is subject to continual variety; it is generally not divided into many lobes; most frequently, perhaps, only into two. As Cuvier has considered the divisions of the liver more in detail than we have done, we shall chiefly follow his description, given in the *Leçons d'Anatomie comparée*.

In the genus *lamprey* (*petromyzon*) there is but a single lobe

lobe; the liver is much elongated, and has a good deal the figure of a tongue.

In the rays the liver is divided into three long lobes, which extend throughout the whole length of the abdominal cavity. Cuvier describes but two long and very distinct lobes in the genus *squalus*, but, besides these, we have noticed in the lesser dog fish (*squalus catulus*) two very small, thin lobes, situated upon the side of the stomach next the spine.

The *spatularia* and *sturgeon* have two large lobes to the liver, which are sub-divided in the latter into a great number of lobules.

There are three divisions made by shallow fissures in the frog-fish (*lophius piscatorius*), and one lobe only in the *signatus pelagicus*, the *tetraodon*, and the *lump fish* (*cyclopterus lumpus*).

Amongst the apodal order of fishes, the eels (*murena*), and the *ammodytes tobianus*, the liver is not divided, but merely a little notched in some species of the first; but there are two lobes in the liver of the *anarrhichas lupus*, the *electrical eel* (*gymnotus electricus*), and the *stromateus paru*.

Of the *jugulares*, the genera *gadus* and *blennius* have two or three long lobes.

In the *whiting* (*gadus merlangus*) the left lobe extends almost the whole length of the abdominal cavity, between the intestines and air bag.

The *weaver* (*trachinus draco*) has the liver composed of one lobe.

The liver is triangular, and without division in the *cottus niloticus*, but the *cottus scorpena* has two lobes. There are also two lobes in the liver of the *scorpena volitans*, although that of the *scorpena horrida* consists of a single lobe. There are two lobes in the liver of the *trigla cuculus*, of the *mullus barbatus*, of the *echeneis remora*, of the *pleuronectes flesus*, and of the *turbot* (*pleuronectes maximus*). The liver is without lobes in the following species of *pleuronectes*; the *plaise*, the *pleuronectes lineatus*, and *limandoides*; there is a small lobe placed behind the principal one in the *sole*, of a singular shape, with two points like horns, which has not been noticed by Cuvier. The liver has three lobes in the *scomber thynnus*; that of the *scad* (*scomber trachurus*), and of the *pilot* (*scomber duclor*), have two lobes. There are three lobes in the little *stickleback* (*gasterosteus pungitius*), the common *stickleback* (*gasterosteus aculeatus*), and four in the *gasterosteus spinachia*. The divisions of the liver are equally various in the *perch* and *sciæna* genera; the liver is without lobes, and of the shape of an arrow; in the *river perch* it is likewise undivided; and triangular in the *sciæna labrax*; although Bloch says, there are two unequal lobes in the liver of this fish. In many other *sciæna* and *perches* there are three lobes, deeply separated. In the *dory* (*zeus faber*) there are two lobes, one of which very much exceeds the other in size, and forms a kind of third lobe at its external corner. There are two lobes in the liver of the *chetodon ciliaris*, and only two slight notches in the *chetodon zebra*. The *holocentrus fago* has three unequal lobes. The liver of the *sparus salpa* has three lobes; there are two in that of the *sparus pagrus*, the *sparus erythrinus*, and likewise in the *labrus melops*; but it is a single lobe in the other species of *labrus*.

In the genera *cyprinus* the liver is very deeply divided into lobes, of which the number varies according to the species; in the *carp* (*cyprinus carpio*) the lobes are so disposed amongst the different convolutions of the intestines, that it is difficult to ascertain their number; the liver in this species exceeds in proportional bulk that of every other animal. The liver does not divide into lobes in the *pike* (*esox lucius*), in the *exocoëtus exilis*, in the *salmon* (*salmo*

salar), in the *anableps tetrapalmus*, and in the *white mullet* (*mugil albula*). There are two lobes in many of the genus *clupea*, in the *silurus glanis*, and in the *Ericaria maculata*. There are three lobes in the liver of the *silurus bagre*.

It should be observed, that in the above instances there are usually several slight notches and fissures upon the surface of the liver, which some anatomists would, perhaps, consider as divisions of this viscous, although Cuvier has not done so.

The divisions of the liver, as well as its figure, are but of little importance in all animals; sometimes they are designed to accommodate the neighbouring viscera, and at others look like accident; but in no case can the form materially affect the functions of this organ.

The texture of the liver in fishes is remarkably soft; unless in a very recent state, it immediately gives way under the pressure of the fingers. From all the observations we have been able to make, however, it appears to possess the same structure as the liver in the three preceding classes; the vena portæ terminates in penicillous branches, even more evidently in many fishes than in birds or reptiles.

The liver contains a great quantity of liquid oil in those fishes that have not the fat dispersed over the different parts of the body; of these the *shark*, *ray*, *cod*, &c. are examples. The *gadus virens* has the liver so rich with oil, that the inhabitants of Norway catch it for the purpose of obtaining its oil to burn. Mr. Home states, that the liver of the *squalus maximus* yielded about three hogsheds of oil. The oil of fishes appears as if it were diffused in those parts which contain it, as it readily flows from them, but it is more probably deposited in large cells, which freely communicate, than in the common interstitial substance.

The *biliary ducts* of the liver in fishes, except in a very few instances, do not conjoin to form a common hepatic duct, as in other animals; they proceed directly as they leave the different lobes of the liver, to open either into the gall-bag or its excretory canal, or into both; in consequence of which the hepatic ducts are in general numerous and very small in fishes.

In the *squalus maximus* a fasciculus of twelve ducts, like a navel string, passes from the liver to the intestine, from which it is presumed there is no gall-bag in this species.

In the *ray* genus there are several very slender ducts, which terminate in the gall-bag, and one large branch, which is furnished by the middle lobe of the liver, and communicates with the cystic duct.

In the *signatus pelagicus* the different hepatic ducts produce a trunk, which, however, does not go on to the intestine, but terminates in the cystic duct.

In the genus *tetraodon* there are three principal hepatic ducts, of which the first opens into the gall-bag, near the neck, and the other two enter the cystic duct at different distances.

In the *lophius piscatorius* there are two hepatic ducts, which end in the cystic; the one at its origin, and the other at some distance.

The *lump* (*cyclopterus lumpus*) forms an exception to the general rule, with respect to the termination of the hepatic ducts; in this fish there is no gall-bladder, and the different branches from the liver soon unite, to form a single duct, which proceeds directly to end in the intestine. The few fishes which do not possess a gall-bag have probably a similar structure, although it has not been examined.

In the *anarrhichas lupus* the hepatic ducts are extremely numerous: the right lobe of the liver furnishes three, each of five or six branches, which enter distinctly into the gall-bag; the left lobe gives origin to three fasciculi; the first

has three branches which open into the neck of the gall-bag; the others are composed each of two branches, and end in the cystic duct.

There are three or four principal hepatic ducts in the *eel*, which terminate in the ductus cysticus near its origin.

In the *cod* (*gadus morrhua*) there are several small hepatic ducts, which form four branches; these, after passing some way, enter an enlargement of the cystic duct, which takes place near its entrance into the intestine. In the *bake* (*gadus merluccii*) there are many small hepatic ducts, which terminate in succession upon the cystic duct.

The hepatic ducts of the *scorpana horrida* penetrate the cystic duct.

In the *sole* (*pleuronectes solea*) the ducts from the liver go chiefly to a dilated part of the ductus cysticus. In the *brill* (*pleuronectes rhombus*) the cystic duct receives two from the liver before its dilatation; and one trunk, which is composed of several branches, enters the dilated part of the cystic duct. In the *turbot* (*pleuronectes maximus*) some of the hepatic lobes open into the gall-bladder, and others into the dilated part of the cystic duct.

In the *dory* (*zeus faber*) there are two or three minute canals which pass from the small lobe of the liver into the neck of the gall-bladder, and four considerable ducts that go from the large lobe to the cystic duct, which they enter at different distances.

In the *river perch* (*perca fluviatilis*) the hepatic duct opens into the neck of the gall-bag, and in the *sea perch* (*sciaenops labrax*) there are three principal branches from the liver which end in the cystic duct, at different distances.

The *barbel* (*cyprinus barbatus*) has the hepatic ducts ending in the cystic.

The *salmon* sends hepatic ducts into the neck of the gall-bladder.

In the *bichir* (*polypterus niloticus*) the trunk of the hepatic ducts is joined to the cystic.

In the *silurus bagre* there are eight or ten little ducts from the liver to the cystic duct.

In all the instances we have examined, the entrance of the hepatic ducts into the cystic, or the gall bag, is not accompanied by any valve or projection of the coats; the structure of the hepatic ducts also appears to be simple, and the internal surface without any valve or reticulation.

The *gall-bag* is not universally met with in fishes; it has not been found in the *lumprey* (*petromyzon marinus*); in the *pride* (*petromyzon branchialis*); in the *lump* (*cyclopterus lumpus*); the *piper* (*trigla lyra*); the *pleuronectes radiatus*, the *perch* of the Nile, and in many *scienas*; we have not observed a gall-bag also in the *weaver* (*trachinus draco*).

These instances of the absence of the gall-bladder are fewer than those noticed in mammalia and in birds; a reservoir in which the bile may be concentrated, it may be concluded, is therefore more necessary to fishes than to the hot blooded animals; the circumstance of the bile all passing through either the gall-bag or its duct, when those parts exist, is a strong proof of this opinion.

Cuvier describes the gall-bag as being more variable with respect to position in fishes than in the other classes; it is situated horizontally or obliquely, in regard to the whole fish, and in those two cases its fundus may be either turned forwards or backwards; at other times it is placed transversely under the stomach, of which the *silurus bagre* affords an example; it is sometimes in a degree imbedded or concealed by the substance of the liver.

The form of the bag is also subject to variety; it is most commonly either egg shaped or pyriform; sometimes it is globular; sometimes it is ovalar, with the end next the duct

very obtuse or flattened; this we have observed in some of the *flat fishes* (*pleuronectes*). In the *lesser dog-fish* (*squalus catulus*) we have found it of the shape of a tube, nearly two inches long; the duct arises from the end the farthest from the intestine, and is seen like a smaller canal, accompanying the other which composed the gall-bladder.

The bulk of the gall-bag is also variable; perhaps it might be stated that it is large in proportion to the rapidity of the digestion in the fish. The bag is large in the *anarrichas lupus*, the *pike*, the *spatularia*, and *moon-fish*, (*diodon mola*); it is small in the *sygnathus pelagicus*, *scorpana horrida*, the *river perch*; several of the genus *cheilodon*, the *sole*, *brill*, and some others of the *pleuronectes*, also have a small gall-bag, but in those the dilatation of the cystic duct makes amends for it.

The structure of the gall-bag would seem to be simply membranous, the parietes are thin and smooth on the inner surface, which do not exhibit any glandular appearance or reticulation.

The *cystic duct* in general passes off directly from one end of the gall-bag, without forming any contortion, as in mammalia; it is also, as far as we have observed, a simple membranous tube, with a smooth surface internally, and the orifice by which it communicates with the gall-bag is unprovided with any valvular structure, by which means the bile flows through it without interruption.

The cystic duct transmits all the bile which passes to the intestines, with a few exceptions of those fishes which are unprovided with a gall-bladder; it therefore corresponds to the ductus communis choledocus of other animals. In several fishes, as the *cod* (*gadus morrhua*), some of the *pleuronectes*, as the *sole*, *brill*, *turbot*, and others, the cystic canal forms a remarkable dilatation previous to its termination in the intestine; this dilated part receives some or all the ducts from the liver; it is so large in the *turbot*, that Cuvier describes it as a second gall-bag, to which it certainly corresponds in its office, by accumulating and detaining the bile on its way to the intestine.

The cystic, or rather common biliary duct, usually discharges its fluid into the intestine, along with the pyloric cæca, by an opening in the midst of theirs; sometimes it ends in one of the cæca. This happens in the *plaïse* (*pleuronectes platessa*), the *river perch*, and the *dory* (*zeus faber*). The duct enters the intestine at some distance from the pylorus in the *pike* (*esox lucius*).

In the *squalus maximus*, the orifice through which the bile is poured into the intestine is placed upon a process like a nipple.

The magnitude of the liver, and the formation of the biliary ducts in fishes, plainly indicate two circumstances in their physiology, namely, that a large quantity of bile is secreted, and that this fluid passes in a concentrated state into the intestinal canal. It is remarkable that the bile is scarcely to be detected in the tract of the first intestine, and that even the mæces in the last portion of the canal are less coloured by this secretion than in other animals; this fact strongly supports the opinion of the bile being destined to assist in the conversion of the alimentary substance into chyle, in performing which it is itself decomposed and disposed of.

The *bile* of fishes, as far as we are acquainted, has not yet been submitted to any exact analysis; it does not however appear to differ materially in its properties from the same fluid in other animals. It is usually of a deep green colour, although the liver is often in fishes of a pale yellow colour, which probably arises from the bile sojourning for some time in the gall bag, before it is carried into the intestine. It is also more fluid than in mammalia and birds, as might

be expected in consequence of the gall-bag not being constructed to furnish a mucous secretion as in these animals.

In *figs. 5 and 6, of Plate I. of the Anatomy of Fishes*, the letter *b* indicates the fasciculi of twelve biliary ducts, which are found to pass from the liver to the first intestines in the *squalus maximus*.

In *Plate III. of the Anatomy of Fishes. fig. 7.* shows the manner in which the hepatic ducts proceed to the gall-bag and cystic duct; *a*, the portion of the liver next the gall-bag; *b*, the gall-bag; *c*, the dilated part of the cystic duct; *d*, the hepatic ducts passing to the gall-bag; *e*, the ducts from the liver to the dilatation of the cystic duct.

Fig. 8. of the same plate, exhibits the termination of the biliary ducts in the *wolf fish (anarrhichas lupus)*; *a* is the liver; *b*, the gall-bag; *c*, the cystic duct; *d*, a portion of the intestine, into which the cystic duct opens; *e*, fasciculus of several hepatic ducts from the right lobe, going to terminate distinctly in the gall bag; *f*, fasciculus from the left lobe ending in the neck of the gall-bag; *g, g.* two other fasciculi from the left lobe, which open into the cystic duct.

Fig. 9. of this plate, represents the hepatic ducts going to the intestine in the *lamp fish (cyclopterus lumpus)*; *a* is a part of the liver; *b*, the hepatic duct, coming from the liver, and uniting into a common duct, which is indicated by *c*; *d* is the portion of the intestine into which the common biliary duct opens.

In *fig. 6. of Plate I. of the Anatomy of Fishes*, the letter *f* points out the nipple-shaped process, on which is seen the orifice of the hepatic ducts within the intestine of the *squalus maximus*.

Cæca, or pyloric Appendices.

Cuvier has, with some propriety, considered these parts as processes of the intestinal canal, and has combined his description of them with that of the intestines; in some fishes they are so wide, that the alimentary substances must necessarily pass into them, but in general they are very small worm-like processes, with a cavity scarcely wide enough to admit a probe; but whatever their bulk may be, they are always continuous with the tube of the intestine.

The internal surface of the cæca is extremely vascular, even more so frequently than that of the adjoining intestine. When the internal membrane of the intestine is plicated or laminated, that of the cæca is sometimes reticulated; but in general the structure of the inner surface of the cæca corresponds with that of the neighbouring surface of the intestine, although it may not be so striking.

The cavity of the cæca always contains a quantity of renacious mucus, which may be more abundantly obtained by pressing the parietes of the cæca between the fingers.

The cæca possess a muscular and a membranous coat, like the other parts of the intestinal canal.

The cæca in general bear considerable resemblance, both in size and figure, to a cluster of worms attached to the canal of the intestine by one extremity; in some instances they are conjoined to form trunks, which open into the intestine. In the *spatularia* they are united two and two, and produce seven principal branches, which at last join in one trunk. In the *sturgeon* they are short and wide, and collected together into one mass, into the centre of which they all open by very large mouths; the inner surface is deeply reticulated, so as to give the whole mass, when cut into, rather the appearance of a congeries of cells, than a collection of ramified tubes, which has led many authors to describe this part in the *sturgeon* as a single gland analogous to the pancreas; the muscular coat is strong; and has the fibres distributed in different directions, and the opening of

the conjoined cæca into the intestine is single, and would be as wide as that canal if it were not for an annular fold which contracts the orifice a little. There is a greyish glandular substance very discernible behind the cæca, similar to the glandular layer already noticed in the first intestine of this fish.

There is great variety with respect to the number of the pyloric cæca, and in several fishes they are altogether wanting; neither their presence, however, nor their number, seems to have much relation to the habits or general structure of the fish, except in the *ray* and *shark* genera, in which the cæca are wanting, and their places supplied by a real pancreas.

Besides, in the *chondropterygii* the cæca are not found in the genera *sygnathus*, *ostracion*, *balistes*, *tetraodon*, and *diodon*, amongst the branchiologi; in any of the *apodal* fishes: in the *uranoscopus* and *blennius* genera, in some species of *pleuronectes*; in the *sparus spinifer*, and the *labrus tinca*: in the *anableps tetrophthalmus*, many species of *esox*, the genera *cyprinus* and *silurus*, and probably others which have not been examined.

Cuvier has taken the pains to reckon the number of pyloric cæca which exist in many fishes; we shall therefore follow his account.

The *lophius piscatorius* has but two, which are small and somewhat pyriform in their shape.

In the *cyclopterus lumpus* the cæca are small, form about six ramified rays, and as they approach the intestine they unite and open into each other.

In the genus *gadus*, the number of the appendices varies: they are also often ramified, or united into trunks, which open into the intestine; there are four orifices of these in the *whiting (gadus merlangus)*, and six in the *cod (gadus morrhua)*. In the *hake (gadus merluccius)* there is, in place of the cæca, one large cul-de-sac, of which the bottom is turned forwards, and which opens by a large aperture into the commencement of the intestinal canal; there are eight cæca in the *gadus mustela*, thirty-two in the *barbel (gadus lota)*, and thirty-four in the *ling (gadus molva)*.

There are eight long and slender appendices in the *weaver (trachinus draco)*.

In the genus *cottus* the number of the cæca varies from four to nine.

There are six in the *remora (echeneis remora)*. Twenty-six cæca are found in the *furmulet (mulius furmuletus)*, and six only in the *mulius barbatus*.

The *scorpena horrida* has four cæca; the number varies much in the genus *trigla*; the *piper (trigla byra)* has from eight to ten; the *trigla cataphracta* six.

In most of the *pleuronectes* there are but two cæca, as in the *turbot*, the *brill*, the *pleuronectes limanda*, the *flounder*, the *dab*. Cuvier also reckons two in the *plaice*, and only one in the *holibut*: as far as our recollection serves, there are two very large cæca in the *holibut*, and in the *plaice*, besides the two small conical dilatations at each side of the origin of the intestinal canal. We have lately discovered, about an inch beyond these, a third cæcum, from the side of the intestine, exactly resembling in shape and structure the two already described by authors. This is the more worthy of remark, as it is the only instance we know in which the first intestine of fishes furnishes any such process except at the pylorus.

In the *mackerel (scomber scombrus)* the cæca are very numerous; but there are only three in the *scomber japonicus*, in the *scomber thynnus* there are two, which divide each into three branches. In the *pilchard (scomber pilchardus)* there are twenty-five; and in the *sea-bream (scomber trachurus)* twelve or thirteen cæca.

There are but two little appendices situated at each side of the pylorus in the *stickleback* (*gasterosteus aculeatus*).

The cæca are fine and small in most of the *perches* and *scienas*. In the common *perch* (*perca fluviatilis*), and the *perca zingel*, there are but three. In the *perca nilotica* there are four; six cæca are found in the *perca lucio-perca*. There are seven or eight in the *sciena nigra*; five in the *sciena labrax*, and six in the *sciena cirrosa*, and a much greater number in the other individuals of this genus.

There are four cæca in the *teuthis bepatur*. The *chetodon arcuatus* has about thirty long, slender cæca; the *chetodon zebra* only five.

In the genus *sparus* there are usually from three to five cæca; the *sparus salpa* has four; the *sparus auratus*, and *sparus sargus*, have three; the *sparus pagrus*, *sparus mena*, and *sparus brama*, have each four, and there are five in the *sparus annularis*.

The cæcal appendages are numerous in the genus *clupea*. There are eighteen long, slender cæca in the *anchovy* (*clupea encrasicolus*); twenty-four in the *herring* (*clupea harengus*), which open into the intestine by twelve orifices, ranged in a line; there are as many as eighty in the *clupea alofa*.

The genus *salmo* exhibits great variety in this respect; there are but six in the *smelt* (*salmo eperlanus*), although in the *salmo muræna* there exist one hundred and fifty; in the common *salmon* (*salmo salar*) there are about seventy, placed in several rows, along the side of the intestine.

There are two cæca in the *mormyrus labiatus*. Geoffroy.

The common *mullet* (*mugil cephalus*) has six cæca; the *mugil albula* but one.

The only point of view in which we can consider the pyloric cæca is, as prolongations, or processes of the alimentary canal, designed to furnish an additional quantity of the intestinal mucus; this office is reconcilable to all the varieties of form and number, and the occasional absence of these parts, which could only affect the mucous secretion of the cæca with respect to quantity, and any deficiency of that fluid might be supplied by a more copious secretion from the intestine itself. This opinion seems supported by the relative magnitude of the cæca, and of the parts of the alimentary canal from which they arise. We have observed that the capacity of the stomach, or of the first part of the intestine, is greatest in proportion to the bulk of the fish, in those species where the cæca are either wanting or few, and that these parts are commonly small when the cæca are numerous or large.

In Plate II. of the *Anatomy of Fishes*, fig. 4. exhibits the three cæca in the *plaife* (*pleuronectes plateffa*): *c* is the pylorus; *d, d*, the two pyloric cæca; *e*, the third cæcum peculiar to this fish, arising from the intestine, at a short distance from the pylorus. Fig. 12 of the same plate gives a view of the internal surface of the cæca, and the adjoining parts of the intestine in the *turbot* (*pleuronectes maximus*): *a* is the laminated surface of the intestine; *bb*, the internal membrane of the two cæca, in which the laminated structure is less apparent. The letters *e, e, e*, of fig. 7. and the letter *d*, in fig. 14. of this plate, refer to some of the cæca in the *mullet* (*mugil cephalus*).

In Plate III. of the *Anatomy of Fishes*, fig. 10. shews the internal structure of the cæca, and their connection with the intestine in the *sturgeon* (*acipenser sturio*); *a*, the cavity of the intestine; *b*, the valve of the pylorus; *c*, the cavities of the cæca exposed by a section. The larger orifices belong to branches of the cæca, the smaller to the cells produced by the reticulation of their internal membrane; *d*, the large common opening of the cæca into the gut; *e e*, the muscular coat which surrounds the cæca, and gives them the

appearance of a single gland. Fig. 11. of the same plate represents the numerous cæca in the *salmon* (*salmo salar*); *a* is a portion of the intestine at the pylorus; *b b*, the cæca in great numbers arranged along the intestine.

Pancreas.

This gland only exists in two genera of fishes, the *ray* and *shark*; the glandular apparatus which has been described by some anatomists as a pancreas, in the *sturgeon*, is really, as we have before observed, only an assemblage of short cæca, having many communications with each other.

The pancreas is situated immediately beyond the pylorus, upon the first intestine; its form is somewhat triangular, but very irregularly so; it is divided into lobes. In the *smaller dog-fish* (*squalus catulus*), we have observed the pancreas to be double, or of two portions, of which one is placed on each side of the intestine.

The texture of the gland is soft, compact, and uniform; its minute structure is, therefore, obscure; its colour is a rich reddish white; it has a much smaller proportional volume, than the pyloric cæca usually have, to those fishes in which they exist.

The fluid which this gland secretes, appears to resemble the pancreatic juice of the three preceding classes of animals, and not the mucus of the pyloric cæca; which circumstance, as has been before mentioned, affords a strong presumption that the offices of these two secretions are different.

Spleen.

This organ is supposed to exist in all fishes; we have, however, failed to detect it in two districts of the *lamprey* (*petromyzon marinus*); but, until assured by further observation, we are unwilling to assert positively, that so extraordinary a departure from the common structure of the class does occur in this species; it may be presumed, however, that if this fish possess a spleen, it is so insignificant as to readily escape notice.

The situation of the spleen, with respect to the adjacent viscera, is by no means uniform in fishes; it is perhaps most commonly placed on the upper side of the cæcal portion of the stomach, that is to say, between its fundus and the swimming bladder, which lies along the back.

In the *shark* and *ray* genera it projects from this situation, so that one half of it lies on the left side of the stomach.

In the *angel-fish* (*squalus squatina*) Monroe observed two spleens, one of which was attached to the large, the other to the smaller curvature of the stomach. In the *lesser dog-fish* (*squalus catulus*) the spleen is divided by a deep fissure, which is what we presume doctor Monroe meant by two spleens; one portion is on the left side of the fundus of the stomach, and the other passes above it. Mr. Home represents the spleen of the *squalus maximus* as a chain passing round the stomach. Cuvier describes two branches of the spleen in the *sturgeon* (*acipenser sturio*), which are attached to the curvature that the stomach makes in this fish posteriorly. Doctor Monroe reckoned seven spleens in the *sturgeon*, but all very small; the largest, he says, did not exceed the size of a dried horse-bean, and the other six were none of them larger than a dried garden pea.

The spleen is enveloped by the mesentery, near the commencement of the intestinal canal in the *lump-fish* (*cyclopterus lumpus*). It is fixed on the right side of the beginning of the first intestine in the *spatularia*. In the *eel* it is placed between the stomach and the next portion of the intestinal canal. In the *scorpana* it is found interposed between the pyloric extremity of the stomach, and one of the cæca. The *remora* has it situated between the liver and the stomach;

Stomach; its position is likewise similar in several species of *pleuronectes*, as the *plaife*, *sole*, *brill*, &c.

In the *dory* (*zeus faber*) it is connected to the left side of the cæcal portion of the stomach. It is extended upon the funnel-shaped cul-de-sac of the stomach in the *mullet* (*mugil cephalus*); and the *pike* (*esox lucius*) has the spleen suspended in the curve which is produced posteriorly by the stomach and the first intestine.

The shape of the spleen is in general irregularly triangular. Cuvier, as before mentioned, describes the spleen of the *sturgeon* as forming two branches anteriorly. The spleen is much elongated in the *spatularia*, the *viviparous blenny*, &c.; it is small and spherical in the *plaife* (*pleuronectes plateia*), the *echeneis remora*, and others; of a very irregular shape in the *barbel* (*cyprinus barbatus*). Collins has stated the spleen to be double in some of the *pleuronectes*, as the *turbot*, *plaife*, and *flounder*; likewise in the *eel*, the *mullet*, and others, in which he appears to have been incorrect, or to have reckoned the fissures of the spleen as complete divisions of the viscus.

The internal organization of the spleen appears to agree with that described in the other classes of animals. The arteries divide like the branches of a broom, and terminate in very minute ramifications; the veins originate from cells, which, although not large, are sometimes very visible in consequence of their containing a dark coloured substance: when the texture of a spleen is unravelled, which is very easy from the looseness of its texture, the cells, if filled with this substance, appear like small grains of coffee adhering to the extremities of the vessels: this dark appearance of the cells is not general, nor do we believe constant in the same individual; it seems to be rather an accidental condition of the organ: after it has once been perceived, there is no difficulty in recognizing the same sort of granular appearance, of a pale brownish colour, in the spleens of other fishes. What is the substance which give the granular appearance in the spleen of fishes? Is it the splenic blood changed in its properties while passing through the cells? More observation is required to answer these questions.

Absorbents.

The honour of discovering the lymphatic system in fishes has been claimed both by Dr. Monroe and Mr. Hewson; but it should probably be shared between these two anatomists, who were both engaged in the pursuit of it about the same period. The reason for its remaining so long unknown, seems to have been the greater magnitude of the absorbent vessels in this class than in mammalia, or birds. Anatomists, in searching for the minute branches, overlooked those palpable plexuses, cells, and trunks, which, when once discovered, rendered the development of the whole system perfectly easy; thus we find Mr. Hewson made many unsuccessful attempts with different fishes, both recently dead and while still alive, before he was able to detect any vessels of this nature. Another circumstance which stood in the way of the discovery of this system of vessels was, that it does not possess any lymphatic glands, as in mammalia.

We shall first give a description of the absorbents in the *chondropterygii*, and afterwards in the *osseous* fishes.

In the *skate* (*raja batis*) the lacteals may be seen to arise numerously from the stomach and intestines; they accompany the blood-vessels of these organs; they communicate with a singular cellular body, which lies along the great curvature or external side of the stomach. The internal structure of this part, when prepared by inflation and drying, resembles somewhat the cancelli of the bones, being composed of a

great many cells of very irregular shapes, and all communicating the one with another. The principal absorbent vessels pass through it.

This cellular receptacle of the chyle may probably perform the same offices of the absorbent glands in other animals.

The lymphatics of the liver, gall-bag, pancreas, and spleen, also accompany the blood-vessels of these parts; they freely communicate with each other, and, uniting with the absorbents of the stomach and intestines, they form a plexus on each side of the stomach, which proceeds along the sides and the back part of the œsophagus to the side of the spine, and near to the large veins analogous to the subclavian; at these parts all the absorbents of the different parts of the body are assembled.

The lymphatics of the kidneys and organs of generation, with those of the tail and posterior parts of the body, proceed along the spine.

The lymph of the head and lateral fins is conveyed into the common reservoir, principally by means of a large trunk, which passes on each side of the head, and which receives large lateral branches from the adjacent parts.

The different absorbents of each side of the body, after communicating with each other in the subclavian plexus, furnish two short trunks which go to terminate, the one on the right, the other on the left subclavian vein, near the junction of those vessels with the internal jugular veins. These two trunks correspond in their office to the thoracic ducts of other animals, but do not serve as reservoirs, as they have less capacity than the plexus from which they take their origin.

At the orifices of the trunks into the subclavian veins, there are placed two semilunar valves, to prevent the blood escaping into them. There is no other instance of valves throughout the absorbent system of fishes; although the vessels have a flattened, jointed appearance, as if their canal was interrupted by valvular contractions.

In the *osseous fishes*, of which the *cod* and *haddock* are taken as examples, the lacteals are of a smaller size than in the *skate*; they run on each side of the mesenteric artery, and form numerous transverse communications over this vessel; they enter a large receptaculum, which lies on the right side of the anterior, or œsophageal portion of the stomach.

This receptacle is composed at its back part, according to Hewson, of two branches; the one lies between the commencement of the intestinal canal and the stomach, and runs a little way upon the cæca, receiving the lymphatics of the liver, cæca, and those of the posterior part of the stomach, and part of the lacteals. The other branch of the receptaculum receives the lacteals of the remainder of the intestinal canal; the receptaculum also derives some lymphatics from the swimming bladder, from the gall-bag, and the posterior part of the œsophagus.

Mr. Hewson has described the thoracic duct as arising from this receptaculum, passing for about half an inch in the *haddock*, on the right side of the œsophagus, where it divides into two branches, one of which passes behind the œsophagus to the left side, the other goes straight on, on the right side, runs past the upper part of the kidney, from which it receives some small branches, and soon after is joined by a branch from the large lymphatic that lies upon the clavicular bone. It likewise, near this part, sends a branch to join the duct of the opposite side, and then a little farther on is joined, by those large lymphatics which make a net-work behind the heart. These last-mentioned vessels receive the lymphatics from the anterior gills and fauces. The thoracic duct, after being joined by these vessels,

vessels, communicates with the net-work near the orbit; where its lymph is mixed with that of the lymphatics from the posterior part of the gills, from the anterior fins, the belly, &c. and then from this net-work a vessel goes into the jugular vein, just below the orbit.

The lymphatics of the left side agree exactly with those of the right. Hewson's Account of the Lymphatic System in Fish. Phil. Trans. for 1769.

Neither Hewson nor Cuvier, (who seems to have copied his description) have represented the common receptacles of the lymph in *osseous* fishes accurately. These parts do not deserve to be called net-works, but, as Dr. Monroe has named them, large *cellular* receptacles; they are particularly large in the *haddock* (*gadus aeglefinus*), and *cod* (*gadus morrhua*), and are most easily demonstrated by injecting with a fluid, or inflating any of the large absorbents in the neighbourhood of them. These receptacles are situated immediately behind the gills, and may be displayed by cutting through the integuments at that place; the receptacles have less magnitude in the *salmon* (*salmo salar*), but are still too much dilated to merit the name of a plexus of vessels.

The receptacles communicate by large canals, which cross from one to the other, behind or above the heart and œsophagus.

Independently of the absorbents of the viscera already described, the lymphatics of the head and muscular parts of the body give origin to four principal trunks, and a plexus which terminate in the large receptacles, or common reservoir of the system.

The first of these carries the lymph of the under surface of the body and tail; it is a considerable vessel, extending along the medial line of fish; from the tail towards the head it becomes a little enlarged under the thorax, and communicates with the large receptacles, by means of some foramina which lead into a canal on each side, between the two ventral fins.

The next two trunks are also superficial; they run along the sides of the fish near the lineæ laterales. From each side of these trunks a number of branches go off immediately under the skin, which produce a beautiful penniform appearance; these trunks open directly on each side into the common receptacles that are placed behind the gills. Beside these vessels, Hewson describes a deep-seated set of absorbents, which accompany the ribs.

The fourth trunk is deeply situated and large, it commences near the tail, and lies between the roots of the spinous processes of the vertebrae; as it proceeds towards the head it collects the lymph, from the dorsal fins and adjacent parts of the body; having arrived near the head it sends a branch to each thoracic duct, near the part where they come off from their common trunks.

The lymphatics of the brain and organs of sense, and those from the mouth, jaws, and gills, form a complex anastomosis or plexus near the orbits, and send a vessel into each of the common reservoirs.

In the *salmon* each of the receptacles terminates the system, by sending a canal into the upper end of the corresponding inferior vena cava, contiguous to and on the fore and outer side of the internal jugular vein.

The entrances into the venous system are guarded in *osseous* fishes, as in the *skate*, by semilunar valves.

As the absorbent vessels are unprovided with valves, the most effectual way of expelling them, is to inject the system from some of the principal trunks; the best for this purpose is the one which runs under the skin of the belly. By this means the most minute branches may be filled and ex-

hibited. Dr. Monroe succeeded in injecting from the trunk; the absorbents of the brain, of the membranes of the eye, and the ear in the *skate* (*raja batis*), by which he discovered that the lymphatics of the brain form an intricate plexus; he also filled the ultimate branches of the absorbents of the skin. These are most beautifully reticulated, and are particularly large and numerous upon the upper or dorsal surface of the *skate*, on which they terminate by foramina capable of being demonstrated. Dr. Monroe says, that not only water, but air, milk, quicksilver, and even oil of turpentine, coloured with the powder of vermilion, were discharged upon the surface of the skin, by a vast number of distinct orifices, placed at regular distances from each other; yet the force with which these liquors were injected was very small, and there was no extravasation into the cellular substance any where under the skin, or in the interstices of the muscles. It is remarkable that the effusion of these liquors upon the skin takes place only on the upper surface of the fish, where the skin is tough and scabrous: it however proves that it does not happen in consequence of extravasation, or rupture of the vessels, for in that case the effusion would be solely or principally seen on the under surface of the fish on which the skin is much more weak and thin. Monroe concludes that the cutaneous lymphatics, situated on the back of the *skate*, are designed to absorb a portion of sea water for the purposes of furnishing the salt liquor found in such considerable quantity within the cranium of that fish. See Monroe's Physiology of Fishes, p. 34.

The facility of injecting the absorbents from their trunks enabled Mr. Hewson also to fill a series of very minute vessels, between the internal and muscular coats of the intestines; and upon the plicæ, (or, as he terms them, villi) in these situations the absorbents anastomose and run together, so as to produce a very close and beautiful reticulation. If mercury be injected into this net-work at one part, it spreads over the intestine; and if the intestine be inverted, and the mercury squeezed, it is easily forced into the small vessels on the internal coat.

In one injection Mr. Hewson made of the stomach of the *cod*, the absorbents were seen to pass through the external coats, dividing into smaller and smaller branches, without any appearance of a net-work between the muscular and villous coats, although considerable force was employed in the injection; from which he concludes that the absorbent vessels of the stomach do not possess the same arrangement as those of the intestines. See Hewson's Account of the Lymphatic System in Fishes. Phil. Trans. vol. lix.

In Plate IV. of the *Anatomy of Fishes*, fig. 1. represents the curvature of the stomach of a *skate* (*raja batis*) with the cellular receptacle of the chyle in situ and of the natural size; *a*, the portion of stomach; *b*, the cellular receptacle attached to it. Fig. 2. of the same plate, exhibits the receptacle magnified, and cut open, after having been previously inflated and dried, in order to expose its internal structure; *a*, indicates the cellular part; *b, b*, the absorbent vessels passing longitudinally through the receptacle and communicating with its cells. Fig. 3. of Plate IV. displays the common receptacle of the chyle and lymph in the *haddock*, (*gadus aeglefinus*) with some of the lymphatic trunks which enter it; *a* is the receptacle distended by injection, it appears like a large sac, situated immediately behind the gills; in order to expose it the gill-cover is cut away; *b* the branchiæ; *c* is the absorbent which runs along the middle line of the belly, and communicates with the receptacle by branches sent in between the abdominal fins; *d*, the lateral absorbent trunk, which enters the recep-

receptacle directly; *e*, the lateral subcutaneous duct obscurely seen, running parallel with the lateral absorbent vessel.

Heart.

Fishes have not, properly speaking, a thoracic cavity, although their heart and gills are very distinctly separated from the abdominal viscera, by means of a septum, which crosses the body immediately before the liver. This diaphragm is not muscular, as far as we have observed, but receives a slender muscle on each side from the scapula. It is usually thick and firm, and is apparently composed of tendinous fibres, interwoven together like the muscular fasciculi of the internal surface of the human auricle, and the web thus formed is further strengthened by the peritoneum on one side, and the pericardium on the other.

The heart is situated in the middle line of the body, between the branchiæ of each side, and farther forward, that is, nearer the head than in other animals; the space between the mouth and the belly being generally very inconsiderable in fishes.

The *pericardium* is larger, and of a rounder figure than the heart; this is necessary on account of the irregular form of that viscus.

The external reflection of the pericardium is in general a stronger membrane than the peritoneum; it appears to be tendinous in structure, although commonly very thin.

We have not observed any material deviations from the common structure of the pericardium, except in the *lamprey* (*petromyzon marinus*), in which we have lately discovered a most singular conformation of the part. The pericardium in this fish is composed of firm cartilage, of a rounded figure, and so far imbedded in the anterior portion of the liver, that a great part of it is concealed from view until the substance of the latter be cut asunder; there are several fræna, or tendinous processes sent off from the internal surface of this cartilaginous sac, which are attached to the surface of the heart, and serve to sustain it in its proper position in the bag.

The above structure in the *lamprey* is a confirmation of an opinion we have held, that the pericardium does not alter its figure with the contraction and dilatation of the different parts of the heart; from which arises the necessity of a greater quantity of aqueous fluid in this cavity, than is found in those containing the other viscera.

The pericardium of the *skate* (*raja batis*), as has been mentioned in speaking of the abdominal cavity, was discovered by Doctor Monroe to produce a funnel-shaped elongation towards the abdomen, which is divided into two branches or canals, terminating by open mouths in the latter cavity; as far as our observation goes, this structure is peculiar to the *ray* genus.

The heart in fishes is composed of two cavities only, an auricle for receiving the blood from the veins of the body, and a ventricle for propelling it to the branchiæ. The distinction of these parts is very evident, by which the figure of the heart is rendered peculiar, appearing like two bodies connected to each other.

The position of the auricle, with respect to the ventricle, is subject to vary; it is usually placed anterior to it; it covers, and even passes beyond the ventricle in the genus *gadus*, the *rays* *smooth bound* (*squalus mystelus*), and the *dog-fish* (*squalus canicula*), &c.

The auricle is generally much more capacious than the ventricle. Its figure is not easily assigned; it is a sac, of which the lateral parts are dilated, and at the place where it becomes connected to the ventricle it is in a degree con-

tracted, or forms a sort of neck. The parietes of the auricle are generally thin; its muscular fasciculi form no remarkable projections, and are distributed over the internal surface rather in the manner of a meshwork or irregular ramification. The opening into the ventricle is usually furnished with two semilunar valves.

In the *moon fish* (*tetraodon mola*) there are four valves of a square shape in this situation, and in other instances, as amongst the *sharks* (*squalus*), the aperture into the ventricle is guarded by a single delicate valve, the border of which is attached by many points to the parietes of this cavity. The opening of the *veræ cavæ* into the auricle is situated rather superiorly, that is, somewhat on the side of the auricle next the spine; it is near the neck, or part which is united to the ventricle, consequently the auricle appears, on opening a fish, like an entire bag, depending from the ventricle, the communication with the *cavæ* not being visible in that view of the parts.

The *ventricle* has, according to Cuvier, most commonly four sides; we should say, the most usual figure is that of a short pyramid with three sides, the base of which corresponds to the fourth. The ventricle is, however, globular in the *smooth bound* (*squalus mystelus*), and triangular in the *dog-fish* (*squalus canicula*), and exhibits some other variations of form in different species. The parietes of the ventricle are strong and fleshy, and furnish many fasciculi on the internal part of the cavity, similar to those observed in the ventricles of other animals.

At the anterior part of the ventricle, and near the aperture into the auricle, there arises a short tube, from which the branchial artery is afterwards continued. Cuvier has called this part the *footstalk* or *bulb* of the branchial artery. Its figure is various; in the *surgeon* (*acipenser sturio*) it is oval; in the *ray* and *shark* genera it is cylindrical, and in other fishes it is most commonly pyriform; the bulb is less muscular than the ventricle, but much more so than the artery; there is often a considerable layer of muscular fibres around it, which are continued upon the branchial artery. The internal part of the bulb is commonly made irregular by a number of strong longitudinal fasciculi. The membrane which lines the bulb produces some folds of a semilunar, or a parabolic form; these have their free edge turned towards the branchial artery, consequently perform the office of valves, in obstructing the return of the blood upon the ventricle. In the *sharks* there are two rows, of three valves each, the one at the origin, the other at the termination of the bulb; there are also two rows in the *surgeon*, the first composed of four valves, the second of five. In the *ray* genus, Cuvier reckons four rows, composed of the same number of valves, and in the genus *gadus*, the *carps* (*cyprinus*), and *salmons* (*salmo*), &c. but two valves, placed at the entrance of the footstalk, and none at any other part.

Arteries.

We have already said that the heart of fishes is single, or consists only of an auricle and a ventricle. it consequently furnishes but one artery; this vessel is analogous to the pulmonary, as it conveys all the blood to the organs of respiration; it being entirely subservient to the functions of the gills or branchiæ, it has been with great propriety termed the *branchial artery*.

This vessel arises from the bulb connected with the ventricle, of which it is in reality but the continuation, and from which, in some fishes, it is not very distinguishable.

In the *skate* (*raja batis*) the artery proceeds under the cartilage which joins the inferior extremities of the bran-

chial arches; it first sends off, nearly at right angles, two large branches, one on each side, by which the trunk is considerably diminished; these two branches soon divide each into three others, which go to the three posterior branchial arches, along the convex edge of which they pass, and are lost in fine ramifications upon the laminae of the gills. The branchial artery then continues its course until it arrives opposite to the first gill, when it terminates in two branches, which make a slight curve backwards, and each divides again into two branches, which supply the two anterior gills in the same manner as already described.

In *osseous fishes* the distribution of the branchial artery does not materially differ from that in the *skate*; the vessel gains the bone to which the inferior extremities of the branchial arches are articulated, along which it divides and sends its branches between the short muscles of the branchiæ situated at this place; the ultimate number of these branches are but four, corresponding to the usual number of the gills in these fishes; the last branch proceeds almost directly backwards.

The branches of the branchial artery having conveyed all the blood to the gills, and distributed it there in a manner to be hereafter described, it is returned by another set of vessels, which many anatomists have considered as veins, but which would with much more propriety be called the *returning arteries of the gills*, both on account of their structure and office. These vessels do not carry back the blood to the heart, but, after uniting together, distribute it to every part of the fish's body; there is therefore but one circulation in this class of animals, in the course of which the organs of respiration are interposed.

The *arteries* which receive the blood from the gills, and convey it to every part of the body, have been so fully described by Monroe and Cuvier, that we have scarcely any thing to add to their account of them. The *skate* (*raja batia*) forms their chief example.

In this fish each gill furnishes an artery, which makes a circuit round the superior extremity of its cartilaginous arch, from below backwards. Monroe describes the arteries produced by the gills as being double upon all except the first, and besides being united together at their extremities so as to form arterial circuits, are conjoined with each other by means of large transverse canals.

The artery of the anterior gill, after anastomosing with the next, by the transverse vessel, turns forwards to be distributed to the head; it supplies the parts of the upper jaw, the eye, the ear, the nose; gives small branches to the fore-part of the brain. There are likewise some vessels sent off from the anterior side of the trunk of the arteries of the first and second gills, which are distributed to the muscles and external parts of the head. These first branches, derived from the arteries of the gills, may be considered analogous to the *carotid*.

After sending off the preceding arteries, the vessels furnished by the gills produce, by their junction at the superior part, or upon the cartilages of the vertebrae of the neck, *three principal trunks*; at the place, where the most anterior is formed, it sends off a vessel which penetrates the cranium, at the inferior part, near to where it is joined with the vertebral column; this artery divides, on entering the cavity of the cranium, into three branches: the 1st runs backwards upon the inferior surface of the spinal marrow, and unites with the corresponding artery of the other side, and with a middle vessel, which forms a communication between the different arteries of the brain. These three branches compose a single artery, which passes upon the spinal marrow, and may be called with great propriety the *spinal artery*. The

2d branch of the artery of the brain goes forwards and inwards, and again forms a junction with its fellow, and the one which runs along the middle line of the lower surface of the brain and spinal marrow. The 3d branch passes to the origin of the medulla spinalis, and there gives off two branches which extend to a vascular ring, produced from the sides of the middle artery; the branch still advances as far as the eighth pair of nerves, where it sends off two other branches, which unite to give origin to the middle artery already mentioned. After producing this vessel the anterior branch goes on distributing small arteries to the brain; it passes under the root of the fifth pair of nerves, to the tubercles of the olfactory nerves, where it is expanded on branches that spread in radii, or like the pes anserinus of the portio dura. The intricate anastomoses produced by this artery with its fellow, and with the middle vessel of the lower surface of the brain, have been compared by Cuvier to the Greek capital letter phi, accompanied with two semi-circles affixed to it, in opposite directions, thus $\phi\delta\epsilon$. This arrangement of the vessels of the brain may be considered as analogous to the rete mirabile of the carotid in quadrupeds, and the circle of Willis in man. The artery which is distributed to the brain in fishes appears, from its origin and course, to supply the place of the *vertebral artery*.

The three trunks produced by the blood vessels of the gills proceed inwards and backwards upon the inferior smooth surface of the cartilage, corresponding to the cervical vertebrae, and soon unite into one large vessel which is analogous to the *aorta*.

At the place where these vessels are assembled to form the aorta, there is given off a large branch, which corresponds to the *subclavian artery*, both in its situation, and on account of the parts it supplies; it passes directly across the cartilages which compose the pectoral member, or great fin of the *skate*, into which it enters, and immediately divides into two great branches, which take the course of the broad cartilage that sustains the rays and muscles of the fin, the one passing anteriorly, the other backwards, and each distributing branches in the direction of the muscles of the fin.

The subclavian, according to Cuvier, furnishes posteriorly a small artery, which goes to the ovary in the female, and to the testicle in the male, and is analogous to the *spermatic*.

Before the subclavian penetrates the fin it gives off a remarkable branch anteriorly, which passes along the fore part of the gills; it there sends communicating branches to the vessels that are immediately produced from the gills, and likewise some which are distributed upon the gills themselves for their nourishment, which are consequently analogous to the *branchial arteries* of those animals which have lungs. It detaches also, inwards, some arteries to the heart and trunk of the branchial artery, which supply the place of the *coronary arteries*; and, lastly, it is lost in branches which go to the muscles and parts about the upper jaw.

The *aorta* proceeds in a straight line upon the under surface of the cartilages composing the dorsal vertebrae, on which there is a groove for its reception, and when it arrives at the tail it becomes completely enclosed in a canal, which is made by the inferior spinous processes of the caudal vertebrae.

Soon after entering the abdomen the aorta sends off the *coeliac artery*; this vessel passes backwards, and is distributed in particular to the spiral valve of the intestines, to the liver, and to the stomach. The first branch accompanies the cystic duct to the commencement of the intestines, which it penetrates very near the pylorus, in order to ramify to infinity upon the spiral valve: some of its small branches also

go to the pancreas, and to the posterior part of the stomach. The second branch, or the *hepatic artery*, is a small vessel; it goes with the hepatic duct to the base of the liver, at which place it enters that viscus. When the cæliac artery has arrived at the internal edge of the stomach, it divides into two branches, the one inferior, of which the ramifications are detached at right angles, from right to left, under the inferior surface of the stomach; the other is superior, and is distributed to the corresponding surface of the same organ, and gives likewise some small arteries to the left side of the spleen.

The next branch of the aorta is the *mesenteric artery*. It passes to the right of the spleen, to which it gives two large branches that enter it at one side, and furnish at the other side arteries to the pancreas; it afterwards follows the right side of the intestinal canal, to which it is distributed. Its chief branches, to the number of nine or ten, detach themselves at right angles at nearly equal distances from each other, and cross and surround the intestine. The succeeding branches of the aorta are much smaller than the preceding.

The two first go to the commencement of the oviduct, which they furnish with many branches, particularly at the superior part; but before arriving there each of them sends an artery to the muscles of the spine analogous to the dorsal branch of the intercostals, or of the lumbar in mammalia.

A third branch furnishes some arteries to the spinal column and to the commencement of the kidney, and goes particularly to the oviduct.

A fourth artery arises from the aorta, and is sent exclusively to the kidney, at the side of which it detaches a small lumbar artery, which is distributed to the parietes of the belly, to the muscles of the spine, and to the vertebral column.

Three other arteries, having a similar destination, arise more posteriorly from each side of the aorta.

Finally, there proceeds from the aorta a large branch on each side; it soon sends off a *renal artery*, which advances the length of the kidney, distributing its branches to it, after which it continues its course outwards in the most posterior part of the abdomen, and produces an artery analogous to the *epigastric*, and then escapes from the cavity, and is expended upon the anal fin.

The arterial system of fishes in general does not differ materially from that described in the *skate*; the gills being four, they consequently furnish one branch less than in the genus *ray*, or the *shark*. The aorta in some of the cartilaginous fishes, instead of passing in a groove as is usual, is contained in a canal formed in the bodies of the vertebrae: this is remarkably the case in the *sturgeon* (*acipenser sturio*), and the *lamprey* (*petromyzon marinus*). The coats of the aorta adhere firmly to the sides of the canal, so that it would appear in these fishes the blood flows through the aorta as through a passive tube.

In those fishes which have ribs, the aorta gives off a number of branches to the intercostal spaces, which correspond to the *intercostal arteries*. These vessels, however, distribute branches to the kidneys before they pass to the parietes of the belly.

The splenic artery is not generally as it is in the *skate*, a branch of the mesenteric, but of the cæliac, or that artery which supplies the first portion of the alimentary canal, the liver, and spleen.

Cuvier states that there are generally in fishes two *mesenteric arteries*, and describes them in the *trout* (*salmo fario*).
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The *first*, or *anterior mesenteric*, he says, is detached from the aorta very near the middle of the body, and at a distance from the trunk of the cæliac; it advances for a little way in the substance of the mesentery, and divides into two branches, of which the one goes forwards and the other backwards, parallel to the intestinal canal, and supplies it with branches which form right angles with the artery that furnishes them, and which having arrived at the intestine, wind round it in a serpentine manner, and give off branches that extend forwards and backwards along it.

The *posterior mesenteric artery* arises from the trunk of the aorta at some distance from the first; it passes backward parallel to the intestine, and distributes its branches to the posterior portion of it: these go off at acute angles, and are not serpentine, as those of the anterior mesenteric artery. This vessel likewise sends branches to the bladder, which also receives others from the posterior intercostals.

Although the arteries of fishes have so peculiar an origin, and are sent to parts differently constructed than those in mammalia, they bear considerable resemblance to the arteries of that class. From the preceding description it will be seen that almost all the arteries of fishes admit of the same names that are applied to the vessels of mammiferous animals.

The mode in which the aorta is formed in fishes, makes it impossible for the heart to communicate its impulse to the arterial system: the circulation of the blood in these animals is therefore carried on slowly, and unaccompanied by the pulse, or that saltatory motion that is observed in the principal arteries of the hot-blooded animals: consistently also with the offices of these vessels, their parietes are thin, and appear to be deprived of the middle or contractile coat. The arteries of fishes very much resemble in their structure the veins of other animals; they further agree with veins in the circumstance of having the branches of large capacity, and often as large as the principal trunks of the body.

In *Plate IV. of the Anatomy of Fishes, fig. 4.* exhibits a view of the heart and branchial artery of the *skate* (*rajabatis*); *a*, the ventricle of the heart; *b*, the auricle; *c*, the bulb of the branchial artery; *d, d*, the places at which the semilunar valves are found; *e, e*, the two first branches of the branchial artery; *f, g, h*, their division into three branches destined for the three posterior gills; *i*, the continuation of the trunk of the branchial artery; *k, l*, the two branches in which the artery terminates; *l, m*, the two branches which go to supply the two anterior gills: the numbers 1, 2, 3, 4, 5, indicate portions of the five gills which are left on one side, in order to shew a little of the course of the branches of the branchial artery along their convex edges.

Fig. 5. of the same plate, shews the formation of the aorta and some of its principal branches in the *skate*, the parts on the lower side of the body are cut away to bring into view the objects of the figure: *a* is the trunk of the returning artery (or vein, as it is often, though improperly, termed) of the anterior gill; *b*, the continuation of this vessel distributed to the snout and external parts of the head; *c*, a communication between the returning artery of the first gill with that of the second, pointed out by *d*; *e*, the trunk formed between those proceeding to form the aorta; *f, f, f*, small arteries sent from this trunk to the muscles and other external parts of the head; *g*, the anastomoses between the two returning arteries of the second gill; *h*, the second artery of the second gill; *i, k*, the returning arteries of the third gill; *l*, their communication; *m, n*, the arteries of the fourth gill; *o*, their anastomosis; *p*, the branch of the first trunk sent to the brain; *q*, the second arterial trunk which forms the aorta; *f, t*, the arteries from the

5th gill united as the others by a cross branch; *u*, the third arterial trunk which produces the aorta; *v*, the commencement of the aorta formed by the congress of the three arterial trunks on each side; *x*, the branch of the aorta which corresponds to the subclavian artery; *y*, the branch of this artery which goes forward, communicates with the external ends of the returning arteries of the gills, and sends off the branches analogous to the bronchial and coronary arteries, and others to the muscles of the jaws; *z*, the division of the subclavian artery in order to supply the great pectoral fins or wings of this fish; 1, the caeliac artery, 2, the mesenteric: several small arteries are seen to arise from the succeeding parts of the aorta which go to the organs of generation, the kidneys, &c.

Veins.

The aperture by which the venous system of fishes terminates in the auricle of the heart is very small, in proportion to the size of that cavity, and to that of the adjoining trunks. The contracted opening into the auricle must, in a certain degree, perform the office of valves, or at least diminish the current of the blood upon the heart.

The common venous sinus with which the auricle immediately communicates, passes on each side transversely and backwards; it is formed, according to Cuvier, by the confluence of five principal trunks: 1, the posterior vena cava; 2, the trunk of the *venæ cavæ hepaticæ*; 3, and 4, the two inferior *venæ cavæ*; 5, a trunk which conveys the blood from the parts in the neighbourhood of the gills.

The *posterior vena cava* receives the deep-seated venous branches in the neighbourhood of the spine; the trunk itself accompanies the aorta, and, like that vessel, it is enclosed between the inferior spinous processes of the caudal vertebrae; and in those fish which have the aorta lodged in a canal in the bodies of the dorsal vertebrae, as in the *lamprey* (*petromyzon*), and the *sturgeon* (*acipenser*), the posterior vena cava is accommodated in a similar manner; the posterior vena cava is in general an inconsiderable trunk with respect to capacity, it is however very long, and is without dilatation, being nearly of the same size throughout: this vessel is not described by Doctor Monroe, and appears to have entirely escaped his observation, although, from the number of species in which we have seen it, we believe that it is constantly to be found in this class.

The *venæ cavæ hepaticæ* of the several lobes of the liver unite immediately before their termination in the common sinus under the heart, they are always considerably dilated; Monroe states that in the *skate* (*raja batis*) they form between the liver and the heart sinuses, the diameter of which is ten times greater than that of their openings.

The *two anterior cavæ* are the most important veins in the body; they receive the blood from a great part of the muscular substance of the fish, the organs of generation, &c. They lie contiguous to each other in the abdomen, and are greatly dilated. They form large receptacles of blood, according to Monroe, above the ovaries in the female, and the testicles in the male fish, at which place these veins communicate freely with each other.

The blood of the anterior and lateral parts of the body, especially in the *flat chondropterygii*, and the fishes with large pectoral fins, is conveyed by trunks of some size, which correspond to the *jugular* and *subclavian* veins of other animals.

The latter trunk appears to be the continuation of the common sinus, into which the other trunks open by orifices smaller than the vessels themselves, the edges of which are prominent and loose, or floating, so as to perform, in some

degree, the offices of valves. Dr. Monroe says, that he observed within the external jugular veins, and at the termination of the internal jugulars, a pair of valves, similar to those in the veins of the human subject. At the termination of the renal veins, and large branches of the hepatic veins, he found single membranes fixed by threads from their edges, resembling the coronary vein of our heart; and at the termination of the other large veins, especially near the heart, he says, there are not only contracted orifices, but doublings at their edges, which have so far the effect of valves, even in the dead body, that we cannot fill completely all the veins, by throwing an injection in at one of their branches. Page 18. Monroe's *Physiology of Fishes*.

It should however be observed, that the veins of fishes are not valvular in their course, like those of mammalia.

It is unnecessary to give a particular description of the venous branches, which produce the trunks above-mentioned; these, as far as we have observed, accompany the ramifications of the arteries, and are single vessels of a somewhat greater diameter than the artery.

The coats of the veins of fishes are extremely fine and thin; so much so, that they would seem to be incapable of suffering much distension without being ruptured.

We have frequently observed that the veins of fishes appeared as if they were in a great measure emptied of their blood, particularly in the dilated parts of the anterior cavæ, which vessels would seem to have a capacity beyond their usual contents: the great size of the principal venous trunks of fishes is therefore, probably, not so much the consequence of long continued distension, as original organization. It appears to be a circumstance in the structure of these animals, adapted to the slow motion of their blood, and not as Dr. Monroe supposed, dependent upon the pressure of the water on the surface of their gills, causing an accumulation of the blood in the interior parts of their bodies. The existence of several venous trunks for collecting the blood from the smaller branches appears also to be a provision to obviate the fulness which would arise, if all the blood was slowly accumulated in one or two trunks.

Fig. 4. Plate IV. of the *Anatomy of Fishes*, presents a view of the principal venous trunks in the *skate*, (*raja batis*); *n* is the common sinus, in which all the veins meet, five passing from each side behind the auricle into which it opens; *o o o*, part of the *venæ cavæ hepaticæ* taken out of the liver; they pour their blood into the sinus, opposite to the auricle; *p. p.* the two anterior *venæ cavæ*; *q*, the place at which they communicate with each other; *r* and *s* the veins analogous to the internal and external jugulars; *t*, the trunk, which corresponds to the subclavian vein; *u. v.* two branches of the subclavian, which collect the blood from the great pectoral fins, *x*, a large vein from the muscles, and other parts behind the abdomen, which opens into the subclavian.

Vital Temperature.

All the hot-blooded animals possess a degree of temperature suited to the functions they naturally perform; which cannot be materially altered without inconvenience to them; and any considerable deviation from which is resisted by an effort of their vascular system: this we have termed their *standard heat*. The temperature of fishes, both from their organization, and the element they inhabit, is in general low: one of their classic characters is being cold blooded. There is however a good deal of variety in the natural temperature of different species: those that live in the sea are some degrees colder than the fresh-water fishes; and

those that are active, and frequent the surface of the water, as many of the genera *cyprinus*, *salmo*, &c. have a higher temperature than the more sluggish species. We may state the standard heat of the one kind of fishes to be about 60° of Fahrenheit's scale, and that of the other about 50° .

As the vital heat is less independent of the external temperature, in proportion to the lowness of the standard, or, in other words, as the heat of the animal is more inconstant when it is not naturally high, we find that the temperature of fishes, commonly, is nearly the same with that of the water in which they reside. In some experiments we made upon *carps* and *eels*, we could not discover any material difference between their heat, and that of the water in which they were placed, until the latter was heated, or cooled, many degrees beyond its ordinary temperature.

Mr. Hunter's experiments on this subject were attended with a similar result, although they appear somewhat inconsistent with each other, as he has stated them.

Upon one occasion he put an *eel*, its heat being 44° , which was nearly that of the atmosphere, into water heated to 65° , for fifteen minutes: and upon examination it was of the same degree of heat with the water. In another experiment, he says, he put a *tench*, whose heat was 41° , into water at 65° , and after remaining there ten minutes, the ball of the thermometer being introduced both into the stomach and rectum, the quicksilver rose to 55° .

Having removed a *carp* out of a pond, the water of which he had ascertained to be 65° and a half, he introduced the thermometer into its stomach; the quicksilver rose to 69° ; so that the difference between the water and the fish was 3° and a half.

These two last experiments do not quite accord with the two following. Having put an *eel*, the heat of whose stomach was 37° , into a freezing mixture, its temperature sunk to 31° . The animal, he says, at that time appeared dead, but was alive the next day. He took a living and dead *tench*, and a living and dead *eel*, and put them into warm water; they all received heat equally fast: and when they were exposed to cold, both the living and the dead admitted the cold likewise with equal quickness.

It is beyond all doubt that fishes readily suffer great alterations in their natural temperature, and that this is not attended in them with any serious injury. It has been asserted that they can even be entirely frozen, and afterwards restored to life; and if we may credit Sonnerat, he saw in the Philippine islands fishes swim in water at the heat of 187° of Fahrenheit.

Mr. Hunter asserts that he never succeeded in freezing whole fishes, and afterwards recovering them; although his experiment of freezing the *eel*, as above-mentioned, would lead us to make a different conclusion. He froze, he says, the tail of a *tench* (as high as the anus), which became as hard as a board; when it thawed, that part was whiter than common, and when it moved, the whole tail moved as one piece, and the termination of the frozen part appeared like the joint on which it moved.

He also froze the tails of two *gold fishes* until they became as solid as a piece of wood. They were put into cold water to thaw, and appeared for some days to be very well; but that part of the tails which had been frozen had not the natural colour, and the fins of the tails became ragged. About three weeks afterwards a fur came all over the frozen parts; their tails became lighter, so that the fishes were suspended in the water perpendicularly, and they had almost lost the power of motion; at last they died. The water in which they were kept was New River water,

changed every day, and about ten gallons in quantity. See Hunter's Animal Economy.

From these experiments it would be inferred, that even parts of fishes will not admit of being frozen without disorganization.

Organs of Respiration.

All truly aquatic animals possess certain parts of a laminated or tufted structure for minutely dividing the water, and extracting from it the air with which it is intermixed. The gills of fishes are peculiarly well contrived for this mode of respiration, both from their position and organization.

The gills of fishes are situated on each side of the neck; they have always a very free communication with the cavity of the mouth, of which they may be generally considered as constituting the posterior parietes. They are covered externally in the *chondropterygii* by the common integuments, and in the other fishes usually by a bony or cartilaginous operculum, which is, in most instances, increased by the addition of some radiated bones that are covered by a process of the skin.

In the *chondropterygii* the gills are fixed by being connected externally to the integuments that enclose them, which are perforated by a number of foramina, varying according to the genus; but in the other orders of fishes the gills are unattached at the external side, and the branchial aperture is single and capable of being much enlarged and diminished by the elevation and depression of the operculum, which is moved by certain muscles in the manner of the lid of a box.

The branchiæ are sustained upon some cartilaginous or osseous arches, which are placed so that their concavity is turned obliquely forwards towards the mouth, and their convex sides are directed backwards and outwards. These arches are constructed to admit of their bases being contracted and dilated, and of being approximated one with respect to another; for which purposes they are provided with numerous and complicated muscles. The motions of the branchial arches are also connected with those of other parts in their neighbourhood; the pharyngeal bones, hyoides, &c. although chiefly intended for deglutition, enter into the mechanism of the respiratory organs; and the branchial arches on the other hand are employed in deglutition; so that all the parts situated about the origin of the œsophagus have complicated functions, as will appear when they are more fully described along with the other organs of motion. It is sufficient at present to state, that by the motions of the different parts with which the branchiæ are connected, their vascular surfaces are expanded, contracted, and pressed against the water, which runs over them.

The real organs of respiration in fishes are the great number of laminae which are fixed upon the convex sides of the branchial arches. These laminae in the *branchiælegi* and *ossifious* fishes are arranged in two rows upon each branchial arch, of which there are generally four on each side. The laminae are very narrow, elongated, and pointed at their free extremity, and are usually united to each other by their internal edge for about two-thirds of their extent from the base; they are commonly set close to each other, producing the appearance, in a great degree, of the teeth of a comb, or the barbs of a feather. Each of the laminae contains a very delicate plate of a cartilaginous structure, by which they preserve their form and position against the force of the water. Their superficies is smooth along the edges, but we have lately discovered that the intermediate surface is covered with extremely fine thin villous processes, by which means the respiratory surface is infinitely extended.

We have already stated that the single artery which arises from the heart of fishes is entirely expanded on the gills. The branches of this vessel pass along the convex sides of the branchial arches under the bases of the laminae. They furnish in this route a branch to each pair of laminae, which ascends between them as far as they are united, and then divides into two branches that go along the internal edge of the laminae to their extremity; these produce an immense number of minute vessels, which are expanded in fine ramifications upon both surfaces of the pair of laminae. The extreme terminations of these vessels form the roots, or give birth to the artery of the body, or aorta. These are collected upon each lamina by a branch which runs along its external edge, and the vessels, thus produced, terminate in one which runs like the branch of the branchial artery under the roots of the laminae, upon the convex side of the arch. These branches receive the blood from each of the gills, and concur to form the aorta, in the manner formerly described.

The structure of the organs of respiration in the *chondropterygii* differs in some respects from that above described. In the *lampreys* (*petromyzon*), there are seven gills on each side, and in the *rays* and *sharks* (*raja* and *squalus*) there are five on each side. The *lampreys* have only, however, a single row of laminae to the first and the last gill, and the two last genera have but one row of laminae to the anterior gill. In these fishes the branchial arches sustain upon their convex edges a number of cartilaginous processes or radii, upon which there is a muscle of some thickness placed, that has the effect of approximating them to each other. The real laminae of the gills arise from the sides of these parts, and are composed, in fact, of reflections of the membrane which covers them. These laminae are broader and set farther asunder than those of other fishes; they are unattached on one edge, and at part of the other. They have upon each side a number of sub-divisions or small folds, which vary in their figure and extent in the different species; these sub-laminae constitute the true respiratory surfaces.

The branch of the branchial artery, which proceeds along the convexity of the arches, furnishes to each pair of laminae two vessels; the larger of which is sent to the internal edge of the laminae, and the other runs upon the external edge along with the branch which collects the blood from the laminae for the aorta. The artery of the internal edges anastomoses at some distance from the extremity of the laminae, with a branch which passes transversely from one lamina to another, and thus establishes a communication between all the internal branches of the branchial artery. The minute or ultimate ramifications of the branchial artery are expanded upon the small or subordinate laminae, which arise from the sides of the others.

Cuvier describes the branchiae of the *hippocampus* as being differently organized from those of other fishes. They are composed of eight rows of tufts united by pairs in such a manner as to correspond with the four ordinary gills. The external rows have only five tufts; those which succeed have six; there are seven in the third; and in the middle rows there are eight tufts. The consequence of there being a different number of tufts in the several rows is, that the entire gills appear of a round figure. Each of these tufts, of which the extremity is round, is formed of a cartilaginous lamina, which is fixed upon the branchial arch, and sustains, as in the *ray* genus, some other little membranous laminae, very distinct from each other, and arranged upon the cartilaginous lamina, in the direction of the branchial arches.

The *silurus anguillaris* has been discovered by M. Geoffroy to possess some supernumerary organs of respiration, of

a very singular structure. In this fish the ordinary gills exist, but with shorter laminae than are usually found; in addition to which there are two organs on each side, consisting of a hollow trunk and numerous branches, the parietes of which resemble the coats of an artery. The external surface of these vascular trees is covered by the ramifications of the branchial artery, which become more fine and numerous as they extend upon their branches. The extremities of the ramifications open into the branches of the arborescent organs, and dilate into them their blood, through a multitude of villi that cover the interior surface of these branches. The trunks of the organs themselves terminate in the roots of the aorta, where they come from under the gills.

Cuvier considers these parts as not only serving the purposes of respiratory organs, but also as acting as hearts, by giving an impulse to the blood which flows through the aorta.

The numerous surfaces furnished by the gills of fishes qualify them for dividing, in an eminent degree, the water which passes over them, and for separating from it all the air with which it may be mechanically combined. The quantity of air consumed by the respiration of a fish is greater than would be at first expected. If one be enclosed in a vessel of water which is completely excluded from the atmosphere, it very soon extracts all the air mixed with the water, and expires. Such a result will, however, excite no surprise if we contemplate the extent of surface upon which the blood is exposed to the surrounding element.

Monroe has calculated that the surfaces of the gills in a large *skate* (*raja batis*) are nearly equal to the whole external surface of the human body. There are eighteen sides on the branchiae; each of these sides has about fifty divisions or doublings of the membrane; each of these divisions, he says, possesses one hundred and sixty subdivisions, doublings, or folds of its membrane, the length of each of which, in a very large *skate*, he takes as about one-eighth of an inch, and its breadth about the one-fifteenth of an inch; so that in the whole gills there are one hundred and forty-four thousand subdivisions or folds, the two sides of each of which are equal to the sixty-fourth part of a square inch; or the surface of the whole gills in a large *skate* is equal to two thousand two hundred and fifty square inches, that is, to more than fifteen square feet.

It appears to us that Dr. Monroe has very much overrated the dimensions of the laminae of the gills in his calculation; still, however, it must be admitted, that the respiratory surface of the branchiae in the *skate* is prodigiously extensive, and vastly surpasses what would be supposed before being thus viewed in detail; and if the aggregate of all the surfaces of the villi we have discovered in the laminae of the gills in *osseous* fishes could be ascertained, it would probably be found to exceed very far the superficies of the gills in the *ray* genus.

Some fishes, as the genus *cyprinus*, &c. come to the surface of the water to obtain a supply of air from the atmosphere; the species that require this are particularly vivacious; many of these will respire air alone for several days after they are caught, during which the operculum of the gills may be observed to rise and fall alternately, like the motions of the thorax in those animals which reside constantly in air.

In Plate IV. of the *Anatomy of Fishes*, fig. 6. represents a portion of the gills of the *cod* (*gadus morhua*) of the natural size. *a* is a piece of the branchial arch, on which the laminae are sustained; *b, b*, the laminae of one row; *c, c*, those of the other row appearing partially behind them. Fig. 7. of the same plate, exhibits the manner in which the two

rows of laminae are placed with respect to each other in the *cod*; *a* is the branchial arch cut transversely; *b b*, the section of the branches of arteries which transmit the blood to the gills, and return it afterwards to form the aorta; *c c*, a lamina of each row crossing each other, which is the position they have in this fish, in which they are not united to each other. Fig. 8. of the same plate, presents a single lamina of the *cod*, considerably magnified, in order to shew the villous processes we have discovered to exist upon its surface. Fig. 9. is a lateral view of a portion of the gill of the *skate* (*raja batis*); *a*, the basis of the gill or branchial arch; *b*, the surface from which the laminae proceed, and to which they are connected by the greatest part of one of their edges; *c, c*, the fine edges of the laminae. Fig. 10. of this plate, shews one of the laminae of the first order of the *skate*, magnified; *a*, the border which is attached; *b*, the edge which floats, is seen furnished with villous processes; *c*, the intermediate surface, covered with fine subordinate laminae.

Kidnies and urinary Bladder.

These glands usually bear a greater proportion to the size of the body in fishes, than in any other class of animals. They not only extend the whole length of the abdominal cavity, but often pass as far forwards as the sides of the oesophagus, and back of the cranium, and sometimes go backwards along the spine, considerably beyond all the abdominal viscera. They are proportionably small in the *ray* and *shark* genera.

The kidneys are always closely applied to the surface of the vertebral column, from which it is difficult to remove them; the surface, which is next to the spine, is consequently very irregular, particularly in *osseous fishes*. The greatest part of the kidneys is covered, on the lower surface, by the air-bladder, when this organ exists.

The form of these glands is somewhat various; sometimes, as in the *carp*, &c. there is a transverse lobule on the external side of each kidney, at the anterior part, which gives them an uniform figure. This lobule projects chiefly from the internal side in the *dory* (*zeus faber*). The kidneys are sometimes of nearly the same breadth at every part; in other instances they are considerably smaller anteriorly. They are in general but imperfectly divided into lobules, which gives an obscure notched appearance along their external edge; there are two posterior lobes which project backwards for a greater or less distance.

The proper coat of the kidneys is extremely thin. On the under surface they are covered by the peritoneum, which closely adheres to them.

The usual colour of the kidneys is a dark reddish brown.

Their texture is soft and fragile, and yields equally in all directions to the pressure of the fingers. In the *ray* and *shark* genera their substance is formed of a lighter red colour than in osseous fishes. In every instance the kidneys have an uniform structure. They are very vascular, being supplied by numerous arteries from the adjacent trunks.

The uriniferous ducts are numerous, and distributed throughout the whole substance of these glands. They are, at their commencement, fine and transparent; but as they become larger their coats appear opaque, and of a silvery hue. There are no cells or reservoirs in the interior of the kidney, into which the uriniferous canals pour out their fluid, as in mammalia; these vessels coalesce to form the *ureters*, as in birds and reptiles.

These ducts run generally along the under surface of the kidneys, imbedded in their substance, and acquire magnitude

as they proceed. In the *squalus maximus*, according to Mr. Home, they run along the inner edge of the kidneys.

An *urinary bladder*, such as exists in other animals, is wanting in a great number of fishes; but in its place we generally find a dilated canal into which the ureters open. This canal is sometimes so wide as to approach the appearance of a sac or bladder; it is generally capable of containing a certain quantity of urine. Its coats are stronger than those of the proper urinary bladder, and it is often plicated or laminated upon the inner surface.

When the urinary bladder exists, it is a thin pellucid bag. It is found in many *cartilaginous* fishes, as the *frog-fish* (*lophius piscatorius*); the *lump fish* (*cyclopterus lumpus*); *mosu fish* (*tetraodon mola*). &c. &c. and the number of osseous fishes in which it has been observed to exist is much greater. In the *carp* (*cyprinus carpio*) the bladder is of a spherical shape; in the *saiber-lasber* (*cottus scorpius*) it is more elongated in its form, and of considerable size in proportion to that of the fish to which it belongs.

The urinary bladder discharges its contents usually by an opening distinct from the anus, and placed a little farther back than that aperture.

There is no proper urinary bladder in the *ray* and *shark* genera. The ureters terminate in a cloaca, as in birds. Mr. Home has, however, observed in the *basking shark* (*squalus maximus*) that "the ureters terminate in an oval cavity just within the verge of the anus, which has an imperfect septum separating it into two parts, the ureters opening on the opposite sides of this septum; this cavity must, therefore, be said, be considered as the urinary bladder. This cavity opens externally in the male, by an infundibular process which corresponds to the penis. Doctor Montoe has likewise called the part which conveys the urine into the cloaca in the *common skate* the urinary bladder.

It is impossible to assign the use of the bladder or any reservoir for the urine in fishes; these animals continually residing in the water, one should have supposed that no inconvenience could have arisen from the expulsion of their urine as fast as it was secreted; perhaps part of their urine is absorbed, as in other animals, and carried back into the system, for which purpose it is necessary to detain it for some time before it is ejected.

No accurate examination has been made of the chemical properties of the urine of fishes, as far as we are acquainted. Although exceedingly transparent, it possesses more of the urinous flavour than the contents of the bladder in reptiles; it may, however, be questioned, how far the fluid found in the bladder of reptiles is really urine: this will be considered in its proper place.

Anatomists have agreed in denying *renal glands* or *capsules* to the whole class of fishes; there are in the *dory* (*zeus faber*) two ash-coloured glandular bodies, about the size of small peas, placed upon the posterior extremity of the kidneys; these glands are of a firm, tough texture throughout; they are attached to the kidneys, and also to the posterior end of the air-bag, by some ligamentous-looking cords. We have not yet examined other fishes with the view of observing similar bodies in them: we are, therefore, not prepared to say how far these glands may correspond with the renal capsules of other animals, or whether they may not be connected with the offices of the air-bag in this particular fish.

Fig. 11. of Plate IV. in the *Anatomy of Fishes*, represents the dilated canal, which takes the place of the urinary bladder in the *dory* (*zeus faber*); *a, a*, are portions of the two ureters which end in the fundus of the sac; *b*, the wide part

of the canal; *c*, the contracted part, which goes on to terminate behind the anus; the canal is laid open to shew that it is plicated on the inner surface.

Organs subservient to the generative Functions.

Male parts of generation.—If we except the *holders*, or *organs of prehension*, in the genera *raya* and *squalus*, there are no external parts of generation in the class of fishes. From the manner in which these animals in general accomplish the act of generation, a *penis* would be perfectly useless to them, and the organs for preparing the male semen would be exposed continually to injury, if placed on the outside of their bodies.

The parts reputed to be the organs of prehension in the *ray* and *shark* kind, are situated at the sides of the anus, between the two ventral fins. They consist of three parts, articulated with the pelvis, resembling additional abdominal members. They are composed of thirteen cartilaginous joints, of different sizes and figures, which are moved by certain muscles covered by the common integuments, and connected with a singular gland.

The first part is formed by three short cartilaginous pieces, articulated one to the other. The second part is likewise composed of three cartilages, which are long, and not moveable upon each other. The two external pieces interrupt a canal which proceeds to open in a hollow formed in the third part. This last is made up of seven cartilages, all moveable on each other; it receives likewise one of the pieces of the second part, which goes on as far as its extremity.

The first part admits of flexion outwards upon the second, and of extension, and the whole member is moveable from without inwards. These motions are performed by the means of two muscles. One of these arises from the pelvis and terminates at the commencement of the second part. It is confounded with the flexor of the ventral fin. The other muscle is smaller, and placed upon the first; it arises from the first part, and is inserted at the commencement of the second.

There is a third muscle which takes its origin from the third part, and envelopes the second, except a small portion of its external side, and is inserted by a slender tendon upon the inferior and external side of the last piece, and is affixed at the superior side to an extended border that is presented before the piece, which has the figure of a blade. The use of this muscle is to open the canal already mentioned, which is closed by the elasticity of the parts composing it.

The gland is situated at the exterior of the middle part of this apparatus. It is an oval figure, and surrounded by a thick muscle; it furnishes a very viscid fluid, and its excretory duct opens into the groove that is formed by the two cartilaginous pieces of the second part, and is lost in the hollow of the third.

Naturalists are not agreed with respect to the use of these singular members. Cuvier thinks that they are only employed in swimming, as the largest of their muscles is also the depressor of the ventral fin, and as their parts are not provided with muscles, to be approximated with sufficient force to act as organs of prehension. Bloch, and many others, supposed that they were designed to hold the female during copulation. Geoffroy believes that they are introduced into the cloaca of the female, and perform the office in some degree of a penis. We are most inclined to adopt the last opinion. If this apparatus was intended for swimming alone, why should it be peculiar to the male? and if for prehension, a gland to secrete a slimy fluid would be not

only unnecessary, but inconvenient. The *ray* and *shark* genera should therefore, perhaps, be considered as exceptions to the general observation, that fishes do not possess a penis.

The *testes* of the genera *raya* and *squalus* differ very much from those of other fishes; they bear a greater resemblance to the same organs in some reptiles than to those of their own class. Each testicle consists of two parts united together. The one is a uniform glandular mass, somewhat like the texture of the testes of other fishes; it is flattened and imperfectly divided into lobes. The other portion is made up of a great number of small spherical bodies, on the external surface of each of which there is a slight depression, like an impression made by the head of a pin; these bodies are united to each other by some strong filaments, and are inclosed in a fine membrane. This tubercular substance forms the principal portion of the gland, and is divided into several lobes or masses of different sizes. When examined with a magnifying glass it appears to consist of very minute round grains.

The testicles in these fishes give origin to a real *epididymis*, which is evidently composed of a convoluted tube. It is thin, where it is connected with the gland, with which it appears to be continuous; it forms a large mass of an oblong shape.

From the lower part of the epididymis the *vas deferens* comes forth; it is a canal of considerable size, and as it proceeds along the spine, towards the anus, forms a great number of sigmoid flexures or coils upon itself. These become less striking, and the duct enlarges as it approaches a *sac* near the cloaca, in which it terminates in such a manner, that although they form a common receptacle, there is not a free communication between them.

Monroe states that these sacs contain a green coloured fluid, and he considers them analogous to the *prostate gland*; they appear to us to correspond much more with the *vesiculae seminales* if they be looked upon as any thing more than a dilatation of the vas deferens. Monroe describes the dilated part of the vas deferens, before its communication with the sac, as a *vesicula seminalis*; in which he is evidently wrong. He was led into this error from considering the *vesiculae seminales* of mammalia as mere reservoirs of the semen.

The vas deferens and sac of each side open into a cylindrical papilla, which is visible in the cloaca.

The testes of the *other orders* of fishes are two elongated bodies, sometimes cylindrical or conic in their form, but most commonly notched or divided into imperfect lobules; they are of a pale grey or ash colour, soft, pulpy, and homogeneous in their texture, resembling very much medullary substance; their softness renders their intimate structure very obscure, but they appear to be composed of an intertexture of fine membrane and pultaceous matter. They do not furnish any epididymis, nor, properly speaking, vasa deferentia; but open at their posterior extremity almost immediately at the foramen, behind the anus, which is a common opening for transmitting the urine and semen. The testes of fishes are popularly known under the name of the *milt* or *soft roe*.

These glands increase remarkably in size during the season that the females expel their ova; they are then full of a white thick fluid, like milk, which is no doubt the male semen. At this period they make so material an addition to the bulk of the body of fishes, that these animals are then only fought after as articles of food.

In *Plate V. of the Anatomy of Fishes*, *fig. 1.* exhibits a view of the genital organs in the male *skate* (*raya batia*); *a* is the white medullary portion of the testicle; *b*, the tubercular portion; these parts are cut away on the opposite

site side to abridge the size of the figure and expose other parts; *cc*, the epididymus of each side; *d, d*, the vasa deferentia; *e, e*, the sacs in which the vasa deferentia terminate; the one on the right side is laid open to expose its cavity and connection with the vas deferens; *f* is the cylindrical papilla upon which the conduits of the semen terminate.

Female organs.

In the genera *raja* and *squalus* these parts are more peculiarly formed than even the male organs of these fishes. They resemble in a very great degree the female organs of birds.

The ovaries of these genera consist of clusters of round eggs of various sizes and different stages of growth. The membrane which envelopes the ovaries nearly surrounds each of the ova, which therefore, especially when mature, appear distinct and have some liberty of motion. These ova consist only of the yolks, and are of a pale yellow colour. In their mode of growth, connection with the ovary, and manner of exclusion from it, they very much resemble the *racemus vitellorum* of birds.

Although in these genera there are two oviducts, they are conjoined at their extremities to form a single aperture, which is placed immediately behind the septum that divides the branchial and abdominal cavities. This part of the oviducts may be considered as analogous to the *infundibulum* in birds. The ovarian tube of each side at first proceeds for some way outwards and backwards, at which place its canal is small, and its parietes thin and plicated longitudinally upon the inner surface. It then suddenly enlarges, and incloses in its coats a large glandular mass, something between a square and kidney shape; this body is composed of a number of white tubes, which are so disposed that their ends are turned towards the cavity or internal part of the gland; at one side of this mass there is the appearance of a stripe of tubes or fibres, which crosses the other structure, and is probably a muscle for contracting the cavity. The internal membrane of this part is smooth, and so thin and transparent that the tubes are very visible through it.

The interposition of so large a gland in the course of the ovarian duct is unquestionably for the secretion of that remarkable *horny covering* or *shell* which is found on the ova of these fishes, and yet it should be observed, that we have not been able to discover the orifices of the tubes upon the internal membrane of the oviduct, nor have we succeeded in expressing the smallest quantity of fluid from the tubes into the cavity of the gland.

The portion of the oviduct which succeeds the gland is greatly dilated, its parietes are thin, and the internal surface (in the *raja* at least) is covered with fine transverse folds, or rather linear impressions, not resembling the plicae of an intestine, which are thin productions of the internal coat.

The oviducts terminate by a corrugated or puckered opening on each side of a considerable cavity, within the anus, which some authors have described as a *uterus*, and others as the *chæra*. The latter name appears to be the most correct, as this cavity receives the urine, and communicates with the rectum. The orifices by which the oviducts terminate in the cloaca are surrounded by mucous glands.

In the genus *chimera* there are first some small ducts, of which the extremity attached to the ovaries is open and spread out. After a short space they suddenly enlarge, and form a considerable glandular mass, of which the fasciculi of tubes that compose it are perpendicular to its parietes

From these glands to their termination the oviducts are membranous, and of great capacity; where they terminate they are conjoined and open externally by one common aperture.

In the *osseous*, and in the *cartilaginous* fishes, except those already described, the ovaries consist of two membranous sacs or bags, the cavity of which is occupied by numerous leaves, formed by reflections of the membrane; the folds are usually placed transversely; they contain the ova within their duplicatures; they are copiously supplied with blood-vessels, and exhibit (especially after injection, with a coloured fluid) a very beautiful and variegated foliated appearance.

The ovaries of different osseous fishes are of various forms; they are usually elongated and pointed at either end. In the *dory* (*zeus faber*) they are flat, and approach a square figure; in many fishes they have four corners, which are elongated forwards and backwards. In some of the *pleuronectes*, and in some other fishes, a part of the ovaries is extended backwards in that process of the abdominal cavity which is continued along the external parts of the spines of the caudal vertebrae.

We have observed but one ovary, of a pear shape, in the *perch* (*perca fluviatilis*); perhaps some other fishes may be found to have single ovaries.

The ovaries of osseous fishes increase prodigiously during the seasons for depositing their ova. At this period they exceed in size all the rest of the viscera; although after the season of spawning they are the smallest viscera in the body: the variations in their bulk depend upon the number of ova they contain, for their parietes are at all times nearly of the same thickness.

Fishes in general surpass all other animals in fecundity. M. Rousseau, a laborious French anatomist, has taken the pains to reckon the number of ova contained in the ovaries of several species. He found in the *sturgeon* (*acipenser sturio*) 1,467,855 eggs; in the *mackerel* (*scomber scombrus*) 129,200; in the *perch* (*perca fluviatilis*) 69,216; in the *carp* (*cyprinus carpio*) 167,400; and in the *pike* (*esox lucius*) 166,400 eggs.

The ova of those fishes which are not viviparous are all small, and of the same size; they are generally about the bulk of pin heads. They are not expelled from the ovary in succession, as in the *chondropterygii*, but in large quantities, like the spawn of frogs; which they further resemble in being impregnated, and undergoing their changes outside the body of the parent.

Except in the viviparous fishes also there are no oviducts; the ovaries terminate immediately at a particular aperture placed behind the anus.

From the preceding description it will be perceived, that the mode of generation in the genera *raja*, *squalus*, and *chimera* is essentially different from that of fishes in general. In those genera the eggs do not leave the ovary until they acquire a considerable magnitude; their structure is completed in their passage through the oviducts, in which also they are most probably impregnated. During the residence of the egg in the oviduct its contents are changed in their organization, and the fœtus is formed in the same manner as during the incubation of the egg of birds; and when the ovum is discharged from the body of the fish, the shell splits, and admits the water in which the fœtus floats, still nourished by the yolk which remains attached to its intestine.

At this period we have discovered that the foetal fish is provided with external branchial appendages exactly similar to those met with in the *tanpois* of some reptiles. It is
when

when these fall off, and the yolk is consumed, that the young fish seeks its own subsistence.

The shells of the eggs of the *raja* and *squalus* genera, after being evacuated by their inhabitants, are commonly from their lightness cast on shore, and are known in some places under the name of *sea bats*. For a further account of the history of the ovum, and the changes it undergoes in fishes, see the articles OVUM and INCUBATION.

The second figure of *Plate V.* of the *Anatomy of Fishes*, gives a view of the female organs of the *skate* (*raja batis*); *a a*, the first portion of the ovarian tubes; *b*, their junction and aperture by which they communicate with the cavity of the abdomen; *c, c*, the glandular bodies; the one on the right side is laid open to shew its composition to be of tubes; *d, d*, the succeeding portions of the oviduct, which are very capacious, and perform in some respects the offices of uteri; *e*, a mature egg seen in the enlarged part of the oviduct; *f, f*, the ovaries containing eggs of various sizes; *g g*, the termination of the oviducts in the cloaca; *h*, the cloaca; the opening by which it receives the urine; *k*, the anus.

Organs employed in the Exercise of the animal Functions.

Brain.

The *dura mater* in fishes resembles very nearly the common periosteum; the distinction of two layers is not evident; and those broad reflections of the internal layer which exist in mammalia for separating the different divisions of the cerebral mass are wanting. The *dura mater* approaches, in the large fishes, nearly to a cartilaginous nature.

As the cavity of the cranium is much larger than the brain, there is a considerable space left between them, which contains a quantity of gelatinous matter in the *cartilaginous fishes*, and commonly an oily fluid in the *ossificous fishes*. There is also a considerable quantity of salt water found in the cavity of the cranium, which has been supposed by doctor Monroe to be sea water carried thither by absorption, as we have mentioned in speaking of the salt liquor met with in the cavities of the abdomen and pericardium of fishes.

The fluid of the cavity of the cranium is very frequently stained by admixture with blood, which appears to be extravasated in it in small quantity.

These fluids are contained in a very loose cellular texture, which corresponds to the *tunica arachnoidea* of other animals. Monroe found the surface of the brain covered with a number of small spheroidal bodies; these are probably contained in the *tunica arachnoidea*.

The *pia mater* closely invests the surface of the brain as usual; it likewise lines the ventricles, and produces a plexus analogous to the *choroid plexus*; which however does not float in the cavity of the ventricles. Cuvier describes also two other productions of the *pia mater*, situated in the fourth ventricle, which appear to be at liberty.

The *brain* of fishes possesses the characters described in that of *birds* and *reptiles* in a still more remarkable degree than this organ in either of those classes. It is very small in proportion to the size of the whole body, and bears even a greater disproportion to the bulk of the nerves which arise from it. Cuvier states the proportion of the brain to the rest of the body to be as 1 to 2496 in the *white shark* (*squalus carcharius*), 1 to 1344 in the *great dog-fish* (*squalus canicula*), 1 to 37440 in the *tunny* (*scomb. r. thynnus*), 1 to 1305 in the *pike* (*esox lucius*), 1 to 560 in the *carp* (*cyprinus carpio*), 1 to 1817 in the *stlurus glanis*. The greater size of the brain in the *carp* accords with the well known docility

and intelligence of that species; and the small proportion which the brain of fishes generally bears to the size of the body, is what might naturally be expected from the dulness and incapacity of this class of animals in general. On looking at the brain of a fish one is struck with its dissimilarity to the cerebral mass of man or quadrupeds; it appears like a succession of tubercles scarcely conjoined together: the eminences which nearly correspond to the cerebrum and cerebellum are not distinguished from the others, which give origin to the nerves, and in some cases might be overlooked from their being smaller.

The *cerebrum* is always composed of two hemispheres, as in other animals; it is smooth and without convolutions: those parts called *corpus callosum*, *fornix*, &c. cannot be distinguished at the junction of the hemispheres.

There is a cavity in each hemisphere which corresponds to the *lateral ventricle*; it is not, however, prolonged and reflected so as to form those parts termed *horns* in *mammalia*.

The floor of the ventricles is plain in the *ray* and *shark* genera, but in most other fishes there is an elevation, usually of a femicircular figure, from the external or convex side of which a number of medullary striz go off in a radiated manner upon the internal parietes of the ventricle: this eminence corresponds to the *corpus striatum*; it varies with respect to size in different species, and also sometimes in its figure: according to Cuvier it forms in the *whiting* (*gadus merlangus*), an elevated oval body.

Between the corpora striata there is a small chink, which opens into the third ventricle.

The *anterior commissure* of the brain is situated a little below these eminences.

There are some tubercles within the hemispheres, which Cuvier considers analogous to the *tubercula quadrigemina*, although their situation is not the same. They are placed, as in birds, before and above the thalami nervorum optico-rom. In the genus *cyprinus* there are four of these tubercles, two anterior and two posterior; the former are extremely long, cylindric in their shape, and bent outwards and backwards, taking the curvature of the lateral ventricles, the cavity of which they fill: they are marked posteriorly by a longitudinal furrow; the posterior tubercles are round, and much smaller than the anterior.

The *eel* (*murena anguilla*), *hadlock* (*gadus aeglefinus*), and *herring* (*clupea harengus*), have but one pair of those tubercles, which produce a femoval eminence before the cerebellum, between the posterior extremities of the corpora striata. The *pike* (*esox lucius*), *trout* (*salmo fario*), *salmon* (*salmo salar*), and *perch* (*perca fluviatilis*), have four tubercles which are distinct, round, and small; the posterior pair is larger than the anterior. These tubercles are not found in the *ray* and *shark* genera.

The *thalami nervorum optico-rom* are two distinct tubercles situated below the hemispheres, as in birds; each of them likewise contains a ventricle.

The *cerebellum* is generally large in proportion to the cerebrum, and in some instances even exceeds it in size: it is sometimes rugous on the surface; it is always a single tubercle without lobes, and usually of a heart shape, the apex of which is turned backwards; sometimes the superior part is the most prominent. When the cerebellum is cut into, the section of it exposes some indistinct pale coloured lines; but that arborescent arrangement of medullary substance, called *arbor vite*, does not exist.

The *fourth ventricle* is generally large; with respect to the other cavities of the brain, it not only passes under the cerebellum

cerebellum as usual, but ascends for some way in its substance.

We have next to consider those additional tubercles of the brain of fishes upon which its character depends, and which constitute in general the greatest part of its bulk; they are placed before the cerebrum and behind the cerebellum.

The anterior tubercles give origin to the nerves, which go to the organ of smelling; they are therefore commonly named the *olfactory* tubercles. They are usually a single pair. In the *ray* and *shark* genera they are united and form one mass, which exceeds in size all the rest of the brain: the figure of this mass is a little various, and is difficult to describe. In the *thornback* (*raja clavata*), it is somewhat of a triangular figure, one of the sides or the base being turned forwards; in the *lesser dog fish* (*squalus catulus*) the fore part is circular, and the back a little concave in the centre. The olfactory tubercle in these fishes has been described by some authors as the cerebrum, and by others as its anterior lobes.

The olfactory tubercles are long and narrow in the *sturgeon* (*acipenser sturio*); they are oval masses, smaller than the hemispheres in the *lump-fish* (*cyclopterus lumpus*), and in the *moon-fish* (*tetraodon mola*). In the genus *gadus* they are round, and in the *cod* (*gadus morhua*) they are nearly as large as the hemispheres: according to Cuvier they are also round and notched on one side in the *wrasses* (*labrus*), and in the *carp* (*cyprinus*): but Ebel and Scarpa have delineated them in the common *carp* (*cyprinus carpio*), of an egg-shape; they are oval in the *silurus glanis*.

There are four olfactory tubercles arranged in pairs in the *flat fishes* (*pleuronectes*), the *herrings* (*clupea*), the *piques* (*esox*), the *perches* (*perca*), and in the genus *salmo*: the anterior pair is in the common *pike* (*esox lucius*) so small, that they might readily escape observation: the posterior pair, although larger, are not equal in size to the hemispheres.

In the *eels* (*genus murena*), there are three pair of olfactory tubercles; the first pair are the smallest; the second somewhat larger; and the third, or posterior, considerably the largest, being about the magnitude of the hemispheres.

The olfactory tubercles do not in any species contain a cavity or ventricle.

The tubercles situated behind the cerebellum are peculiar to the class of fishes: they are in general a single pair, but in some species there is a third single tubercle placed in the middle immediately before the other two, and behind the cerebellum.

Some anatomists suppose that the lateral tubercles are analogous to the *corpora olivaria* of mammalia, and the middle tubercle has been described as a second cerebellum: the latter is evidently erroneous; but the former appears to be perfectly well founded: the corpora olivaria and these tubercles correspond both with respect to situation and in giving origin to the posterior nerves of the brain: it would be more correct, however, to say that the corpora olivaria are these tubercles on an abridged scale.

The posterior lateral tubercles are large and irregularly furrowed in the *ray* genus. In the *whiting* (*gadus merlangus*), and the *cod* (*gadus morhua*), the tubercles are oval, and placed above the medulla oblongata. They are similar in the common and *conger eels* (*murena anguilla* and *m. conger*); they are inconsiderable in the *pike* (*esox lucius*), the *salmon* (*salmo salar*), the *trout* (*salmo fario*), and the *perch* (*perca fluviatilis*).

In the *carp* (*cyprinus carpio*) the posterior lateral tubercles are extremely large; they equal in size the hemisphere of the cerebrum; they have somewhat the figure of kidneys.

This fish likewise possesses the middle tubercle, which is large, and of a round figure.

There are no cavities in the posterior tubercles of fishes. There is nothing very peculiar to remark with respect to the origin of the nerves in fishes.

The olfactory nerves are produced from the tubercles placed before the cerebrum, as already mentioned; they generally appear as the continuation of these tubercles; this is particularly evident in the *ray* and *shark*.

In the *carp* and *silurus glanis*, &c. the olfactory nerves arise by two or three filaments from the tubercles.

The optic nerves take their rise, as usual, from the thalami nervorum opticorum; immediately after their origin they decussate, or cross each other. In *ossious* fishes this is most obvious; in which the optic nerves may be seen lying one across the other, and only connected by cellular substances. The right nerve goes to the left eye, and the left nerve to the right eye. Many anatomists have supposed, in consequence of the decussation of the nerves being so palpable in fishes, that something of the same kind takes place in other animals, by which they have explained the sympathy that is well known to exist between one eye and the other, in the superior animals; there is, however, sufficient connection between the two sides of the brain, to account for the sympathies of the organs of vision, without ascribing it to the decussation of the optic nerves.

Eustachius and Malpighi have stated, that in some fishes the optic nerves have an investment of pia mater, containing very elegant longitudinal folds.

The third and fourth, and sixth pair of nerves, arise as near as may be from the same parts of the brain which furnish them in mammalia.

The fifth pair are produced by a common trunk with the *portia mollis*, or auditory nerve; this trunk arises from the tubercles behind the cerebellum in the *rays* and *sharks*, and from the beginning of the medulla oblongata, in the *ossious* fishes.

The facial nerve, or that analogous to the *portia dura* of the seventh pair, is quite distinct from the auditory; and arises in common with the *par vagum*, or the eighth pair, of which it might, with equal propriety, be considered a branch.

The nerves analogous to the eighth pair arise from the side of the medulla oblongata, and the back part of the posterior lateral tubercles of the cerebellum, when these exist.

There is no nerve analogous to the ninth pair, or hypoglossal nerves in fishes; although Ebel has figured a large *stipitatus* in the *carp*, (*cyprinus carpio*), which he describes as the ninth pair. Much confusion exists amongst authors on this subject; thus Ebel confounds the eighth with the ninth pair; Monroe calls the olfactory tubercles the anterior protuberances of the brain; and describes the sixth for the fifth pair of nerves; Scarpa delineates the hemispheres of the cerebrum under the name of the *olive shaped protuberances* of the brain. See Monroe's *Physiology of Fishes*. Anatomizæ D.quisitiones de Auditu & Olfactu, by Scarpa; and Observations Neurologicæ ex Anatom. comparata, by Jo. Godof. Ebel.

The brain of fishes has been hitherto but little studied in a physiological point of view. Its structure in this class of animals, however, promises to illustrate the functions of the different parts of the organ, as they are so distinct, that their proportional magnitude and importance may be fairly appreciated. The great relative size of the eminences which furnish the nerves of sense, and the small quantity of cerebral substance employed to unite them into one mass, would lead us to conclude, that fishes receive vivid impressions upon

their organ of sense, under the immediate impulse of which their actions are directed; and that they have little capacity for combining or associating their sensations: a conclusion which exactly accords with what has been observed respecting the habits and manners of this class of animals. We believe if the same rule for judging of the mental faculties be extended to other animals, that it will answer equally well; and that the *sensitive* powers will be found proportioned to the relative magnitude, and the distinctness of the parts of the brain which give origin to the nerves; and that the *intellectual* faculties will keep pace with the development of those parts which serve to unite the preceding. It is possible that this rule may be employed, to calculate the comparative excellence of the sensitive, and intellectual faculties of individuals in the same species. Perhaps even by these means some steps may be made towards ascertaining the shades and varieties in the mental character of men.

The sympathetic connection of the different parts of the system, doubtless depends upon the union of the nerves in the common sensorium, which being imperfect in fishes, it became necessary that their optic nerves should be distributed to the sides opposite to their origin, on account of the organs of vision acting contemporaneously, or in harmony, with each other.

In *Plate VI. of the Anatomy of Fishes* *fig. 1.* exhibits the upper surface of the brain of the *carp* (*cyprinus carpio*); *a, a,* the two olfactory tubercles; *b, b,* the two hemispheres of the brain; *c,* the cerebellum; *d, d,* the two lateral tubercles placed behind the cerebellum, analogous to the corpora olivaria; *e,* the simple tubercle behind the cerebellum; *f* the medulla oblongata.

Fig. 2. shew the brain of the *carp* also, in which the hemispheres of the brain are cut, and turned to each side, in order to bring into view the anterior tubercles which fill the lateral ventricles, and which are supposed analogous to the *nates*; *g, g,* indicate the tubercles in question, the other letters indicate the same parts as in the preceding figure.

Fig. 3. is the same brain, with the *nates* separated at their posterior part, in order to expose the posterior tubercles, or those corresponding to the *testes*; *h, h,* are these parts; the references of the other figures are the same as in the first figure.

Fig. 4. is another view of the same brain; the *nates* and *testes*, or tubercula quadrigerina, are raised to shew the corpora striata, and the opening into the other ventricle, &c. *i, i,* exhibit the striated bodies; *j,* the fissure which leads into the inferior ventricle; *k, k,* the thalami nervorum opticorum, which are scarcely visible. The other letters have the same signification as in the preceding figures.

Fig. 5. is still the same brain, with the hemispheres removed, in order to expose completely the thalami nervorum opticorum, which are designated by the letters *l, l.*

Fig. 6. shews the brain of the *carp*, with the cerebellum divided and turned towards each side, to expose the fourth ventricle; the references are continued the same.

Fig. 7. is the brain of the *carp*, viewed upon its under surface. The parts seen in that position, which have been already represented in the other figures, are indicated by the same letters. The nerves are numbered according to the names they usually bear, as the 1st pair, or olfactory; the 2d, or optic, and so on; the decussation of the optic nerves is pointed out by the letter *m.*

Fig. 8. is a representation of the upper surface of the brain in the *eel* (*murena anguilla*). The letters *a, a, a, a, a,* designate the six olfactory tubercles; *b, b,* the two hemispheres of the brain, which are not larger than the posterior olfactory tubercles; *c,* the cerebellum; *d,* the medulla oblongata.

Fig. 9. exhibits the inferior surface of the brain of the *eel*; *e, e,* are the thalami nervorum opticorum: the other letters correspond with those of *fig. 8.* In both these figures the nerves are indicated by their numbers.

In *Plate VII. of the Anatomy of Fishes*, *fig. 1.* is a view of the head of the *thornback* (*raja clavata*), dissected to expose the brain and organs of sense: *a* is the large medullary mass formed by the olfactory tubercles; *b, b,* the two hemispheres of the cerebrum, called by *Scarpa* *olive-shaped protuberances* of the brain; *c,* the cerebellum depressed along the middle, but not divided into two lobes; *d,* a portion of the brain, which must be considered either as a division of the cerebellum, or the middle posterior tubercle; *e, e,* the lateral posterior tubercles; *f,* medulla spinalis. Where the nerves are seen in this figure, they are expressed by their number.

In the dissected head of the *pike* (*sox lucius*), shewn by *fig. 1.* in *Plate VIII. of the Anatomy of Fishes*, *a, a,* indicate the two principal olfactory tubercles; *b, b,* two inconsiderable enlargements of the root of the olfactory nerves, which might be considered as lesser tubercles; *c, c,* the two hemispheres of the cerebrum; *d,* the cerebellum. In this figure, likewise, such nerves as are seen to arise from the brain are expressed by their numbers.

In *fig. 4.* of *Plate VIII. of the Anatomy of Fishes*, the olfactory tubercles of the *carp* (*cyprinus carpio*) are shewn: *a,* the cerebrum; *b, b,* the olfactory tubercles; *c, c,* the origin of the olfactory nerves by filaments; *d, d,* the trunks of the olfactory nerves. The other nerves that appear are indicated by corresponding numbers.

Nerves.

The course and distribution of the *first* or *olfactory pair of nerves* are pointed out in the description of the organ of smelling.

The termination of the *optic nerve* is described in that part of the article which treats of the eye of fishes. The component filaments of the optic nerve are particularly evident in this class of animals, and may be demonstrated without any preparation. They are commonly flat; and *Cuvier* describes them as being sometimes formed of a very thin medullary lamina, folded on itself, and contracted into the figure of a cord. This is particularly observable in the *cod* (*gadus morhua*), and the *sword-fish* (*xiphias*).

The *third*, *fourth*, and *sixth* pairs of nerves in fishes differ so little, with respect to their distribution, from the same nerves in other animals, that they do not require to be described.

The *fifth pair of nerves*, as before-mentioned, arise by a common trunk with the auditory nerve. In the *skate* (*raja batis*) they form two trunks in the cranium, and appear to coalesce in passing out. On the outside of the cranium there are again two nerves produced: the one is the *ophthalmic*; the other passes under the cartilage behind the orbit, and immediately divides into three branches: one of these is a nerve which has not been hitherto accurately described; the other branches correspond to the *superior* and *inferior maxillary nerves*.

The *ophthalmic* branch of the *fifth pair* passes out of the cranium into the superior part of the orbit, and then divides into two branches; of which one proceeds across the orbit, under the rectus superior and externus, and the external oblique muscles of the eye; the other crosses above all the parts in the orbit. These two branches, on arriving at the nasal cavities, re-unite to form a single nerve. Previous to this re-union, the superior branch of the *ophthalmic* gives off a branch to the organ of smelling. This forms an anastomosis.

anastomosis with another branch, which is sent off from the conjoined nerves of the ophthalmic.

After passing beyond the nasal cavity, the ophthalmic breaks into a long fasciculus, from the sides of which a great number of short branches arise, which are lost in the gelatinous substance that is on each side of the middle cartilage of the snout, and upon the edge of that cartilage.

The remarkable anastomosis of the ophthalmic nerve, and its distribution in the snout, is represented in *Plate VII.* of the *Anatomy of Fishes.* and *fig. 1 r.* shews the origin of the ophthalmic from the fifth pair; *s.* the superior branch passing over the muscles of the eye; *t.* the inferior branch going between the muscles of the eye; *u.* the coalition of these two; *v.* the first branch sent to the organ of smelling; *w.* the second branch given off from the united nerve; *x.* the anastomosis of these branches; *y.* the distribution of the ophthalmic nerve in the snout. This plate exhibits the parts as they appear in the *thornback (raja clavata)*, in which they do not differ materially from the description we have given of them in the *skate (raja batis)*.

The branch of the fifth pair of nerves, which we mentioned as not being accurately described by other anatomists, proceeds in a straight line from its origin, under all the parts of the orbit, to reach the transverse cartilage, situated on the external side of the organ of smelling. Having penetrated this cartilage, one part of the nerve forms a sort of bulb or ganglion, from which a number of fine filaments depart like rays: these are abruptly, and almost immediately, lost in the membranous structure which forms the centres of the albumino-gelatinous ducts, to be hereafter described. The other portion of the nerve is distributed in long branches to the same gelatinous substance of the snout. This branch of the fifth pair is the most remarkable in the fish's body, on account of its giving the only example of a gangliform enlargement of a nerve, (those of the organs of sense excepted) and from the peculiar mode of its termination. It is difficult to determine whether the singular conformation of this nerve be designed to bestow a nicer sense of touch on the snout, or to produce, with the albumino-gelatinous ducts, an electric apparatus similar to what exists in the *torpedo*, &c. The latter, from analogy of structure, is very probable; although the electric property, if it exist in the ray kind generally, has not yet been detected by its effects.

The *superior maxillary nerve* of the *skate* passes forwards under the external side of the cranium, to gain the outer edge of the middle cartilage of the snout. In this course it distributes some small branches to the neighbouring parts, and afterwards runs in a groove in the side of the cartilage, as far as the point of the snout, sending off small branches to the gelatinous substance, in the same manner as the ophthalmic nerve.

The *inferior maxillary nerve* in the *skate (raja batis)* goes forwards under the orbit, and sends off several small branches, which penetrate and are lost in the operculum of the nasal cavity, and the integuments before the upper jaw: it then turns round the external part of the upper jaw, concealed by the large muscles which surround the ends of the jaws, and divides into several branches, which are distributed to these muscles. One of these branches goes on to be expended upon the integuments of the lower jaw.

The *facial nerve*, or that which corresponds to the *portio dura* of the seventh pair, is much larger in the cartilaginous than the *osseous* fishes. It forms two branches soon after its origin: one of these ascends in the cranium, through which it passes, and is lost upon the integuments.

The other branch goes through a particular foramen, into

the cavity of the ear, passes beneath the principal cretaceous body, and there forms the remarkable anastomosis with the auditory nerve, from which the ampulla of the posterior femicircular canal is supplied. The trunk afterwards penetrates the cranium, and re-appears upon the external part, where it is lost in a number of branches in the soft parts and integuments of the head.

The *auditory nerve* of the fifth pair in fishes is analogous to the *portio mollis* of the seventh pair in other animals; and, like it, is distributed exclusively to the interior of the organ of hearing. It is described and figured in that part of the article where the ear is treated of.

The *eighth pair of nerves* in fishes differ materially from the same nerves in other animals, with respect to their course and ramification. This depends upon the situation and structure of the parts they supply, in order to preserve an analogy with the nerves of this name in the other classes of animals. The first and most important branches are sent to the branchiæ: these may be considered as supplying the place of the *par vagum* of mammalia. They are situated most anteriorly, and are usually four on each side: they separate from each other immediately upon leaving the cranium, and proceed to the branch *x.* When they approach these, each branch divides into two; one of which runs in the groove situated on the convex edge of the cartilages or bones that bear the branchiæ, and sends off numerous filaments to the laminae of the gills; the other branch passes in the corresponding groove or gutter of the concave edge of the branchial cartilages or bones, and is distributed in a similar manner. The anterior branch of the first branchial nerve, however, returns into the cranium, in order to be distributed to the ear.

The second branches of the eighth pair most commonly come out of the cranium as two or three distinct nerves, but sometimes they are furnished from the same trunk, as the last branchial. One of these nerves is lost upon the branchial muscles. The second, which is larger, is distributed to the side of the œsophagus, as far as the stomach. The third branch is conjoined with the cervical nerves that go to supply the pectoral fin.

The last branch of the eighth pair has a very remarkable distribution; it is situated posteriorly to the others, at its origin; it proceeds almost directly outwards, and backwards towards the integuments of the side of the body, immediately under which it runs as far as the tail, when it terminates in fine filaments, upon the rays of the caudal fin. This singular nerve is nearly of the same size throughout its whole length; it has no palpable communication with the inter-vertebral or other nerves; and its course corresponds to the lateral line on the side of the body. It bears a greater analogy, perhaps, to the *nervus accessorius* than to any other, although its termination is much more remote.

According to Cuvier the eighth pair of nerves in the *chondropterygii* consists of a single trunk, which does not divide until it reaches the parts to which it is distributed. In these fishes the long lateral nerves are situated nearer to each other, and more towards the back.

The *glossopharyngeal nerve* is not a distinct trunk in fishes, but arises from the anterior part of the first branchial nerve; it furnishes a great number of filaments, which are expended upon the tongue and surrounding parts. The trunk is lost in the inferior part of the throat, before and between the gills.

The *hypoglossal nerves*, as before mentioned, do not exist in fishes.

The cervical vertebrae cannot always be distinguished from

from the dorsal. Cuvier asserts that there are never more than four spinal nerves, which deserve to be called *cervical*; and frequently there are none to which this name can be applied. The first nerves of the spine, however, furnish those of the pectoral member in osseous fishes, as will be hereafter described, and likewise a nerve which is distributed to the septum that divides the branchial from the abdominal cavity; and which, therefore, may be considered analogous to the *phrenic* nerve of other animals.

The *dorsal*, *lumbar*, *sacral*, and *caudal*, nerves of fishes resemble each other in their course and distribution, with the exception of those which supply the pectoral fins of the *ray* kind, and those that are sent to the abdominal fins of fishes; generally all the spinal nerves pass out of the vertebral canal, and are immediately distributed to the muscles and integuments adjoining. The nerves of the spine anastomose with the great sympathetic, but do not produce a series of ganglia, as in other animals.

The *intercostal*, or great sympathetic nerve, comes out of the cranium, by the canal of the first vertebra; it is but a small filament extended along each side of the spine, without any sensible enlargements or ganglia. It distributes branches round the principal arteries of the viscera, which supply the place of the different plexuses of the *splanchnic* nerve of mammalia.

The *brachial* nerves, or those which supply the pectoral fins of *osseous* fishes, are furnished by the two first vertebral nerves. The anterior of these is situated so near the eighth pair in some fishes, that it might be mistaken for a branch of the latter; it passes out, however, through a foramen peculiar to itself. The second vertebral nerve lies more behind the œsophagus, and more towards the middle line of the body. These two nerves proceed directly to the internal lamina of the scapula, where they are conjoined without being intermixed. The first vertebral then forms two branches, which send off filaments that anastomose with each other, and are distributed to the adductor muscles of the fin. One of the branches of the first vertebral nerve is sent to the septum of the branchial and abdominal cavities. This filament is considered by Cuvier as analogous to the *phrenic* nerve.

The two cords, formed by the vertebral nerves, pass through the hole situated before, and on the outer side of the articulation of the fin with the shoulder, where they unite and produce an irradiation of nervous filaments, several of which are lost in the external surface of the shoulder, and in the oblong articular capsule which receives the small carpal bones. One of these filaments runs under the skin that covers the rays of the fin.

The *brachial* nerves are remarkably large, and are formed of a great number of nerves, from the spinal marrow in the *flat cartilaginous* fishes (genus *raja*). There is first a thick cord produced by the union of twenty vertebral nerves. This cord passes through the middle of the cartilaginous bar upon which the rays of the wing or great pectoral fin of these fishes are articulated; it then proceeds forwards along this cartilaginous bar, and sends off a number of branches which run outwards along the rays of the anterior part of the fin, supplying the muscles placed between these rays, and the integuments, as far as the external edge of the fin.

A second cord is thus formed by the four or five next vertebral nerves, which divides at the roots of the rays of the middle part of the fin into seven or eight filaments; these are distributed in the same manner as the branches of the first cord.

Afterwards each two vertebral nerves, as far as the forty-fourth, are united into cords, which penetrate the cartilaginous bar, and supply the posterior portion of the fin.

These different cords, which result from the junction of the vertebral nerves, may be considered as representing the *brachial plexus* of other animals.

The *pelvic nerves*, or those which supply the *ventral fins* of the *flat cartilaginous fishes*, are disposed in the same manner as those of the pectoral fins. Four or five vertebral nerves unite to form a single cord, which penetrates the cartilage that sustains the rays of the fin, and is expanded in filaments, in the muscles of the fin. There are usually four more vertebral nerves sent to the posterior part of the ventral fin, upon which they are distributed in the same manner as the preceding cord.

The nerves of the ventral fin in *osseous* fishes are filaments of the vertebral pairs, which are distributed to the intercostal spaces. These filaments supply the muscles of the rays, and may be traced upon the skin to the edge of the fin.

The nerves of fishes are distinguished from those of other animals by the want of ganglia, and their great magnitude in proportion to the bulk of the brain, and of the whole body. Monroe has described the coats of the nerves of fishes also as being covered by a number of spheroidal bodies.

Organs of Touch.

Fishes are unprovided with any members capable of encompassing external bodies, and consequently possess the sense of touch in but an imperfect degree. The only parts in which any peculiar feeling appears to reside, are the *cirri*, the *tentacula*, and the *extremity* of the *snout*.

The *cirri* are situated upon the lips or about the mouth; they are commonly pointed taper processes, which in some instances appear to be composed chiefly by the common integuments; in the *cod* (*gadus morhua*), however, there is a very firm cartilage, and perhaps the same in other species.

These parts are not better supplied with blood vessels or nerves than the adjacent parts, and their surface is smooth and without papillæ; from which circumstance it is probable, that they do not enjoy any peculiar feeling or sense of touch except what they derive from their form and prominent situation. Cuvier mentions only one process of this kind in the genus *gadus*, in which he differs from other naturalists, who allow to some species three, four, and five cirri. There are two long cirri in the *surmullet* (*mullus*). In the *gudgeon* (*cyprinus gobicus*) there are two, in the *carp* (*cyprinus carpio*) there are four short cirri, and in the *barbel* (*cyprinus barbatus*) there are four, two from the sides of the mouth and two from the summit of the head.

There are several cirri in the *pogge* or *armed bull-head*, (*cottus cataphractus*) which appear like a beard; there are six or eight in the genera *colitis* and *silurus*; in the latter two are placed before the eyes, like the antennæ of insects, and four project from the under lip, which the animal is said to cast every year.

The cirri are numerous around the mouth in the *frog-fish*, (*lophius piscatorius*), and the *gadus taru*.

The *tentacula* appear better calculated than the cirri, from their figure, for receiving the impressions of external bodies. In the *gattorugine* and *crested blenny* there are two tentacula on the top of the head, which form tufts, or are setaceous at the end.

The tentacula are most remarkable in the genus *lophius*; the

the anterior tentaculum of the *lophius histrio* is divided at the extremity into two branches, the ends of which terminate in fleshy masses; the other tentacula are very long and conical, and end in filaments.

The *lophius piscatorius* has some long tentacula on the head, which it has the power of moving in different directions. It is supposed by some naturalists, that it employs these tentacula in angling for its prey, and hence it derives the specific name *piscatorius*.

The principal feat of the sense of touch appears to be the end of the snout; the sensibility of this part, however, does not depend upon any peculiar organization of its surface, but arises entirely from being largely supplied with nerves.

The *ophthalmic branch* of the fifth pair of nerves in the *thornback* and *skate*, after distributing branches to other parts in its course, as already described, runs along the side of the cartilage which forms the middle of the snout, and sends off a great number of short filaments which are lost upon this cartilage, and the gelatinous substance on the side of it, as far as the very point of the snout, where these nerves terminate in some fine fibrillæ: the last branch of the *superior maxillary nerve* of the fifth pair exhibits, in these fishes, a similar distribution along the sides of the cartilage inferiorly. According to Cuvier, the ophthalmic and superior maxillary nerves terminate in small branches, which are sent to the hooks of the snout in the *saw-bark* (*Squalus pristis*), and in the spines or tubercles of the snout in the ray genus.

In the *lesser dog-fish* (*Squalus catulus*) the ophthalmic nerve goes on to the end of the snout, where it terminates in several short branches.

In *offeous fishes* the snout is also supplied in a similar manner by large nerves.

The above account shews, that the snout of fishes strongly resembles the bill of birds, as far as regards its sensibility and its functions as an organ of touch; through its means the animal will be adverted of the approach of any foreign body, but it is by no means calculated to take cognizance of the qualities of substances applied to it.

In *Plate VII. of the Anatomy of Fishes, fig. 1.* exhibits the distribution of the *ophthalmic nerve* in the snout of the *thornback* (*raja clavata*); *x*, indicates the origin of the nerve, *y*, its ramification in the snout.

Fig. 3. of Plate VIII. shews the ophthalmic nerve as it appears in the *pike* (*esox lucius*); *f*, the nerve passing to the snout; *g*, an artery derived from the internal carotid, which accompanies it.

In *Plate IX. of the Anatomy of Fishes, fig. 2.* exhibits the external part of the snout of the *frog-fish* (*lophius piscatorius*); *c, c, c*, numerous branched cirri around the lower jaw; *d, d*, long tentacula from the front of the snout, with which this fish is supposed to angle.

Integuments.

Fishes are covered by skin like other animals, in addition to which they have a peculiar integument formed by the *scales*.

Although fishes inhabit the same element as the *actacea*, they are not provided with a subcutaneous layer of fat. This seems to arise from the standard of their animal heat approaching so near the temperature of the water, that they do not stand in need of defence against the latter. It is to be observed, however, that some fishes have a considerable quantity of oil diffused amongst their muscles and under the integuments, examples of which are found in the genera *stuppea* and *salmo*, &c.

The only fish which appears to have really an integument of fat is the *moon-fish* (*tetraodon mola*). There is spread under

the skin of this species a layer of a fatty looking substance, of about two inches in thickness. Upon examination this matter is found, however, to possess all the chemical properties of albumen. The use of such a covering on this fish is not understood.

It cannot be properly said that fishes possess a *panniculus carnosus*, or *muscular integument*; in many species the skin adheres to the muscles of the body, which seem in some places to be inserted into it; by this connection the skin more exactly complies with the motions of the body, but we doubt whether any fish is capable of moving the skin distinctly or independently of the body. Cuvier describes a subcutaneous layer of muscular fibres in the *carp* (*cyprinus carpio*), and some other fishes with large scales. It adheres to the inner surface of the skin, and is divided into two portions by a longitudinal line corresponding to the situation of the vertebral column. At this place there are impressions made by the tendons inserted into the skin. They describe curves, the convexity of which is towards the tail. These muscular fibres seem to perform the office of constricting the skin, and thus regulating, in a degree, the position of the scales.

The *skin* of fishes consists, as in mammalia, of the *cutis*, or *true skin*; the colouring substance, or *rete mucosum*; and the *insensible integument* or *epidermis*.

The *cutis* seems to possess essentially the same structure in fishes as in mammalia, but more particularly resembles the *cutis* of lizards and serpents.

The skin adheres commonly very firmly to the external surface of the muscles by means of a web of aponeurotic fibres, which appear in some species, as the *sole* (*pleuronectes solea*), the *common eel* (*murena anguilla*), &c. as a complete integument. The skin, or the aponeurotic fibres under it, adhere to the muscles chiefly at the parts where the latter are divided into longitudinal masses; the middle portions of these masses are at liberty, and lie enclosed by this means in a sort of sheath.

The skin appears to vary in thickness according to the strength of the scales; it is very thick in the *ray* and *skark* genera, the *eels* (*murena*), &c. and thin in those species that possess large scales, as the *carp* and *bream* (*cyprinus carpio* and *c. brama*), hence in preparing these fishes for the table, the former are deprived of their skin, and the latter of their scales.

The *rete mucosum* is very palpable in this class. It adheres to the surface of the scales, and produces all those brilliant colours, and varying metallic tints, for which the bodies of fishes are so remarkable. It possesses, in general, considerable firmness, and in some instances has a smooth membranous appearance, which, however, we believe does not depend upon a fibrous texture, but the compression of the mucous pigment.

The whole of the external surface of fishes is covered by a soft mucous coat, which corresponds to the *epidermis*; it forms a thicker layer in the fishes that have smooth skins, than in those with large scales. The epidermis is so soft and pulpy that it does not deserve the name of a membrane; it is very easily rubbed off the skin, and is also spontaneously shed; in both cases, however, it is speedily removed.

The surface of the skin of fishes is more or less besmeared with a slimy substance of a peculiar nature. The apparatus by which it is secreted is one of the most curious parts of the anatomy of this class of animals. Beneath the integument there are a number of ducts, or tubes, which open by many orifices upon the skin, more particularly about the head, and those parts of the surface of the body which are the most exposed to friction. Their ducts are largest and most numerous in the

fishes with soft skins, but we believe they exist in every species, even those with large scales, and with ossous integuments. They are most remarkable in the *shark* and *ray* genera, in which they have an arrangement, not the same as in the ossous fishes.

In the *skate* (*raja batis*) there is, on the outside of the branchial apertures, a duct under the skin, about the thickness of a crow's quill, which is coiled or reflected in a waving line towards the head; one extremity of it is shut, and ends at the anterior edge of the head; the other passes round to the upper surface of the head, where it sends off upwards of thirty smaller ducts, that terminate by open ends upon the skin; other branches are expanded upon the inferior surface of the snout, dividing and re-uniting to form several curves and zig zags, without being materially diminished in their diameter; from one of which a large duct goes to the upper part of the snout. There are not, according to Monroe, above six or eight outlets on the inferior surface of the fish's body.

On each side of the fish, a little farther forward than the foremost of the five breathing holes, there is a central part, from which several fasciculi, composed of a great number of ducts of a subordinate order or magnitude, go off in different directions, to open upon the greatest part of the surface of the body. These centres present the appearance of an irradiation of membranous coils. A very considerable branch of the fifth pair of nerves, already described, after forming an enlargement, resembling a ganglion, is instantaneously lost in filaments upon the parietes of this structure, with which they become so inextricably united, that it is impossible any longer to distinguish them. Monroe supposes that the nerves disappear in consequence of changing their structure, but it should rather be said that they become imperceptible by abruptly terminating; for how can they be called nerves after they cease to possess the characters of such? This affords the most striking example of the sudden termination of a nerve with which we are acquainted in the whole animal economy, and illustrates what we have observed less evidently with respect to the nerves that go to the pulps of feathers and bulbs of hairs, &c.

In the *sharks*, the principal subcutaneous ducts about the head are so large, that they would admit a goose's quill.

In the *tope* (*squalus galus*), according to Cuvier, there is but one centre of communication for the ducts, which is situated in the snout.

In the *ossous* fishes the ducts are less numerous than in the *chondropterygii*; they are likewise unprovided with centres of communication. The principal ducts are situated upon the sides of the head, or over the jaws; where they send off several short ducts to terminate upon the surface. The ducts of each side communicate with one another on the top of the head, and with one which extends along the side of the body parallel to the lateral absorbent vessel.

The pores by which the ducts open upon the skin of the head are very visible in the common *pike* (*esox lucius*), and the *sea pike* (*esox belone*.) Cuvier states them to be more distinct upon the head of the *chimera monstrosa* than in any other fish.

The substance contained in the subcutaneous ducts of fishes has not yet been strictly analyzed as far as we are informed. It is a sem fluid transparent jelly. It resembles very much the matter found in the cells of the electric organs of fishes, and that which surrounds the ova of frogs. It appears to be a combination of albumen and gelatine, in which the proportion of the former is so great, that instead of being dissolved by water it is slightly coagulated, by coming into contact with it: we have submitted it to

the action of tannin, with which it combines like common gelatine. It however resembles in no respect mucus; therefore, Dr. Monroe very improperly calls the tubes containing it, *mucous ducts*. See his Physiology of Fishes.

There can be no question, both from the parts of the body upon which this gelatinous substance is principally shed, and its being most abundant in those species which are not protected by hard integuments, that it is a defensive secretion against the continual friction and washing of the water to which fishes are exposed. Cuvier however, and other anatomists, are disposed to think that the subcutaneous ducts are in a degree analogous to the electric organs of fishes, which opinion is rendered not improbable from the great size and singular termination of the nerve sent exclusively to the centres of the ducts in the *ray* kind. Perhaps delicate experiments might detect a degree of this electric property in all fishes; if so, this faculty must answer other purposes in their economy than to preserve them from the attacks of the larger species of their own kind. We do not pretend to decide upon those questions, which can only be determined by nice investigations, that have yet been made upon the subject.

The distribution of the albumino-gelatinous ducts is represented in *Plates X. and XI. of the Anatomy of Fishes*. In *Plate X.* the upper surface of a *skate* (*raja batis*) is shewn; *a*, the centre of the ducts on the left side; *b*, fasciculus of ducts going towards the spine; *c, c*, other fasciculi sent to the anterior parts of the fish; *d, d*, fasciculi proceeding to terminate upon the outer and back part of the great fins; *e*, a long fasciculus running backwards to terminate near the tail; *f*, a large branch of the fifth pair of nerves passing outwards from the cranium; *g*, its singular termination on the common centre of the ducts of the right side; *h, i, k*, the beginning of the large duct of the under surface of the snout; *l*, the same duct seen through the snout; *m*, the duct which is reflected from the anterior surface of the snout; *n, n, n*, several branches of this duct which open upon the skin, on the side of the snout.

Fig. 1. of Plate XI. exhibits the anterior quarter of the under surface of the *skate* (*raja batis*); *a*, the large serpentine duct reflected upon itself on the external side of the branchial apertures; *b, b, b*, branches of the serpentine duct that open upon the inferior surface of the body; *c, c*, the branches that surround the nasal cavity; *d, d*, anatomoses with the duct of the opposite side; *e*, the point from which a large branch is sent to the upper part of the snout; *f*, the extremity of the serpentine duct which turns round to the upper surface of the fish; *g*, the blind extremity of the serpentine duct; *h, h*, parts of the corresponding ducts of the opposite side of the fish; *i*, the centre of the ducts on one side; *k, k, k, k, k*, fasciculi going off from the centre in different directions to open upon the under surface of the body of the fish.

Fig. 2. of Plate XI. is a lateral view of the head and part of the body of the *cod*, (*gadus morhua*); *a* is the anterior portion of an albumino-gelatinous duct, which runs upon the side of the fish, and has numerous short branches terminating by open mouths on the surface; *b*, the superior branch of this duct, which unites with the corresponding one of the other side, upon the top of the head, as seen at *c*, and terminates in a blind extremity on the end of the snout, as indicated by *d*; *e*, shews the interior branch of the lateral duct, running along the upper jaw; *f, f, f*, &c. are its branches opening upon the skin; *g* is another large duct lying on the lower jaw, which has no communication with the others; *h, h, h*, &c. are the short branches it sends off to terminate upon the surface.

The integument which furnishes the most effectual defence to fishes is produced by the *scales*, and the other *osseous pieces*, which grow on their skin. For the description of these parts, see the article *SCALES*, in this dictionary.

Organ of Smelling.

The apparatus for receiving the sensation excited by odorous substances is more complicated in fishes than other animals, although the organs are less ostensible.

The *nasal cavity*, except rarely, as in the *frog fish* (*lophius piscatorius*), does not form any external projection; the organ of smelling, therefore, from not striking the eye, received little attention from anatomists, and no full or accurate description of it was given before the publication of Scarpa's book *De Auditu & Olfactu*; it was even formerly mistaken for the organ of hearing; and Blumenbach says, this absurd opinion has been revived in modern times, but we are unacquainted with any anatomist at present who entertains such an opinion.

In the *chondropterygeous* fishes the organ of smelling is situated on the under surface of the snout; but in the *osseous* fishes on the upper and fore part of it; it is contained in an oval or round shallow cavity, which in the *rays* and *sharks*, and in some *osseous* fishes, as the *gurnard*, &c. is formed by an excavation of the cartilage or bones of the head, but in most *osseous* fishes it is partly composed of bone, and partly of membrane.

The nasal cavity has no internal communication with the fauces, nor is it connected with any sinuses or hollow parts in the bones of the face; in the *chondropterygii*, however, there is a groove or hollow, leading from the edge of the organ of smell, under the operculum, to the angle of the mouth.

The apertures of the nasal cavities, or *external nares*, of the genera *raya* and *squalus*, are in a great measure covered by an *operculum*, composed of two irregularly-formed cartilaginous flaps connected and covered by the common integuments. The operculum is elevated at the pleasure of the animal, according to Scarpa, by a number of fine muscular fibres which arise from the end and fore parts of the snout, proceed obliquely backwards towards the angle of the mouth, and are inserted into the operculum. The nares are closed by some fibres which act like a sphincter. We confess we have not been able to discern either of these muscles, although we have examined very large *skates* for the purpose. As the opercle is opened or shut, the water flows in and out of the nasal cavity with more or less force, and thus the odorous matter is exposed to the surface of the organ.

In the *osseous*, and most other fishes, the apertures of the nasal cavity are crossed by a flexible septum or bar; in some fishes this ligament is narrow like a cord; in others it is broader, and formed with irregular edges: each aperture is thus divided, so as to present the appearance of two nares on each side, an anterior and posterior; the former always continues open, and preserves the same figure, but the latter varies in size, in proportion as the cord is drawn outwards or recedes into the cavity of the nose.

The septum of the nares is drawn outwards by a fasciculus of muscular fibres which arises from the bones of the snout, and is inserted into the middle of the septum. When this muscle is not in action, the elasticity of the parts, and the impulse of the water, are sufficient to depress the septum, and force it within the nares. Under these circumstances the posterior aperture is contracted into the figure of a chink. Some fishes, as the *carp*, (*cyprinus carpio*), have the power of elevating the septum so much, that the aperture of the nares is drawn out as a tube.

The *frog fish* (*lophius piscatorius*) has the nares, and indeed the whole nasal cavity of each side, elevated upon the top of the snout, in the shape of two drinking glasses, which are moveable in every direction.

The external integuments are reflected into the nasal cavity; on arriving at the bottom of which they seem to form the pituitary or olfactory membrane.

The immediate organ of smelling consists in all fishes of a number of fine laminae, upon which the olfactory nerves are distributed. The varieties in its structure depend upon the different arrangement of these laminae, and the form and mode of ramification of the nerves.

In the *ray* kind (*raya*) there are two series or rows of laminae, separated from each other by a ligament which extends through the middle of the nasal cavity, from one end to the other. The laminae are round upon the superior edge, and falciform upon the inferior margin. They are broader in the middle of the cavity than towards each end of it, corresponding to its oval shape.

The surfaces of the laminae that are applied to each other furnish a number of thin narrow laminae, which are arranged in a radiated manner.

The disposition of the pituitary membrane is similar in the *shark* genus (*squalus*.)

The other cartilaginous, and the *osseous* fishes have the internal laminae of the nasal cavity arranged in radii, around an elevated tubercle. In the *sturgeon* (*acipenser sturio*), the laminae ramify or divide upon their free border into thinner plates. The *carp* (*cyprinus carpio*), and some others, have the central tubercle approaching an oval figure, which gives the organ a good deal of the appearance it has in the *ray* and *shark*.

The pituitary membrane is abundantly besmeared with mucus in fishes, as is usual in other animals; the glands which secrete it are evident on the membrane of the *ray* and *shark*; it is generally covered with red vessels, and sometimes with black, as in the *pike* (*esox lucius*.)

The *olfactory nerves*, after arising from the brain in the manner already described, proceed a considerable way forwards, either in a canal left in the bones of the head for the purpose, or in the continued cavity of the cranium, as the case may be, during which course they usually acquire a greater size than when they left the brain.

After the olfactory nerves pass out of the cranium, and arrive at the organ of smelling in the *ray*, they become enlarged and softer in their texture, and proceed transversely outwards along the middle of the superior surface of the organ, enclosed in a firm sheath, which is perforated by a number of foramina on each side: through each of these foramina a branch of the olfactory nerve passes, and soon after divides into a tuft or bunch of fibrillae, which are distributed in a beautiful manner upon the laminae already described.

In the *tope* (*squalus galeus*) the olfactory nerve is at first very slender, it passes out of the cavity of the cranium through a particular foramen, and soon after forms a round ganglion, from which two fasciculi of nerves are produced: these send branches to the olfactory laminae on each side of the ligament which divides the organ into two portions.

The olfactory nerves of *osseous* fishes usually begin to divide into branches on approaching the back of the organ; these again divide into others, which are distributed in a very palpable manner on the olfactory laminae.

The *carp* (*cyprinus carpio*), the *silurus glanis*, the *had-dock* (*gadus aulefinus*), and the *cod* (*gadus morhua*), have each of the olfactory nerves enlarged into a remarkable round

ganglion.

ganglion just before they penetrate the back of the organ of smell; from this ganglion a bundle of branches go immediately off to be dispersed upon the olfactory laminae. It is probable that ganglia also exist upon the olfactory nerves of the other species of *gadas*, *cyprinus*, and *flarus*.

It would seem, from the greater extent and sub-division of the olfactory membrane, that the *ray* and *shark* genera have a more acute sense of smelling than the *osseous* fishes. All this class of animals possess it in a high degree, which is shewn by their nicety with respect to the different baits employed in catching them; thus, a worm which has lost its flavour by maceration will be refused by a fish; but the same worm, having its smell revived by incisions made on it, will be taken greedily; we cannot, however, determine exactly the degree of excellence of the sense of smelling in fishes, as the medium through which they receive the impression of odorous matter is different from that by which it is applied to other animals; but we may suppose their perception of odorous substances to exceed that of mammalia, as the latter have no discernment of odour when diffused in water, and brought into contact with their organs of smelling in that state. The structure of these organs in fishes would also lead us to make the same conclusion; for the magnitude of the nerves of smelling, and the surfaces upon which these nerves are spread, are proportionally greater in fishes than in any quadruped.

In *fig. 10.* of *Plate VI.* of the *Anatomy of Fishes*, will be seen the external parts of the organ of smelling on the under surface of the snout of the *thornback* (*raja clavata*); *a a*, the operculum, partially covering the nasal cavity, exhibiting a thin layer of muscular fibres running obliquely from before backwards; *b, b*, the ducts containing gelatinous matter, seen faintly through the muscular fibres of the operculum; *c, c*, the cartilaginous folds placed around the nasal cavity, and forming the interior part of the operculum; *d*, the conjunction of the cartilaginous folds seen through the muscle; *e e*, the ligament of each side which divides the olfactory laminae; *f, f, f, f*, the membranous plates or laminae arranged on each side of the ligament; *g, g*, the hollow folds by which the nasal cavity communicates with the angles of the mouth.

Fig. 1. in *Plate VII.* of the *Anatomy of Fishes*, exhibits a dissected view of the upper part of the organs of smelling in the same fish; *n, n*, the olfactory nerves enlarged, previous to their entering the sheath; *o, o*, the bulbs of the olfactory nerves seen passing across the nasal cavity, the sheath being laid open on one side, and removed on the other, the branches that arise from the bulb are exposed; *p, p*, the superior or convex edges of the laminae covered with membrane; *q q*, the ramification of the olfactory nerve brought into view by removing the membrane on the back of the organ.

Fig. 5. in *Plate VII.* of the *Anatomy of Fishes*, is a transverse section of the organ of smelling in the *thornback*; *a*, the bulb of the olfactory nerve; *b b*, the ligament which runs through the centre of the olfactory laminae; *c, c*, the membranous laminae of the second order that arise from the sides of the others.

Fig. 6. of the same plate, shews about the half of the organ of smelling in the *thornback*, magnified; *a a*, the ligament; *b, b*, the laminae of either side; *c*, one of the nerves given off from the bulb; *d d d*, the ramification of the nerve upon the duplicature of the olfactory membrane; *e*, the membranes of the second order.

Fig. 7. of the same plate, represents the distribution of the olfactory nerve in the *tope* (*squalus galeus*); *a, a*, the olfactory laminae from above; *b*, the trunk of the olfactory nerve; *c c*, the bulb or ganglion; *d*, the fasciculi of nervous filaments; *e*, the division of these into two parts, indicated by

ff; *g, g, g, g*, the double series of branches of the olfactory nerve distributed to the two sets of laminae.

Fig. 1. of *Plate VIII.* of the *Anatomy of Fishes*, exhibits a dissected view of the olfactory nerves in the *pike* (*esox lucius*); *s, s*, the olfactory nerves when they first begin to break into filaments; *t t*, the filaments distributed to the bottom of the nasal cavity; *u u*, the anterior aperture of the nares; *v v*, the posterior aperture; *x x* the bar or bridge across the nares; *y, y*, branches of the fifth pair of nerves sent to the organ of smelling for common sensation.

Fig. 3. of *Plate VIII.* shews the external parts of the organ of smelling in the *pike*; *a*, the posterior opening of the nasal cavity; *b*, the anterior opening; *c*, the bar or bridge between them; *d*, muscular fibres for elevating the bar or septum of the external opening of the nasal cavity; the bar being removed, the bottom of the nasal cavity is exposed, in which are seen the radiated membranes or laminae of the organ indicated by the letters *e, e*.

In *fig. 4.* of the same plate, the distribution of the olfactory nerves is exposed in the *carp* (*cyprinus carpio*); *d, d*, the trunks of the olfactory nerves; *e, e*, the trunks becoming fasciculated or composed of filaments; *ff*, the bulb or ganglion of the olfactory nerves; *g g*, branches sent off from the ganglia, and distributed upon the olfactory membranes; *b*, foramen left on one side, through which the branches of the olfactory nerve pass to the organ of smelling.

The dissected head of the *frog fish* (*lophius piscatorius*) in *fig. 1.* *Plate IX.* of the *Anatomy of Fishes*, exhibits the course and termination of the olfactory nerves; *x*, the olfactory nerve passing through the cranium; *y*, the same nerve continued along a canal in the snout; *z*, the nerve spreading into filaments, previous to its distribution upon the laminated structure of the organ, indicated by *.

The second figure of the same plate represents the external part of the snout of the *frog fish*; *a*, the organ of smelling as it appears elevated upon a toothpick; *b*, the organ of the other side with a part of it cut out, to bring into view the olfactory laminae.

Organ of Taste.

There is every reason for denying the sense of taste to the tongue of fishes. This organ in them wants almost all the peculiarities of structure which fit it for receiving the impressions of sapid substances. The integuments are without papillae, and do not possess greater vascularity, or a larger supply of nerves, than the covering of the other parts of the mouth, and in many species the surface of the tongue is beset with teeth. The movements of the tongue of fishes are also limited to elevation, depression, and a very slight degree of lateral motion; it is incapable of flexion or extension, which are the actions mostly employed in tasting; the extent of surface the tongue affords is usually very inconsiderable in fishes, as this member projects but a little way into the cavity of the mouth; and in the *cloudropterygii* there is no prominence of the parietes of the interior part of the mouth to be discerned. Lastly, the whole surface of the mouth in fishes being besmeared with a thick tenacious mucus, must very much obscure the perception of sapid substances.

In the *ray* genus there are two flaps of the integuments upon the edge of the mouth, somewhat of a triangular shape, with the free border denticulated, or rather fringed. These parts appear to us better adapted for receiving the impressions of taste than the tongues of fishes.

It is most probable, that the sense of taste is extremely imperfect, if it exists at all in this class of animals; indeed, it could seldom be called into action, as most fishes choose their food by the assistance of the senses of seeing and of smelling.

Organ of Hearing.

As sound is always conveyed to the ear of fishes through the medium of water, they do not require an external *concha*, or any projecting parts for collecting the sonorous vibrations. The whole of the organ is, properly speaking, internal, or within the head, in these animals.

Anatomists disagree with respect to there being any meatus auditorius externus, or external opening leading to the interior of the organ. It is only contended for in the cartilaginous fishes with free branchiæ. Both Monroe and Hunter assumed the merit of discovering this part. The former described it in the *skate* (*raja batis*) in these words: "In the back part of the occiput, near the joining of the head with the spine, two holes, not larger than to admit the head of a small pin, are found at the distance of an inch from each other; in a large fish each of these leads into a capacious winding canal or *concha*, which describes nearly a complete circle; the two *conchæ* are separated from each other by a thin partition; each *concha* terminates in a funnel, from which a small cylindrical canal, or meatus auditorius externus, is continued; the meatus is lodged in a hollow left between two thick cartilages; and as there is no *membrana tympani*, it opens, he says, into a large sac, which contains a white or opaque matter, with a quantity of clear watery-looking, but viscid matter."

This sac is the part upon which the auditory nerve is spread, as will be afterwards described.

He further says, "that generally some portion of a similar white matter is found in the meatus auditorius externus and *concha*, as if part of it passed off by the meatus, or was somehow necessary for communicating the impression of sound to the bottom of the ear."

In another place Doctor Monroe conjectures this "meatus auditorius externus performs the office of the Eustachian tube, at least so far as that tube may be supposed to serve the purpose of discharging useless or hurtful matter." Monroe's *Physiology of Fishes*, p. 48, 49.

Mr. Hunter does not give any particular description of the external opening of the ear in the *ray* or *shark* genera, but frequently mentions it as a part he had discovered, and notices a passage in Willoughby's *History of Fishes*, in which there is some account given of an external opening on the head of the *skate*, in the neighbourhood of what Willoughby supposed to be the organ of hearing in that fish.

The existence of any opening into the interior of the ear from the external part of the body has been denied by a number of highly respectable anatomists.

M. Geoffroy, who described the organ of hearing before either Mr. Hunter or Doctor Monroe, mentioned an external opening, which he states as being difficult to find; he says it is concealed by the muscles, and situated near the condyles at their lateral external part; and in another place he speaks of the auditory foramen being covered with the muscles and the fat. This account is different from the one given by Monroe and Hunter, that it adds no confirmation to their opinion.

Camper positively denies an external opening to the ear of the *skate*. He says, "L'organe de l'ouïe de la raye n'a donc aucune communication avec l'air de l'atmosphère; mais il est enfermé," &c. Camper, *Mem. de Math.* tom. vi. p. 194.

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Vicq d'Azyr entertained the same opinion; in speaking of the cartilaginous fishes with fixed branchiæ, he says, "L'organe de l'ouïe n'a point chez eux d'ouverture extérieure." Vic. d'Azyr, tom. 7. p. 20.

To these authorities we may add that of Scarpa, who asserts, in the most positive manner, that there is no external opening to the ear of either the flat or round cartilaginous fishes; he supposes, that the foramina which Doctor Monroe discovered were the openings of some of the ducts containing gelatine, which are found in this situation; he even treats Doctor Monroe's account with derision; and considers it absurd to suppose that there should be a communication between the external element and the immediate seat of the sense of bearing.

Scarpa, in denying an external opening, admits the existence of a conduit from the integuments into the vestibulum or sac containing the amyloceous substance.

In this Cuvier agrees with him, and we may add, that we have frequently and carefully dissected the organ of bearing in the *ray* and *shark* genera, but have never been able to discover the openings mentioned by Monroe and Hunter. What we have observed agrees almost exactly with the description given by Scarpa.

Behind the occiput, where it is articulated with the first vertebræ of the neck, the skin is smooth and a little depressed: if it be raised at this place two oval membranes present themselves, one on each side. These are pellucid, but at the same time dense and unyielding; they adhere strictly to the edges of two foramina, from each of which a funnel-shaped duct leads directly into the vestibulum. Scarpa considers these foramina analogous to the *fenestræ ovales*; the membrane which covers them, however, has some of the properties of the *membrana tympani*, and may have some effect in regulating or increasing the impression of sound; we perceive then that the cavity of the labyrinth is perfectly closed at every point, as well in the *chondropterygii* as in the osseous fishes: indeed, a different structure would be a departure from the plan of the organ in all other animals.

The membranous labyrinth in the cartilaginous fishes with fixed branchiæ is situated in a corresponding excavation of the sides of the back part of the head; it is so much wider than the part it encloses that they would not preserve their places, but from their connection with vessels, nerves, and processes of cellular substance, which pass to them in different directions: the cartilaginous labyrinth has no communication with the cavity of the cranium, except through the foramina, for transmitting the nerves to the ear. It is composed of very transparent, and much softer cartilage, than the other parts of the head.

In the fishes with free branchiæ, whether cartilaginous or osseous, the greatest part of the membranous labyrinth is contained in the sides of the same cavity which holds the brain; there are, however, some depressions on the inside of the cranium for receiving parts of the ear, and some portion of the semicircular canals is situated round the projecting columns of bone, or in short osseous canals.

According to Cuvier, the large lateral depression of the cranium in the *moon fish* (*tetrardon mola*), containing the ear, is divided by only two small cartilaginous columns, one of which is horizontal, and furnishes a pulley to the posterior semi-circular canal; the other is vertical, and affords one to the horizontal canal; but as the interval between these columns and the parietes of the cranium is ten times greater than the diameter of the canals, they are suspended in that space by vessels and cellular substance. The anterior vertical canal has even no column of this kind, and there is no depression for the sac in the base of the cranium.

In the *frog-fish* (*lophius piscatorius*) the cartilaginous columns are broader, and approach more to the parietes of the cranium, and form two pulleys, through which the posterior and horizontal canals pass.

In the *osseous* fishes there are larger columns or divisions of the cavity of the ear than exist in the *branchiolegous* fishes, and the pulleys are lengthened into short canals, which include a certain portion of the membranous semi-circular canals, more especially the posterior and horizontal ones. The anterior semi-circular canal is sometimes uncovered. In the *pike* (*esox lucius*), the *eel* (*murena anguilla*), the *roach* (*cyprinus rutilus*), and the *mackerel* (*scomber scombrus*), there is only a small osseous pillar corresponding to the space within the anterior canal. In the *dory* (*zeus faber*) this canal rests in a furrow. In the *cod* (*gadus morhua*), and the *carp* (*cyprinus carpio*), the anterior canal is partly inclosed in one of bone, and the posterior and horizontal canals are almost concealed in the bones of the cranium.

When the sac which contains the ossiculum is at a distance from the sinus, the depression which receives it is deep. The *cod* affords an example of this, but it is more remarkable in the *carp* and *herring*.

In these fishes the cell for holding the sac surrounds it, leaving an opening only for the narrow canal which joins the sac and sinus together.

In every instance amongst the *osseous* fishes, in whatever way the sac and canals may be inclosed, the sinus and extremities of the canals remain in the cavity of the cranium; the nerves therefore, in passing to these, do not go through any foramina in the bones. But in the *sturgeon* (*acipenser sturio*) there is an approach to the structure described in the cartilaginous fishes with fixed branchiæ; each of the canals is entirely enveloped in a tube, considerably larger however than the one it incloses; the sac lies close to the side of the cranium, from the common cavity of which it is separated by a very thick membrane, secured there by several ligamentous processes. The nerves are transmitted through holes in this membrane left for that purpose.

The parts which immediately constitute the organ of hearing are essentially the same in all the orders of fishes; they consist of membranous semi-circular canals, and certain dilated parts or sacs, which contain calcareous substances, either hard or soft, and upon which the nerves of hearing are chiefly spread; all these parts are further completely filled up with a gelatinous fluid, or transparent pulp.

The structure of the canals and sac is nearly the same in all fishes, they are as thin as membrane, but transparent and elastic, like cartilage, of the nature of which they should probably be considered: when these parts are cut around, they do not collapse, but present open mouths, like the section of an artery.

All fishes agree with respect to the number and direction of the canals; they are always three, an *anterior*, *posterior*, and *horizontal*; the first is situated forwards, is inclined outwards, and stands nearly upright; the second is directed backwards and outwards, and its position is also nearly vertical; and the third makes its circuit outwards, and in a horizontal plane.

Each of these canals forms an *ampulla* or spherical dilatation at one of its extremities; the ampulla of the anterior canal is placed at its anterior or inferior extremity; that of the horizontal canal at its anterior extremity, therefore, near the preceding; the ampulla of the posterior canal is situated at the inferior extremity.

The anterior extremity of the posterior canal, and the posterior extremity of the anterior canal, form a junction before they terminate in the sac. The other extremities of

these canals, and both the extremities of the horizontal canal, have distinct terminations. There are therefore five openings from the three semi-circular canals.

As far as respects the form and distribution of the semi-circular canals, the organ of hearing in fishes will be perceived to resemble the membranous labyrinth in the higher classes of animals: the circumstance in which it most materially differs is the existence of the sac containing the calcareous bodies.

In the *cartilaginous* fishes with fixed branchiæ, the sac is triangular in its form; the internal angle, or that next the brain, communicates with the duct leading from the fenestra ovalis. The part corresponding to the second angle is round or oval, and situated posteriorly. The third angle has an anterior and external direction.

In these fishes there are three calcareous masses, a *large* or principal one; and two smaller, of which one is smaller than the other, and therefore they are called the *lesser* and *least* bodies of this kind. The consistence of these substances is soft, resembling a mixture of plaster of Paris before it is used for making a cast more nearly than any other substance with which we are acquainted: they have been likened to a soft mixture of chalk, and to starch, and hence they are called the *cretaceous* and *amylaceous* bodies. The large cretaceous body has somewhat the figure of a bivalve shell; one side is convex, and the other a little concave, with a groove along its broadest margin; the lesser cretaceous body is triangular; and the least has the figure of a kidney bean, but is a vast deal smaller in size.

These bodies are not allowed to float at liberty in the sac; some of their surfaces are applied close to the membrane, and the others adhere to the gelatinous pulp, which is moulded to their shape, and they are further retained in their situation by the ramifications of the auditory nerves.

In the fishes with *free* branchiæ, there is considerable variety in the structure of the dilated parts, for containing the calcareous bodies, and in the form of these bodies.

The sac in the *moon-fish* (*tetraodon mola*) is cone-shaped; the pointed end is turned towards the brain, and the base receives the semi-circular canals.

In the *sturgeon* (*acipenser sturio*) the sac is a broad flat disk, placed in a vertical direction.

In these, the *frog-fish* (*lophius piscatorius*), and as far as it has been observed in all the *cartilaginous* fishes with *free* branchiæ, the sac is an undivided cavity; but in the *osseous* fishes, the coalition of the extremities of the semi-circular canals produce an intermediate cavity between these and the sac.

Scarpa calls this part *sinus utriculiformis*, or the *bottle shaped sinus*. It might with great propriety be considered as analogous to the membranous vestibulum of other animals, although considerably different from it in shape. The sinus is usually elongated, and tubular in its appearance, and distinguished from the sac by a contraction: it contains the third ossiculum or calcareous body.

The *sac* of *osseous* fishes is generally oval in its figure, and placed on the lower surface of the cranium, so as frequently to approach the one of the opposite side; sometimes there is a hollow in the base of the cranium for its reception, as already mentioned. Cuvier considers the sac analogous to the cochleæ, on account of there being a septum formed within them by their internal membrane and contained parts.

In the *pike* (*esox lucius*) there is a small oval cavity lying behind and below the sinus, to which it is connected by a small canal. This part has been called the *appendix* of the semi-circular canals by Scarpa and others; but it should rather be called an additional sac. It has not yet been observed

in any other fish except the *pike*; but there is nothing peculiar in the general anatomy of this species, which would lead us to suppose that it is confined to it. The appendix receives a branch from the first spinal nerve.

Amongst the cartilaginous fishes with free branchiæ, the *frog-fish* (*lophius piscatorius*), has three calcareous bodies: a large one and a small behind it are contained in the sac; the third is very small, and is situated in the cavity formed by the junction of the anterior and horizontal femicircular canals, just below the ampulla of the former. It is triangular in its figure.

In the *sturgeon* (*acipenser sturio*) there is only one calcareous body: it is triangular, and consists of a hard nucleus, which is partly surrounded by soft cretaceous matter.

The substances found in the sac of the *moon fish* (*tetraodon mola*) appear more like mucus than chalk.

Probably many more varieties would be discovered in the cartilaginous fishes with free branchiæ, if their anatomy were better known.

In all the *osseous* fishes there are three calcareous bodies, which have commonly been called *ossicula*: their composition is, however, different from that of any other bones; they are extremely hard, of a pearly white colour, and almost transparent in their thinner parts. They appear to consist of pure calcareous matter, without any mixture of animal substance, and more nearly resemble the enamel of the teeth than any other part of the osseous system.

There are considerable varieties in the bulk and form of the ossicula, respecting which we are indebted to Cuvier for some details.

The principal ossiculum is usually placed obliquely in the sac. It is commonly an oval figure in the genus *gadus*: it is nearly round, with an angle internally, in the genus *silurus*, and in the species of *cyprinus* that have been examined, as the *carp* (*C. carpio*), the *breem* (*C. brama*), the *tench* (*C. tinca*), and the *roach* (*C. rutilus*). In the genus *salmo*, the *pike* (*esox lucius*), and the *sturgeon* (*acipenser sturio*), it is irregularly triangular.

The ossiculum is small in the *eel* (*murena anguilla*), the *star gazer* (*uranoscopus scaber*), the *flat fish* (*pleuronectes*), the *dory* (*zeus faber*), and the *pike* (*esox lucius*); of a middle size in the *herring* (*clupea harengus*); and large in the genus *gadus*, particularly the *cod*, in the *carp* (*cyprinus carpio*), and a number of the *thoracic* fishes.

The chief ossiculum is convex on one side, and concave on the other; the external surface is rough; the internal is smooth, except a furrow which appears to form, with a production of the internal membrane of the sac, a small canal which passes through the interior of the sac. This furrow is commonly longitudinal; sometimes it is shaped like a horse-shoe. In the *carp* (*cyprinus carpio*), it is nearly circular; in the *cod* (*gadus morhua*), its place is supplied by an elevated ridge.

The anterior end of the ossiculum has frequently some projections from it. There are two of them in the *pike* (*esox lucius*), the *mackerel* (*scomber scombrus*), and the *herring* (*clupea harengus*). The ossiculum of the *carp* (*cyprinus carpio*) has three; the one in the middle projects like a style. The end of this bone is round and without points in the genus *gadus* and *labrus*, the *roach* (*cyprinus rutilus*), &c.

The edges of this bone are usually notched or denticulated, and the superior margin is most so. The denticulations are nearly equal all round the edge of the ossiculum of the *cod* and *carp*; in the former they are blunt, in the latter they are pointed. They only exist on one edge in the genus *salmo* and the genus *perca*. There are but three which are on the superior margin in the *conger eel* (*murena conger*).

Some fibres are almost always observed to extend transversely from the furrow to the edge of the principal ossiculum: these are intended to lodge the numerous fibrillæ of the auditory nerves. These impressions are particularly remarkable in the *carp* genus (*cyprinus*); in which they have a radiated appearance.

The second or middle sized ossiculum is commonly situated behind the large bone, but somewhat more externally: its most usual form is semilunar, the concave side being anterior. Its size varies, but it is always much less than the principal ossiculum. Its figure is peculiar in the *carp*, in which it resembles that of the head of a spear.

The third ossiculum, as already mentioned, is situated in the sinus utriculiformis: it is sometimes so near the principal bone, that it is apt to escape observation; its figure varies. In the genera *gadus*, *scomber*, &c. it is triangular; in the *gurnards* (*trigla*), it is leucular; in the *pike*, it is rounded and unequal. It is larger proportionally in the *carp* than in any other genera, and its surface is scabrous, and the edge serrated.

By these hard or extraneous substances being placed in the gelatinous pulp, and in contact with the nerves, it is evidently designed to increase the impressions of sound upon these parts: they thus compensate for the want of an osseous labyrinth, which most probably in mammalia and birds has the effect of rendering the concussion of sound more sensible. Camper has ingeniously observed, that to be convinced that a hard body floating in a gelatinous substance is affected by the slightest external motion, it is only necessary to introduce some hard body into a glass of jelly, when the motion of this body will be sensible to the fingers holding the glass, on shaking the jelly, or giving the glass a little shock with the finger of the other hand. He mentions another simple but illustrative experiment, which consists in putting some hard body into a bladder containing a fluid, the slightest motion of which will be communicated to the hard substance, by which a strong sensation will be excited in the finger holding the bladder.

Two nerves, which correspond to the *portio dura* and *portio mollis* of the seventh pair, are found in fishes. The latter has a peculiar origin, not being a distinct trunk, but conjoined at its root with the fifth pair of nerves, of which it is usually reputed a branch, although, with more propriety perhaps, the fifth pair should be considered a branch of the *portio mollis*.

In the cartilaginous fishes with fixed branchiæ, the auditory branch, or *portio mollis* of the fifth pair, after passing through the foramen, which transmits it from the cavity of the cranium into that of the ear, bends round behind the external parietes of the vestibulum, and divides into two principal branches, one of which is vastly larger than the other. The *lesser* branch is distributed in a retiform manner upon the posterior surface of the sac, containing the smaller cretaceous body, and sends off two longer branches, which proceed to the ampullæ of the anterior and horizontal canals, in which they are expended. The *large* or *principal* auditory nerve forms a fasciculus, the filaments of which divide, subdivide, and re-unite upon the posterior surface of the sac containing the large cretaceous body, so as to produce an intricate and close plexus, from the posterior side of which a nerve goes off to be distributed upon the sac of the smallest cretaceous substance. A branch, also furnished from the posterior side of the plexus, coalesces with one belonging to the *portio dura*, which passes through a particular foramen from the cranium, and arrives behind the large sac. From this anastomosis a branch, which supplies the ampulla of the posterior femicircular canal, is given off. The nerve afterwards

proceeds to the external part of the head, and is distributed immediately under the integuments about the occiput, and the beginning of the neck.

The *portio mollis* in *osseous* fishes, which also is a branch of the fifth pair of nerves, almost immediately divides into two branches, of which one goes to the ampulla of the anterior canal, and the other passes under the sinus to the ampulla of the horizontal canal. The second branch of the *portio mollis* further gives off a longer branch, which goes to the posterior part of the head, behind the superior margin of the cavity for lodging the sac, and divides into many filaments, which are dispersed in a net-work upon the portion of the sac next the brain. From the upper and posterior part of this reticulation a nerve is joined by a branch of the *portio dura*, and proceeds to the ampulla of the posterior canal. In the *osseous*, therefore, as well as the *cartilaginous* fishes, the ampulla of the posterior semicircular canal is supplied by an anastomosis of the *portio dura* and *mollis*.

Dr. Monroe and Mr. Hunter thought that the auditory nerves did not pass through the parietes of the membranous labyrinth in fishes; but, after running a little way upon the surface of the sacs and canals, became pellucid and disappeared: the termination of these nerves is very differently described by Scarpa and Cuvier; the former traced the branches into the ampullæ of the semicircular canals, in which they become soft and pulpy, and with the assistance of the membrane produce a septum which nearly interrupts the half of the cavity. Cuvier states that the nerves of the sac penetrate into the interior of the cavity, and are distributed immediately upon the calcareous bodies contained therein. As we have not at present examined this matter, we quote the authorities. See Hunter in *Phil. Trans.* vol. lxxii. part 2. Monroe's *Physiology of Fishes*, p. 50. Scarpa de *Auditu & Olfactu*, p. 15. Cuvier's *Lectures on Comparative Anatomy*, translated, vol. ii. p. 468 and 546.

Hunter and Monroe have made some experiments to determine the possibility of hearing under water, which were very unnecessary, as it was well known that fishes were sensible of sounds produced even in the air. In fact, sound is communicated with greater or less facility according to the density and elasticity of the medium through which it passes; consequently it will be more readily propagated through solid substances and water than through air, and hence we find the organ of hearing less complicated in those animals that receive impressions of sound from the earth or water, than in those that inhabit the air. The ear of fishes is admirably constructed for receiving sonorous vibrations in a dense medium; the great extent and elasticity of the sac and canals; the existence of calcareous bodies, more especially when they are hard, and the large plexus of nerves, all seem calculated for this purpose. If the ear of fishes were provided with a tympanum, it would probably be of no use, unless it were filled with some fluid as dense, at least, as water.

In *Plate VII* of the *Anatomy of Fishes*, *fig. 1.* exhibits a view of the organs of hearing in the *thornback* (*raja clavata*) in situ; *g*, anterior semicircular canal; *b*, posterior semicircular canal; *i*, horizontal semicircular canal; *j*, the ampulla of the horizontal canal; *k*, cavity of the vestibulum, which contains the large sac laid open; on the other side, at *l*, is seen the cellular reticulation of this part; *m m*, the membrane of the fenestra ovalis on each side.

Fig. 2. of *Plate VII.* of the *Anatomy of Fishes*, shews the organ of hearing of the right side of the *thornback*, abstracted from its situation, and viewed from the side next the brain, the cavity of the vestibulum and the cartilaginous tubes which enclose the membranous canals being laid open; *a*, the anterior semicircular canal; *b*, the posterior semicircular

lar canal; *c*, the horizontal semicircular canal; the ampullæ of each of the canals is sufficiently evident without letters of reference; *d*, the membrane of the fenestra ovalis seen on the side of the vestibulum; *e*, sulcus leading from the membrane of the fenestra to the interior of the vestibulum; *f*, the portion of the sac containing the large cretaceous substance; *g*, that of the lesser; *h*, the situation of the smallest cretaceous body; *i*, the coalition of the anterior and horizontal membranous canals; *j*, the branch of the auditory nerve distributed to the ampulla of the anterior semicircular canal; *k*, branch of the auditory nerve to the ampulla of the posterior canal; *l*, branch of the auditory nerve to the ampulla of the horizontal canal.

In *fig. 3.* of *Plate VII.* of the *Anatomy of Fishes*, an opposite view is given of the organ of hearing in the *thornback*, by which the posterior surface of the sac and the distribution of the nerves upon the immediate seat of hearing are exposed; *a*, the anterior semicircular canal; *b*, the posterior semicircular canal; *c*, the horizontal semicircular canal; *d*, auditory nerve; *e*, branch of the auditory nerve to the ampulla of the anterior canal; *f*, branch of the auditory nerve to the ampulla of the horizontal canal; *g*, nervous plexus upon the capsule of the large cretaceous body; *h*, nervous plexus upon the capsule of the lesser cretaceous body; *i*, plexus upon the capsule of the smallest cretaceous body; *k*, *portio dura*; *l*, anastomosis of the *portio dura* with the auditory nerve; *m*, nerve furnished by this anastomosis to the ampulla of the posterior semicircular canal; *n*, continuation of the trunk of the *portio dura*; *p*, part of the cavity of the cranium; *q*, a part of the transverse cartilage which passes outwardly to sustain the jaws; *r*, the first vertebra of the neck.

Fig. 8. of the same plate represents the thin cretaceous bodies of the ear of the *thornback*; *a* is the large cretaceous body viewed upon the anterior surface; *b*, the groove that runs along it; *c*, the same substance viewed posteriorly; *d*, the lesser cretaceous body; *e*, the smallest cretaceous body.

Fig. 4. of *Plate VII.* exhibits the ampulla of one of the membranous semicircular canals magnified and laid open to expose the distribution of the auditory nerve in its interior; *aa*, the enlarged part, or ampulla opened; *b*, the branch of the auditory nerve, becoming gradually broader and separated into filaments; *c*, the nervous septum of the ampulla; *d d*, semicircular canal above and below the ampulla.

In the dissected head of the *pike* (*sox lucius*), represented in *fig. 1.* of *Plate VIII.* of the *Anatomy of Fishes*, there is a view of the organ of hearing on each side seen from above; *e*, the anterior semicircular canal entirely seen; *f*, its ampulla; *g*, the posterior semicircular canal partially exposed; *h*, its ampulla seen below; *i*, the course of the horizontal semicircular canal; *j*, its ampulla; *k*, sinus utriculiformis of the semicircular canals; *l*, appendix of the sinus, which is a part peculiar to the *pike*; *m*, the situation of the smallest ossiculum. No. 5 is the trunk of the fifth pair, and any other nerves seen in this figure arising from the brain are indicated by corresponding numbers; *n*, the branch of the auditory nerve sent to the ampulla of the anterior semicircular canal; *o*, the branch of the auditory nerve sent to the horizontal canal; *p*, the branch sent to the ampulla of the posterior canal; *q*, branches of the auditory nerve expended upon the sac containing the principal ossiculum; *r*, nerve going to be inserted behind the sinus, where the smallest ossiculum is contained.

Fig. 2. of *Plate VIII.* shews the three ossicula of the *pike*; *a*, the principal one; *b*, the lesser ossiculum; *c*, the smallest ossiculum; *d*, the same magnified.

In *Plate IX.* of the *Anatomy of Fishes*, *fig. 3.* exhibits a lateral view of the organ of hearing in the *pike*; *a*, the cavity of the cranium; *b*, spinal canal; *c*, anterior semicircular canal; *d*, its ampulla; *e*, the ampulla of the horizontal canal; *f*, the other

other extremity of the same canal; *g*, the ampulla of the posterior canal; *b*, the other extremity of the posterior canal; *i*, the utriculiform sinus of the semicircular canals; *j*, appendix peculiar to the *pike*; *k*, the smallest ossiculum seen through the sinus; *l*, the sac containing the other two ossicula. No. 5 indicates the trunk of the fifth pair of nerves; *m*, the auditory nerves; *n*, the branch of the auditory nerve to the ampulla of the anterior canal; *o*, the branch of the auditory nerve to the ampulla of the horizontal canal; *p*, nerves derived from the auditory going behind the smallest ossiculum; *q*, the branch of the auditory nerve sent to the ampulla of the posterior canal; *r*, auditory nerves distributed upon the sac on the side next the brain; *s*, nerve analogous to the par vagum or portio dura; *t*, the anastomosis of the preceding nerve, with a branch of the auditory or portio mollis, from which the ampulla of the posterior canal is supplied; *u*, a nervous filament sent from the first spinal nerve to the bottom of the appendix.

Fig. 4. of the same plate explains the different cavities of the bones of the cranium, in which parts of the labyrinth are enclosed; *a*, the cavity of the cranium; *b*, a hollow, in which the sac with the ossicula is lodged; *c*, a sinuosity for containing the ampulla of the anterior semi-circular canal; *d*, the aperture leading into the passage which holds the horizontal semi-circular canal; *e*, the common foramen to the horizontal and posterior canals; *f*, the other opening, through which the posterior semi-circular canal passes; *g*, the foramen, by which the portio dura goes out of the cranium; *h*, canal of the spine; *i*, *i*, foramina for the exit of the fifth pair of nerves; *k*, foramen for the first spinal nerve.

In Plate IX. of the *Anatomy of Fishes*, fig. 1. is a section of the head of the *frog-fish* (*Iopbius piscatorius*); *a*, the anterior semi-circular canal; *b*, its ampulla; *c*, the horizontal semi-circular canal; *d*, its ampulla; *e*, the posterior semi-circular canal; *f*, its ampulla; *g*, the conjunction of the anterior and posterior semi-circular canals; *h*, a large canal, into which all the others open; *i*, principal sac containing the large ossiculum; *k*, the facculus of the lesser ossiculum; *l*, the third or smallest ossiculum seen through the membrane below the ampulla of the anterior canal; *m*, the nerve going to the ampulla of the anterior canal; *n*, the nerve of the ampulla of the horizontal canal; *o*, nervous filaments sent behind the seat of the third ossiculum; *p*, filaments of nerves distributed to the capsule of the large ossiculum; *q*, a filament which goes to be expended upon the capsule of the lesser ossiculum; *r*, a long nerve sent to the ampulla of the posterior semi-circular canal; *s*, the portion of the fifth pair of nerves that go out of the cranium; *t*, the fourth pair of nerves; *u*, the third pair of nerves; *v*, the second or optic nerves; *x*, the first or olfactory pair of nerves.

Organs of Vision.

The eyes of fishes are usually situated on the sides of the head, in which cases the animal only beholds objects with one eye at a time; some remarkable exceptions exist, however, with respect to the position of the eyes in this class; they are turned directly upwards in the *star-gazer* (*uranoscopus*). All the genus *pleuronectes* have both eyes placed on one side of the head, which, from the position the fish observes, is always the uppermost. In the *callionymus* and the *ray* genus the eyes have an oblique aspect.

The figure of the eye in fishes usually approaches that of a semi-sphere, the flat surface of which belongs to the cornea. In the *ray* genus the eye is flat also superiorly, and has, consequently, the form of a quarter of a sphere. Some fishes have the cornea gibbous, and the eye of the same figure that it possesses in those animals which inhabit

the air; the *gadus lota* affords an example of this shaped eye.

The *sclerotic* coat is dense, elastic, and cartilaginous in its structure; and although sometimes thin, it preserves the figure of the eye. In some species, more particularly amongst the cartilaginous fishes, it is thick. This is remarkably the case in the *sturgeon* (*acipenser sturio*); in this fish the sclerotic composes the greater portion of the eyeball, the cavity for containing the transparent parts bearing but a small proportion to the rest of the globe. This coat is thin in the posterior part of the eye of the *salmon* (*salmo salar*), and hard and unyielding as bone on the fore part. The induration of the front of the sclerotic is also found in several other species.

The sclerotic of the *ray* and *shark* genera forms a tubercular projection at the back of the eye; this is articulated with a piece of cartilage which is connected at the other extremity to the bottom of the orbit. The eye in these animals, therefore, is sustained upon a footstalk, upon which it is moveable only to a certain extent.

The *cornea*, as before mentioned, is commonly flat in fishes.

The distinction between this coat and the sclerotic is particularly plain in the *tope* (*squalus galeus*); these two coats are conjoined by oblique edges, between which is interposed some compact cellular substance, which appears to be a production of the conjunctiva that passes into the eye to be united to the ciliary ligament.

The *conjunctiva* is reflected over the external part of the globe of the eye in fishes as in other animals. This is satisfactorily shewn in the *eel* kind (*murena*), in which it adheres so slightly at this place, that it is removed in stripping the skin off the rest of the body.

The *choroid coat*, and *membrana ruyfchiana*, are very distinct from each other in this class.

In the genera *raja* and *squalus* the choroides possesses the usual vascular structure, and is of some thickness and consistency; the ruyfchian membrane is very thin and transparent, and between the two membranes there is spread a silvery pigment.

But in other fishes the choroides is very thin and little vascular. It is a white silver or gold colour. The ruyfchiana has more consistence, and is composed of an infinite number of vessels interwoven together. It is a black colour. There is interposed between these coats a remarkable body called the *choroid gland*, which is not found in the *chondropterygii*.

The *choroid gland* has usually the figure of a thick flat ring; it encircles the optic nerve, but not entirely, as there is always a small deficiency in the ring.

In the *cod* (*gadus morhua*), the *salmon* (*salmo salar*), and the *moon-fish* (*tetraodon mola*), it has been observed to form not a true circle, but to be irregularly bent; and in the *perca labrax* it is composed of two pieces placed on opposite sides of the optic nerve.

The choroid gland is very compact in its structure; it receives a multitude of fine vessels which pass through the membrana ruyfchiana; they are covered by a white opaque mucus, anastomose with each other, and seem to terminate in an infinite number of ramifications in the substance of the gland, which thereby acquires an uniform, vivid, red colour at every point, appearing more like a dyed body than one coloured by blood-vessels, in which circumstance, and the obscurity of its texture, it bears a strong resemblance to the vascular bodies found in the swimming bladder of fishes. The circulation of the blood through the choroid gland appears to be slow and embarrassed, as the colour remains in the

the part in a considerable degree after it is macerated and preserved in spirits.

The choroid gland likewise receives a number of nervous filaments from the ophthalmic branch of the fifth pair, which proceeds for some way in the same sheath with the optic nerve.

Anatomists are not agreed with regard to the use of this singular part: some have supposed it to be a muscular apparatus, intended to alter the figure of the eye when beholding objects at different distances; others, amongst whom is Cuvier, consider it as a gland which secretes some of the humours of the eye; this latter opinion is most consistent with the form and structure of the part, which are very unlike those of any other muscle; but, on the other hand, its situation on the outside of the ruyfchiana, and the want of any excretory opening, are difficulties in the way of its furnishing any of the transparent parts of the eye; it appears to us to supply the place of the vascular structure of the choroides, which membrane is always thin and deficient in blood-vessels in those fishes that possess the choroid gland. The functions of the choroid coat are not, we conceive, yet fully understood; it enjoys a degree of vascularity greater than is necessary for its supposed offices of secretion; we have examples of the same circumstance in several other organs in the body, but the most striking are the choroid gland and the vascular bodies of the swimming bladder of fishes.

The membrana ruyfchiana, near the front of the eye, sends off, in some fishes, a triangular process, which passes through the vitreous humour, and is attached to the side of the capsule of the crystalline lens, in the manner of the marsupium of birds. Some very evident vessels which come through the vitreous humour, are transmitted along this process. On the opposite pole of the capsule of the crystalline we have observed in the *dory* (*zeus faber*), and others, the mark of an attachment which appears to be produced by a vessel. This mode of connection between the crystalline and the internal coats of the eye appears perfectly analogous to the *peden* or *marsupium* in the eye of birds, and no doubt answers a similar purpose.

The *ciliary processes* have not been observed to exist in any fish except the *tope* (*squalus galeus*), in which the laminae, according to Cuvier, project as much as in birds, and after forming a short point, which joins the capsule of the crystalline, they are continued with the striae of the uvea.

Fishes want that coloured appearance of the bottom of the ruyfchiana, which is called the *tapetum*; this membrane is black at every part, except in the *ray* kind, which have it transparent at the bottom of the eye, and therefore admitting the silver colour of the choroides to be seen through it.

The *iris* is in general a very fine membrane in fishes, and so transparent that the uvea is visible.

The *uvea* has commonly a brilliant metallic colour, which makes the eyes of fishes so striking.

The form of the *pupil* is round in this class, with the exception of the genus *raya*, in which a very remarkable *curtain* or *veil* is continued from the superior edge of the pupil. It is nearly a triangular shape; the base is connected above, and the two sides hang down. These are notched, or rather divided into short stripes or shreds along the edge: they appear gilded externally, but are black on the inside. When the eye is unmoved, the veil is turned up between the superior edge of the pupil and the vitreous humour; but if it be depressed, either by external force or the will of the animal, the veil comes down and entirely covers the pupil. The *torpedo* has been observed to let down its veil in this

manner always at the moment of communicating an electric shock.

In the *ray* and *shark* kinds, the *carp* genus, and a number of other fishes, the *optic nerve* has been observed to enter the eye by a round hole, and to produce a tubercle on the inner side, from which the *retina* goes off in a radiated manner. In the *ray* genus, the tubercle of the optic nerve is irregular in its figure, or papillated.

Cuvier has observed in several of the genera *salmo*, *clupea*, *scomber*, *perca*, *gadus*, *zeus*, and *tetraodon*, that the optic nerve, after entering the eye, and traversing the ruyfchiana, forms two streaks or tails: these tails are parallel, but not contiguous, a production of the ruyfchiana passing between them. The *retina* is produced from the opposite edges of these streaks, in the same manner as it arises in birds from the single white line.

The *aqueous humour* is very small in quantity, or totally wanting in fishes; it is also of a different consistence than in the animals which do not inhabit the water. It is viscid and filamentous.

The *crystalline lens* has generally in fishes very nearly the spherical form, and in some instances it is a perfect sphere. It is more dense and hard, especially in the nucleus or internal part, than it is in any other animal, except the *cuttle fish* (*sepia*). As the aqueous humour is small, the crystalline is in the same degree large in this tribe of animals.

The *vitreous humour* of fishes is less in proportion to the other parts, and has more consistence than in the animals living out of the water.

Cuvier has furnished us with some tables, partly the result of his own observation, and partly derived from other sources, exhibiting the proportions that exist as to the form, magnitude, density, &c. of the transparent parts of the eye in different animals. We shall extract the following particulars, as serving to explain the optical properties of the humours of the eye in fishes.

The degree of convexity or approximation of the crystalline to a sphere is determined by comparing the axis with the diameter. In the human subject, the axis is to the diameter as 1 to 2.

In the following fishes as below:

<i>Salmon</i> (<i>salmo salar</i>)	-	9 to 10
<i>Sword fish</i> (<i>xiphias</i>)	- -	25 — 26
<i>Shad</i> (<i>clupea</i>)	- -	10 — 11
<i>Pike</i> (<i>esox lucius</i>)	-	14 — 15
<i>Barbel</i> (<i>cyprinus barbus</i>)	-	11 — 12
<i>Carp</i> (<i>cyprinus carpio</i>)	-	14 — 15
<i>Whiting</i> (<i>gadus merlangus</i>)	-	14 — 15
<i>Mackarel</i> (<i>scomber scombrus</i>)	-	12 — 13
<i>Shark</i> (<i>squalus</i>)	- -	21 — 2
<i>Ray</i> (<i>raya</i>)	- -	21 — 2
<i>Herring</i> (<i>clupea harengus</i>)	-	10 — 11
<i>Tench</i> (<i>cyprinus tinca</i>)	-	7 — 8
<i>Eel</i> (<i>murena anguilla</i>)	- -	11 — 12
<i>Conger</i> (<i>murena conger</i>)	-	9 — 10

The portion of the axis occupied by each of the three transparent parts of the eye are represented by fractions, the length of the axis being considered the unit.

	Aqueous humour.	Crystalline lens.	Vitreous humour.
In man	$\frac{1}{22}$	$\frac{4}{22}$	$\frac{11}{22}$
In the herring (<i>clupea harengus</i>)	$\frac{1}{7}$	$\frac{4}{7}$	$\frac{2}{7}$

The following table has been given by Monro, of the comparative specific gravity of the humours of the eye in the

the *cod* (*gadus morhua*) and the *ox* (*bos*); distilled water, being supposed a thousand.

	In the <i>ox</i> .	In the <i>cod</i> .
Of the aqueous humour	1000	1000
Of the vitreous humour	1016	1013
Of the whole crystalline	1114	1165
Of its external part	1070	1140
Of its nucleus	1160	1200

We have not proved the accuracy of this table, but it appears to be incorrect, particularly with respect to the density of the aqueous and vitreous humours, which are probably greater than are here represented.

We have not a sufficient number of experiments to determine accurately the refractive power of the different humours of the eye. All that have been made, however, as well as common observation, shew that the refrangibility of the humour is much greater in fishes than in terrestrial animals, by which means they are enabled to perceive objects through so dense a medium as water.

The eye in fishes is moved by six muscles, as in the human subject. The one analogous to the *trochlearis* does not, however, pass through a pulley.

Fishes are not provided with moveable eye-lids. In the *salmon* (*salmo*), and the *mackerel* (*scomber*), there is at each angle a vertical and immoveable veil, which projects a little way over the eye. Most *osseous* fishes have something of the same structure.

In the *moon fish* (*tetraodon mola*) there is a very singular apparatus for covering the eye. This animal can entirely cover its eye by a lid, which contains a circular perforation. This aperture is shut by a true sphincter muscle, and is opened by five muscles which arise at the bottom of the orbit, and proceed in a radiated manner to be inserted into the eyelid.

Fishes, from the nature of the medium in which they reside, do not require any aqueous secretion for keeping the surface of their eyes moist; we therefore do not find a lacrymal gland in any species of this class.

The figures which illustrate the structure of the eye are contained in *Plate IX. of the Anatomy of Fishes*: *fig. 5.* exhibits a lateral view of the eye of the *skate* (*raja batis*); *a*, the eye, flat above and anteriorly; *b*, the tubercle of cartilage; *c*, the cartilaginous peduncle or footstalk upon which the tubercle is articulated; *d*, a portion of the cartilage of the orbit to which the footstalk is connected. *Fig. 6.* is an anterior view of the eye of the *skate*, with the cornea removed, to bring into view the veil which is seen at *a*, covering the greatest part of the pupil. *Fig. 7.* is a section of the eye of the *sturgeon* (*acipenser sturio*); *a*, the thick mass formed by the sclerotic coat; *b*, the cavity of the eye. *Fig. 8.* exhibits a portion of the skin taken from the side of the head of the *eel* (*murena anguilla*) including the spot covering the globe of the eye which corresponds to the conjunctiva. *Fig. 9.* shews the choroid gland in the *carp* (*cyprinus carpio*); *a*, the gland; *b*, the optic nerve; *c*, the ruyfchiana, the choroides being removed. *Fig. 10.* exhibits the choroid gland as it exists in the *cod* (*gadus morhua*); *a*, the gland somewhat irregular in its figure; *b*, the optic nerve; *c*, the ruyfchiana; *d, d*, vessels passing into the gland. *Fig. 11.* exposes the internal parts of the eye in the *dory* (*zeus faber*); *a*, the vitreous humour; *b*, the crystalline lens; *c*, vessel passing through the vitreous humours, distributing branches to this humour and the lens; *d*, production of the ruyfchiana attached to the capsule of the crystalline; *e*, the other point of the capsule which seems to have a particular connection with the adjacent parts. *Fig. 12.* is intended to contrast the spherical form of the

crystalline of a fish at *a*, with the flattened appearance of the anterior part of the lens in a bird, as seen at *b*. *Fig. 13.* represents the tubercular termination of the optic nerve in the *skate* (*raja batis*); *a*, the optic nerve; *b*, the irregular or papillated tubercle formed within the eye; *c*, the retina. *Fig. 14.* shews the termination of the optic nerve in two streaks, as it exists in the *gadus*, and many other genera; *a*, the optic nerve; *b, b*, the streaks or tails; *c*, the retina.

Bones.

Fishes have been divided by all naturalists into two great tribes, according to the structure of their skeleton; those of the one have been called the *cartilaginous*, and those of the other the *osseous* fishes. This distinction, although justified by the difference in the composition of their bones, and proper as being consistent with natural habits and structure, is nevertheless not strictly correct; for the skeleton of the cartilaginous fishes possesses some calcareous matter, and the bones of the osseous fishes contain in general a much smaller quantity of earth than is found in those of other animals: if they were compared with the bones of mammalia, or of birds, they would themselves deserve the epithet of cartilaginous. The composition is not uniform in the different bones of a fish's body; some contain a greater quantity of phosphate of lime than others; the cranium, spine, and the thick bones, are hard, white, and opaque in the osseous fishes, but the thin bones are flexible and transparent; and in the cartilaginous tribe, although we can as readily cut with a knife many parts of their skeleton as we could common cartilage, yet their cranium and spine give considerable resistance, especially in the larger species, and present more of a fibrous texture.

The structure of the skeleton is more purely cartilaginous in the fishes with fixed branchiæ, as the *ray* and *skark* genera, than in the order of cartilaginous fishes called *branchiostegi*.

The colour of the bones of fishes does not appear to be subject to much variety; one species, however, the *gar fish* (*esox belone*), is remarkable by having the whole skeleton green.

The skeleton of a fish is, in its general form and mechanism, so very unlike that of other animals, that a person at first view would not suppose there existed the most distant analogy between them; but after examining the parts in detail, and comparing their relations to each other, we are astonished by the correspondence which prevails between them, and the pieces of the skeleton of mammalia. Nature is always economical in her means, and never deviates from the type, or creates a new part, until all the modifications which the organ is capable of receiving be exhausted. The combination of simplicity of design with diversity of effect, cannot be more strongly illustrated than in comparing the anatomy of the skeleton of fishes with that of the other classes.

The skeleton of the *chondropterygii*, and of the genus *ray* in particular, differs as much in form as in composition from that of the *osseous* fishes; it likewise bears less analogy to the skeleton of other animals: we shall therefore postpone its description until we have given an account of the bones of *osseous* fishes, for which purpose we shall take in general the *dory* (*zeus faber*), as affording one of the best examples of the osteology of this tribe of fishes.

The bones which compose the cranium are all united by a species of squamous suture; they not merely overlap each other, but the edge of each bone forms a great number of irregular, sharp, thin processes or spiculae, which are inserted into one another: the union thus produced does not admit

of any motion of the several parts, and the cranium appears to be composed of a single piece. Cuvier says that the bones of the cranium are ankylosed with each other; but we have not only found the usual number of bones to be distinct in the cranium of even old fishes, but the portions of which each bone is originally composed to be separable from each other. To be satisfied of this fact it is only necessary to examine the skull of a fish that has been thoroughly cleaned and bleached by long maceration in the sea, and exposure to the weather, many of which are frequently found lying on our shores: these skulls we have been enabled to separate into portions, corresponding to the *frontal*, *parietal*, *temporal*, *sphenoidal*, and *occipital* bones, and to divide again the frontal and occipital bones into two pieces each.

The *external form of the cranium* is very irregular, and varies in different fishes. In the *dory* it has two flat sides, which have an oblique direction, like the roof of a house; the top or part corresponding to the ridge is an irregular hollow or groove; the posterior part of the cranium is much larger than the anterior; it is truncated or flat, except two thin processes corresponding to the occipital ridge; the anterior portion of the cranium is slender, elongated, and slightly arched, somewhat resembling the superior mandible of a bird: under this part there is a very large vacancy, through which most of the nerves pass out. The inferior part of the cranium is depressed on each side, and then forms a remarkably strong process, which is analogous to the *basillary*, and extends from the condyle, with which the spine is articulated, to the bone analogous to the vomer, of which more will be said hereafter. The parietes of the cranium, corresponding to the situation of the organs of hearing, are thin, cellular, and exhibit an irregular fossa externally; in many fishes the sides of the cranium are not flat and sloping, but spread out into a thin edge, nearly on a plane with the superior part: there is often also a sharp thin spine extended along the medial line of the superior part of the cranium, which, in some species, stands high, and projects considerably from the back of the head, in order to give attachment to the muscles and ligaments of the spine. The lower part of the cranium is most commonly, in osseous fishes, enlarged on each side of the basillary process.

The *cavity of the cranium*, as before observed, is much larger than the brain; it is extremely irregular upon the internal surface, furnishing a number of craggy and spiculated processes, impossible to describe: it is not, therefore, adapted, as in other animals, to the form of the brain. It is more nearly oval than any other figure.

In the account given by Cuvier of the *bones of the face*, he does not appear to us to have named the different pieces according to their true analogy, or likenesses to the parts composing the face of other animals. In the *dory*, from which we take our description, the bones of the face are large and very distinct.

There is no *osseous septum* to the orbits; the eyes are separated from each other only by membrane. In the genus *anarrhichas*, however, the orbits are divided by bone.

The *zygoma* is formed by a chain of very thin bones, extended from the temporal to the malar bone; it makes the inferior margin of the external part of the orbit: these, in some fishes, are incomplete in the middle; Cuvier considers them as supplying the place of the *lacrymal bone*.

The bones which appear most analogous to the *lacrymal* are two irregular-shaped, small, thin pieces, situated at the anterior part of the *os frontis*, on each side of the nasal bones.

The bones which supply the place of the *ethmoidal* of other animals are situated before the *os frontis*, immediately

below the last mentioned; they descend obliquely from the frontal to the malar bones, with which they are articulated; they form the anterior margins of the orbits.

The *nasal bones* are supplied by a strong process of an arched figure, which is continued from the middle of the anterior part of the *os frontis*, under the posterior ends of the inter-maxillary bones, which move over it; from this bone there arises a thin plate, which is analogous to the *osseous septum* of the nasal cavity, and which is united to the vomer.

The *vomer* is a bone of a singular form, it is long, and passes in a straight line from the basillary process of the occiput, with which it appears to be really ankylosed, along the superior part of the palate, and ends anteriorly in a thick broad extremity, somewhat resembling in figure a horse's foot, which is commonly armed with teeth: this bone serves as the base to the septum of the orbits.

The bones we have called the *malar*, Cuvier appears to consider as analogous to the *palatine*; they are thick, short, and irregular in their shape; they are articulated with the zygomatic bones, with those analogous to the ethmoidal, with the superior maxillary, and with the articular bones, which will be hereafter described; they send processes backwards and inwards, which contribute to form the vault of the palate.

The *superior jaw* is formed of four pieces, which are connected to each other, and to the adjoining bones, by ligament, in such a manner as to permit a considerable degree of motion; the two external pieces correspond to the *superior maxillary bones*; the intermediate ones to the *inter-maxillary bones*.

The *maxillary bones* are two arches placed with their convexity outwards; they are broader and thinner at their extremities than in the middle; near their superior end they furnish a thick process, which projects anteriorly like a small cone, and presents on the surface next the mouth a rounded ridge; from entering into the composition of the roof of the mouth, some persons would perhaps consider them analogous to the *palatine bones*. They are connected by ligament with the malar bones superiorly, with the coronoid process of the lower jaw inferiorly, and anteriorly with the inter-maxillary bones.

The part of the upper jaw that corresponds to the *inter-maxillary bones* forms the superior margin of the mouth, and is commonly furnished with teeth; it is composed of two pieces, which are united to each other by ligament and cartilage; each of these sends off posteriorly two thin plates, and one long round process; the first slide under the maxillary bones, and the round processes are tied together by ligament, and move in a sheath which is thus formed upon the nasal bone: a free motion of these parts on each other becomes necessary in the protrusion, the opening, and the shutting of the mouth.

The *inferior jaw* consists of two triangular shaped pieces, which are united to each other by ligament at their anterior part: the angle of those pieces that is placed upwards corresponds to the *coronoid process*; the articulation is situated near the posterior angle, and this last corresponds with what is called the angle of the jaw in mammalia. The middle part of the pieces composing the lower jaw is either of extremely thin cartilage or membrane.

The lower jaw is articulated with a bone analogous to that to which Cuvier has given the name of *the square bone*, (*l'os quarré*,) but which we have preferred calling the *articular bone* in the description of the anatomy of birds, from the circumstance of its being interposed between the articulation of the jaw and the cranium.

The articular bone is composed of several pieces firmly united together; they produce a considerable extent of surface on the side of the head in the *dory*: one piece, which is of some strength, is articulated with the under surface of the temporal bone, from which it proceeds downwards and forwards in a curved manner, declining in thickness as it descends: this piece sustains the thin bone of the operculum, and receives the horn of the os hyoides: over this piece there is another thinner one laid; they are apparently ankylosed with each other, and the external one commences a short distance from the cranium, by a sharp distinct point, and goes on to the articulation of the lower jaw: another osseous piece is articulated below, and anterior to the orbit with the inferior end of the malar bone, from which it proceeds directly downwards to join the anterior end of the other piece, and forms with it the articular surface for the joint with the lower jaw. The intermediate space left between these pieces, which is very considerable and of a triangular figure, is filled up with a very thin plate of cartilage, which is in parts ossified. The articular bone in fishes is evidently formed to carry the lower-jaw forwards, and thus to facilitate the protrusion and dilatation of the mouth, and for affording a surface for the attachment of the muscles of the jaw; it is therefore found much larger in this class than in birds.

The part corresponding to the *os hyoides* is formed by two flat osseous plates, which meet together anteriorly upon the bone which sustains the tongue, and, separating from each other posteriorly encompass the gills: a small round branch goes off from the external end of each plate; these are analogous to the horns of the os hyoides, and become attached to the internal surface of the articular bone by ligaments, which allow the hyoides to move nearer or farther from the cavity of the mouth: each plate of the hyoides is composed of several pieces, the edges of which are in a certain degree ankylosed with each other: there are six pieces observable on each side in the *dory*. Cuvier states three to be the usual number.

There is a very thin osseous plate situated between the anterior ends of the two sides of the hyoides, and the junction of the scapula; it is connected by pieces of ligament to each side of the os hyoides, to the lingual bone, and to the scapula, where they meet: this bone has almost exactly the outline of a heart, it has been therefore called the *cordiform* or *heart shaped bone*; it is peculiar to fishes, but does not appear to have any other use, than to afford attachment to the strong muscles situated at this place.

There are a number of bones that are peculiar to the organs of respiration and of deglutition in this class of animals, which require a connected description: these are the branchial arches, the pharyngeal bones and the bones which sustain the operculum or gill cover, with those of the membrana branchioslega.

In describing the organs of respiration we have stated that each of the gills is sustained upon an arch of bone: each *branchial arch* is composed of two pieces or limbs, two of the ends of which are conjoined by ligament in such a manner, that the other extremities can be moved nearer or farther asunder, and thus the arch rendered narrower or wider: the superior limb, or that next the cranium, measures about one-third of the whole arch, and the inferior about two-thirds of its extent. The branchial arches are placed, with respect to each other obliquely in succession; they are commonly slender, thin bones, and have four sides, or rather two edges and two sides: the convex edge is directed outwards and backwards: it is upon this the laminae of the gills are planted: the concave edge is turned forwards and in-

wards, towards the mouth. Along the external or anterior side there are usually a number of small osseous eminences, placed at short distances from each other, which project a little beyond the concave edge: these do not commonly arise from the bone, but the membrane covering it: they are furnished with teeth, which are thence called the branchial teeth, as already described. The inferior extremity of the branchial arches are attached in succession along the sides of some osseous pieces, which are situated in the lower part of the mouth, and appear as the continuation of the lingual bone: these bones vary in number in the different species, but they are firmly united to each other, so as to form a sort of sternum, to which the branchial arches are affixed like ribs. The superior surface of these bones is smooth, but inferiorly they furnish some processes, through which some of the branches of the branchial artery pass to the gills.

From the posterior extremity of this species of sternum there arise two slender branches, which separate from each other in the manner of horns, and soon terminate in flattened surfaces or disks: these are the inferior *pharyngeal bones*, and are, as before observ'd, commonly covered with teeth.

The superior extremities of the branchial arches are indirectly connected with the basis of the cranium: a slender footstalk is articulated at one end with the superior extremity of the posterior arch, and at the other with the base of the cranium; the superior extremities of the three anterior arches of each side terminate upon two flattened bones, which are called the *superior pharyngeal bones*; from the upper edge of which a second footstalk goes off, and is attached to the cranium, on the inner side of the one first mentioned.

In consequence of this sort of connection between the branchial arches and the cranium, two additional joints are created, by which the flexion of the arches, and the approximation of the superior pharyngeal bones to each other, and to the inferior pharyngeal bones, are more completely performed; the muscles likewise which move these parts gain considerable power by their whole force operating upon the points at which they are inserted.

Cuvier states the connection between the branchial arches and the cranium of osseous fishes in a manner somewhat differently than we have described it above. He says the superior extremities of all the four arches are attached to the superior pharyngeal bones, when these exist; the two posterior arches by an articulation, which admits of a flexion motion; and the two anterior arches more loosely: for this purpose, the first arch bifurcates and sends to the pharyngeal bone a strong ligament from one of its branches, while the other is immediately joined to the cranium.

In the *silurus anguillaris*, which has but one large pharyngeal plate fastened under the superior extremity of the last arch, this extremity unites with that of the third arch, and converges with those of the two first towards the base of the cranium.

In the *pike* (*esox lucius*) the two last arches unite at their superior extremities to the second, which, as well as the first, is articulated with the cranium.

In the *carp*. (*cyprinus*.) which has not moveable superior pharyngeal bones, the superior extremities of the four arches are approximated and articulated with a common piece, which is united to the cranium.

In the *trout* (*salmo trutta*) the superior extremities of the six arches are united by several pieces, the posterior of which bears a small plate covered with teeth, at the place where it is joined with the extremity of the last arch.

The bones which form the *operculum* are generally two. The principal one has a triangular figure; it is very thin at every part, except at the superior angle, at which part it

forms a sort of neck, and a little prominence or head, in which there is a depression that is joined to a corresponding process, on the back of the superior end of the articular bone. This bone of the operculum has a degree of rotatory motion, in addition to those of elevation and depression. The other bone of the operculum is long, narrow, and thin, and resembles the blade of a knife; it lies posterior to, and nearly parallel with, the articular bone; it is not joined to any bone by articulation, but is connected by ligaments posteriorly, with the triangular bone of the operculum, and the back part of the os hyoides, and anteriorly to the angle of the lower jaw. The use of this bone seems to be chiefly to sustain the integuments which are extended over this place.

The *osseous rays* which support the *membrana branchiostega* are attached to the posterior margin of the broad bones of the os hyoides; they increase in size from before backwards. There is an interval between the origin of the first three rays, and that of the four posterior rays, which, however, does not cause any material irregularity in the succession of the points of the rays. These bones are capable of being elevated and lowered, of being approximated and expanded. The elevation and expansion of the posterior rays are opposed, beyond a certain extent, by a process from their roots.

The *vertebræ* are divided by Cuvier into two classes; the first are the *abdominal* or *dorsal*, which have spinous processes from the superior side of the spine only; the second are the *caudal* vertebræ, which have spinous processes from both the upper and lower sides of the spine: but this distinction is not quite correct, as the posterior abdominal vertebræ furnish short spinous processes inferiorly; the caudal vertebræ may, however, be reckoned with propriety from the large bone, which forms the posterior boundary of the abdominal cavity.

The bodies of the vertebræ vary with respect to figure in different fishes, being cylindrical in some instances, and angular or compressed in others; they are all, however, distinguished by having the surfaces by which they are conjoined hollowed out to form a semi-spherical or conical cavity: these cavities are opposed to each other, and thus produce, throughout the whole spine, a chain of cavities, each of which is nearly of a spherical figure, and alternates in succession with the vertebræ; these cavities are furnished with concentric layers of cartilage, or rather a peculiar intervertebral substance, which somewhat resembles ligament, but is highly elastic: these concentric layers complete the form of each cavity, and constitute the bond of union between one vertebra and another. The interior part of the cavities is actually filled by fluid.

The centre of each vertebra, which is very thin, is perforated with a small hole, which is lined by the same substance that invests the cavities; a communication is therefore established between the cavities, the whole length of the spine, which is probably designed to obviate the compression of the fluid in the different cells or cavities during the motions of the spine.

By this species of articulation of the vertebræ with each other several advantages are obtained; strength and lightness are bestowed on the spine, and a great facility of motion, as every vertebra rolls upon a globe composed of an elastic substance, and of fluid. The first vertebra is articulated with the occiput in the same manner as those of the spine are with each other.

The external surface of the vertebræ are very generally marked by a number of depressions or little cavities, in the longitudinal direction of the spine, which give to the circumference of each vertebra very much the appearance of

being constructed of short pillars, with regular spaces between them. This structure diminishes very considerably the weight of the spine, without subtracting from its strength.

The spinous processes of the vertebræ are commonly long, slender, sharp-pointed bones; they arise from the superior sides of the bodies of all the vertebræ, and from the inferior sides of the caudal, and some of the last dorsal or abdominal vertebræ. They originate in the lower surface of the caudal vertebræ we believe always as two processes, which coalesce, and form a triangular space, in which the blood-vessels of the tail pass along the spine. They are double at their roots in the *pleuronectes* and other fishes, along the superior part of the spine also.

The inferior spinous processes of the last dorsal vertebræ are short, imperfectly formed, and have their extremities applied and fastened to each other, in order to sustain the large bone that forms the boundary of the abdominal cavity, of which more hereafter.

The last vertebra of the tail has its extremity spread out in the figure of a fan, which appears to be composed of a number of osseous rays united to each other.

The *ribs* are sometimes wanting in fishes, and, when they do exist, are usually very small.

The genera *silurus*, *cyprinus*, and *chetodon*, however, furnish examples of fishes with strong ribs, which surround the abdominal cavity almost to its top.

In the *herring* genus (*clupea*), the *zeus vomer*, &c. they unite in a sort of sternum.

In many fishes the ribs divide at their extremities into two branches; it is very common also to meet with a second row of ribs, which arise above the others; these are usually fewer in number than the proper abdominal ribs, and pass between the portions of the lateral muscles.

The *sternum* but rarely exists in this class of animals, as the ribs seldom extend as far as the inferior part of the body.

In the *dory* (*zeus faber*) there is a species of sternum formed by a number of irregularly shaped osseous pieces, which appear to be only connected with each other by ligament, and the common integuments. They are furnished with sharp spines externally, and are hollow next the cavity of the body.

The members which correspond in fishes to the anterior and posterior extremities of other animals are the *pectoral* and *abdominal fins*.

The *pectoral fin* is sustained by a very considerable bone, which, with the corresponding one, surrounds the body immediately behind the aperture of the gills. Cuvier has, from hence, called them the *girdle-formed bones*; he likewise considers them as analogous to the *scapula*, in which he is justified by their position, and some circumstances in their formation. These bones are articulated with the inferior and posterior part of the cranium; they pass backwards and outwards, as far as the middle line of the body of the fish, during which course they are narrow, flat on the external surface, and have a round ridge along their internal surface. They then make a turn forwards and inwards, and meet each other a short distance behind the os hyoides. At the place they turn forwards, they send a thin, sharp process backwards, and soon after they receive, in articular depressions, the ends of two long, slender, three-sided bones, which pass from below upwards, across the muscular parietes of the abdominal cavity. Some anatomists consider these bones as being analogous to the *clavicles*; Cuvier does not allow it, but without stating the grounds of his objection. It is sufficiently plain, however, from their position and connections, that there are no other

other bones, except the clavicles, or the fork-shaped bones of birds, with which they can be compared.

It is the inferior half of the scapula that properly corresponds with the bone which bears that name in other animals; the other portion seems to be a part added in fishes, in order to give firmness to the whole member, by connecting it with the head, and likewise to carry the pectoral fin farther down upon the body. The inferior portion is broad and thin, and furnished with a thin, spinous process, or rather plate, which runs along each side of the bone, near the anterior edge, which may be compared with the spine that divides the surface of the scapula in mammalia.

The *osseous rays* which compose the pectoral fin are connected to the posterior edge of the scapulæ by means of a number of small bones, that seem to perform the office of a *carpus*, and with which it should perhaps be considered to correspond. Each osseous ray, towards the extremity in particular, consists of a succession of minute bones, closely united to each other: these might be compared to the joints of the fingers.

The above description of the pectoral member has been taken from the *dory* (*zeus faber*); it is necessary, therefore, to mention some varieties of structure that exist in other fishes.

The pectoral fin does not exist in some fishes, as the genera *murena* and *cecilia*.

The angle, which is formed by the union of the two inferior extremities of the scapulæ, is very acute in those fishes that have the body compressed vertically; but in those with a depressed or flattened body, the scapulæ turn inwards, and meet each other nearly in a straight line.

The number of carpal bones varies; Cuvier states, that there are four large bones of this kind in the *wolf fish* (*anarrhichas lupus*), the *red gurnard* (*trigla cuculus*), and in the *armed and flying trigla* (*trigla cataphracta* and *trigla volitans*); four small bones in the genus *pleuronectes*, and the *whiting* (*gadus merlangus*); eight small bones, in two rows, are found in the *dory* (*zeus faber*); three small cylindrical bones in the *silurus*, and five in the *chetodons*, *perches*, &c.

When the first rays of the pectoral fin are spinous, they are composed of single sharp-pointed bones; they are attached immediately to the scapulæ.

In some of the genera *silurus* and *gasterosteus* the articulation with the scapula is so contrived, that the fish can at pleasure lay the spine close to the body, or place it erect, and keep it fixed in that position: there is a cylindrical tubercle formed on the scapula, in the front of which there is a hole. The spine of the fin is articulated with this cylinder by a depression, which has a projecting process before and behind it. When the spine is extended, the anterior process, which has the figure of a hook, enters the above-mentioned hole, and the spine turning a little on its axis, the process is hooked upon the edge of the hole in such a manner, that the spine cannot be inflected until it makes a turn upon its axis in a direction opposite to the former.

The ventral fins which correspond in fishes to the posterior extremities are sometimes wanting, or situated at different parts of the inferior surface of the body. They do not exist amongst the cartilaginous fishes, in the genera *petromyzon* and *sgnathus*; and in some species of *balistes*, *ostracion*, *tetraodon*, &c.

The orders of the osseous fishes are determined by naturalists from the absence or position of these fins; thus all the *apodal* order want the ventral fins. The *jugulares* have them situated under the throat, and before the pectoral fins. In the *thoracici* they are placed below the pectoral fins, and in the *abdominal* order of fishes the ventral fins are found under

the belly, which is their proper situation, or that which their name implies.

The bones analogous to the *pelvis*, and which sustain the rays of the ventral fins, are various in their figure and position, with respect to each other. They are most commonly flat, and have the internal edges applied to one another in the jugular and thoracic fishes; but their inner surfaces and external or inferior edges are more or less separated, in order to accommodate the muscles which approximate and retract the rays of the fin.

In the *dory* (*zeus faber*), the pelvic bones are triangular plates, slightly concave on the surfaces next each other, and furnished with a spinous ridge on both the surfaces; one angle, which is very acute, is directed obliquely inwards and forwards, towards the cavity of the body; the posterior angle produces a long styloid process, and the anterior angle is blunt or a little rounded: both the anterior and posterior angles are connected by a ligament to the chain of bones forming the sternum in this fish. The rays of the fin are articulated to the middle of the inferior surface, and not to the anterior angle, as stated by Cuvier.

We are indebted to this anatomist for some details of the structure of the ventral fins in several fishes.

In the *waveur* (*trachinus*), and the *star-gazer* (*uranoscopus*), the pelvic bones are folded together at their internal edge; their inferior surfaces are opposed to each other, and leave between them an oval space. The angle of their junction projects within the cavity of the abdomen.

In the genera *cottus*, *sciaen*, *chetodon*, and *perca* the bones of the pelvis are also united at their internal edge; they are flat and long, and their external edges are directed downwards, so as to form a fossa.

In some of the *sticklebacks* (*gasterosteus*) the pelvic bones are separate, extremely long, and receive near their middle a moveable spine, which occupies the place of the fin.

The *zeus vomer* has these bones small and cylindrical.

The pelvic bones are not connected to the inferior points of the scapulæ in the abdominales, as they are in the jugular and thoracic fishes.

In this order of fishes the bones of the pelvis are also, according to Cuvier, generally unconnected with each other, and are preserved in their situation by ligaments.

In the *carps* (*cyprinus*) they are long, and only touch about one-third from their lower end.

In the *herrings* (*clupea*) they are very small, close together, and form an addition to the little bones that supply the place of the sternum.

The pelvic bones in the *pike* (*esox luciu*) are broad and triangular; they are close together at the anterior extremity, but diverge at the posterior end, which is broader and receives the rays of the fin.

In the *anableps* these bones are very far asunder, and bear upon their external border a very long spine, which ascends towards the vertebral column, and is inserted in the direction of the ribs.

In the genus *silurus* the pelvic bones are united to each other; they have the shape of an escutcheon, round in the middle, and often spinous in front. The rays of the fin are attached to their external and posterior edge.

These bones are ossified into one piece in the genus *loricaria*. The fins are conjoined to the outward edge.

The osseous rays of the ventral fins are similar to those of the pectoral fin, but in general shorter; the ventral fins are capable of being moved forwards or upwards, and of having their rays expanded, and of being brought backwards, closer together, and of having their rays approximated and folded.

The *dorsal*, *caudal*, and *anal* fins are members superadded

to fishes, to assist in the motions of swimming; they vary in number and extent in different species, which peculiarities it is the province of the naturalist to point out. They consist of a number of osseous rays which resemble those of the pectoral and ventral fins. The first rays of the dorsal fin are, however, frequently single spinous bones, and those of the tail are generally larger, exhibit more of a jointed appearance, and are more frequently bifurcated at the extremities than the other fins of the body.

The rays of the caudal fin are sustained upon the posterior edge of the fan-shaped extremity of the last caudal vertebra, with the intervention of some small bones, which resemble the carpal bones of the pectoral fin.

The rays of the dorsal and anal fins are supported upon the extremities of long, slender, spine-shaped bones: the other extremities of these bones alternate with the extremities of the superior and inferior spinous processes of the vertebrae, to which they are attached by ligament.

These additional spinous bones are intended to increase the lateral surfaces of fishes; we therefore find them, as well as the real spinous processes of the vertebrae, long in proportion to the breadth of the body; in the flat fishes (*pleuronectes*) they are particularly long.

The additional spines, in some instances, as the *dory* (*zeus faber*), are united to each other by thin cartilaginous laminae, and sustain similar laminae in a vertical position with respect to the spines, by which means regular sheaths are produced on each side for the muscles of the posterior part of the dorsal and the anal fins.

It remains, to complete the account of the skeleton of osseous fishes, to describe the bone which forms the boundary of the abdominal cavity: this bone is not unusually the strongest in the whole body; it is of an elongated shape, and slightly bent, rounded, and very smooth on the side next the cavity of the abdomen; it appears in many fishes like a large inferior spinous process of the vertebrae, but it is in reality a bone interposed between some of the spinous processes of the dorsal vertebrae, and some of the additional spines of the anal fin, with both of which it is united by a sort of squamous suture, which appears like an anchylosis.

This bone is extremely useful in binding together and giving firmness to the osseous fabric of the tail, which otherwise would not be able to sustain the impulse of the water during the actions of swimming. It likewise affords a smooth and secure boundary to the abdominal cavity.

The skeleton of the *flat cartilaginous* fishes differs so much from those above described, that it is almost impossible to discover any analogy between many of these parts.

The subjects we shall chuse as examples of this genus of fishes are the *thornback* and *skate* (*raja clavata* and *raja batia*.)

The cartilaginous pieces which compose the cranium are so intimately united, that it is difficult to recognize them: sutures, however, are discoverable, which mark out pieces that correspond to the temporal, occipital, and parietal bones.

The *form* of the cranium is nearly that of an oblong square, somewhat enlarged, and irregular posteriorly.

The internal surface corresponds with the external form, except where the organs of hearing are contained, at which places the cavity of the cranium is proportionally diminished.

The cavity of the cranium is also prolonged anteriorly, or, more properly speaking, is continuous with the cavity of the snout, which renders the disproportion between it and the brain even greater than in other fishes.

The foramina for transmitting the olfactory and optic nerves are at opposite sides of the cranium.

The *parts composing the face* in the flat chondropterygii are few, and very unlike the bones of the face in other animals.

The cranium, as before observed, is continued anteriorly into a long, taper, hollow cartilage, which forms the central part of the snout.

Where this cartilage commences from the cranium, there is placed on each side of it a hollow cartilage or box, nearly of an oval figure, which contains the organ of smelling. The cartilages of the snout and organs of smelling might be considered as analogous to the *nasal* and *ethmoidal* bones, the *vomer*, and *os palati*, united together.

Upon the external parts of the bones holding the organs of smelling, there is articulated a small irregular spur-shaped cartilage, which is bent backwards: this appears to supply the place of the malar and zygomatic bones.

Both the *jaws* are situated under the cranium, and are sustained upon two elongated cartilaginous pieces, which correspond in office, though not in figure, with the *articular bones*: these pieces are connected by one of their extremities with the lower jaw, close to the articulation; and by the other extremity with the parts of the cranium which correspond to the temporal bones. The jaws are two cartilaginous rims, nearly of the same size at every part: each jaw has a moveable articulation at the symphysis, by which means they can be protruded, and the figures of the mouth altered. The jaws are articulated with each other, by a round tubercle of the superior jaw being received into a socket in the inferior.

The tongue is wanting, as before observed, in the *ray* genus. There is, however, a rim of cartilage extended between the two first branchial arches and under the membrane, lining the lower part of the mouth, which takes the place of the *lingual bone*, and when the mouth is widely opened forms a projection, which has been mistaken for a tongue in these fishes.

The part corresponding to the intermediate bones which sustain the inferior extremities of the branchiae, are two thin pieces of cartilage, which are united in the middle, at the posterior part have a pointed shape, and terminate before in two horn-like processes.

The cartilages which appear most analogous to the *hyoides* are two branches which arise from the external edges of the thin pieces just described, and two other branches which are attached to the side of the cervical spine immediately behind the last branchial arches: the branches from the intermediate cartilage ascend backwards and outwards: those from the spine descend in the same direction: they are united to each other on the anterior part of the scapula, to which also they are connected at their point of union.

The *branchial arches* are very strong in this genus, and the joints have a freer motion than in other fishes, by which the extremities of the arches can be brought closer to each other: a number of cartilaginous rays also arise from the convex side of each arch, which pass between the rows of the membranous laminae, as already mentioned. The superior extremities of the arches are articulated with the cartilage, which takes the place of the cervical vertebrae, and not with the cranium, as in other fishes.

The spine is articulated with the cranium by two condyles, between which the spinal canal projects a little, and is received into a deficiency of an arched figure formed on the superior and inferior sides of the foramen magnum.

The *cervical vertebrae* are consolidated into one piece; on the superior and lateral parts of which cartilaginous plates are produced, which correspond to transverse and spinous processes.

The *dorsal* and *caudal* vertebrae are distinct, as in other fishes.

fishes. The former furnish from the superior part of their bodies small, thin, square plates, which are connected to each other by ligament. The last have their lateral surfaces increased by similar processes on their superior part, and some projections also inferiorly; they, however, gradually decline, and towards the extremity of the tail are scarcely to be discerned. In the *thornback (raja clavata)*, the superior processes sustain, besides the dorsal fin, a row of hook-shaped bones, which have their points turned backwards.

The bodies of all the vertebræ, except the cervical, which form but a single piece, are united by elastic ligament; the inter-vertebral joints contain a fluid, and each vertebra is perforated in the centre by a small hole, in the same manner as in fishes generally.

A favourable opportunity for examining the nature of the inter-vertebral articulation occurred to Mr. Home in the dissection of the *basking shark (squalus maximus)*. "Four days after the fish was brought on shore, the inter-vertebral substance being cut into, a limpid fluid rushed out with so much velocity that it rose to the height of four feet. At the end of twelve days a portion of the spine was examined, the inter-vertebral joints of which had been preserved entire: upon sawing through two of the vertebræ a fluid was met with, of the consistence of liquid jelly, with clots of different sizes floating in it; so that in eight days a considerable tendency to coagulation had taken place, although the fluid was entirely excluded from the air."

"The cavity between every two vertebræ was found to contain, in the *basking shark*, about three pints of liquid. When this fluid was evacuated, the elastic ligamentous substance which united together the concave surfaces of the two contiguous vertebræ, brought the ends of the vertebræ within an inch and one-half of each other, in which state the inner layers of the ligaments, which are less firm in their texture than the outer, project into the cavity, and may be mistaken for a part of its natural contents: this portion, when soaked in water, swells out to a considerable size, the water readily insinuating itself between the layers of which it is composed."

"The whole thickness of the ligaments is about one inch, the external half of which is compact and elastic; the other appears to possess a very high degree of elasticity."

Mr. Home states that the gelatinous substance which fills the inter-vertebral joints of other fishes is fluid during life, which fact was ascertained in the *skate (raja batia)*.

Mr. Brodie found that in the *hog* and *rabbit* the central part of the inter-vertebral joints contains a cavity with a smooth internal surface, of the extent of half the diameter of the vertebræ, which is filled with a thick gelatinous fluid; and we have observed the same fact in other quadrupeds, from which it would appear that the mode of articulation in the spine of fishes is not absolutely peculiar to them.

Mr. Home describes the structure in the spine of the *surgeon (acipenser sturio)* as being different from that of other fishes. "There is," he says, "externally, the common appearance of regular vertebræ; but these prove to be only cartilaginous rings, the edges of which are nearly in contact, and are united together by elastic ligaments, forming a tube the whole length of the spine. This is lined, throughout its internal surface, with a firm, compact, elastic substance; within this is a soft, flexible substance, in a small degree elastic; in the centre there is a chain of cavities in the form of lozenges, containing a fluid, and communicating with one another by very small apertures. The spine of the *lamprey eel (petromyzon marinus)* is found to resemble that of the *surgeon*."

The above structure is not so different from that of the spine of fishes in general, as it would at first seem to be; since

we have discovered the communication between the inter-vertebral cavities to exist both in the cartilaginous and osseous tribes of fishes.

Cuvier states that there are no ribs in the *chondropterygii*; but we find on the sides of the bodies of the dorsal vertebræ a number of short-pointed processes, which might be considered as rudiments of these parts.

The pectoral member of the *ray* genus is peculiar in its form and direction, and is of prodigious magnitude. The pieces which sustain the rays of the fin are analogous to the *scapulae*; they are connected with the back part of the dorsal spine by means of two thin, flat cartilages. They pass outwards, enlarge, and form two wide foramina on each side, through which the nerves and vessels pass to the fin. The scapula next produces two branches, one of which passes backwards nearly parallel with the spine, and the other goes forwards as far as the anterior part of the head; these branches have several joints in them, by which they can be moved nearer and farther from the body.

The scapulae are united on the under part of the fish by a strong cartilaginous bar, which supplies the place both of *sternum* and *clavicles*.

The rays of the fin arise from the external side of the branches, which is slightly concave; they are exceedingly long, particularly in the middle of the fin, and each composed evidently of many joints. It is upon the great number and extent of the rays of the pectoral fin that the peculiar square figure of the *flat chondropterygii* depends.

The pectoral fins of the *sharks* are constructed upon the same plan as in the genus *raja*, but are much smaller, and are not connected to the spine.

The *ventral fins* are supported upon the extremities of a transverse piece of cartilage in the *chondropterygii*, which is situated at the posterior part of the abdomen; it is not attached to the spine, but held in its place by its connection with the muscles.

The external rays of the ventral fin in these fishes are stronger than the others, and are composed of some pieces articulated to each other in succession, which very much resemble the joints of the digits in other animals, and which, therefore, form the analogy which exists between the rays of the fins of fishes in general, and the fingers or toes of digitated animals.

Fig. 1. Plate XII. of the *Anatomy of Fishes*, exhibits a lateral view of the skeleton of the *dory (zeus sibir)*; a is the cranium; b, the vacancy left between the two orbits; c, the zygoma; d, the part corresponding to the lacrymal bone; e, the piece which appears analogous to the ethmoidal bone; f, the nasal bone; g, the osseous stalk which comes from the occiput to join the vomer; h, the bone analogous to the malar, or the palatine; i, the superior maxillary bone; k, the inter-maxillary bone; l, the inferior jaw; m, the articular bone by which the lower jaw is connected to the head; n, the os hyoides, on the edge of which are seen the rays of the membrana branchioslega; o, the lingual bone; p, the principal bone of the operculum; q, the other bone of the gill-cover; 1, the superior pharyngeal bone; 2, the branchial arches; 3, the inferior pharyngeal bones; 4, the cordiform bone. As these last parts are situated internally, they are seen but imperfectly; r r, the scapula; s, the bone analogous to the clavicle; t, the carpus, on which are arranged the rays of the pectoral fin; u u, the chain of bones formed under the integuments, in the manner of a sternum; v, the pelvis, on which are seen the rays of the ventral fin; x, x, x, the cervical, dorsal, and caudal divisions of the spine; from the two first of which long, spinous processes are seen to proceed upwards, and to sustain the additional

tional spinous bones on which the dorsal fins are articulated. From the inferior part of the caudal, and some of the last dorsal vertebræ, spinous processes are seen to arise, which become connected with the additional spines supporting the anal fin, and of which some are united to the extremity of the bone that bounds the abdominal cavity. The extremity of the tail produces the fan-shaped bone, which bears the caudal fin; *y*, the true or abdominal ribs; *z*, some supernumerary ribs which are designed to pass amongst the muscles of the spine.

Fig. 2. of the same plate, shews the cavity which exists between the vertebræ of an osseous fish; *a, a*, two of the vertebræ of the turbot (*pleuronectes maximus*), divided longitudinally; *b b*, ligamentous substance by which they are united; *c*, the inter-vertebral cavity.

Fig. 3. of Plate XII. of the *Anatomy of Fishes*, gives a view of the cavity in one vertebræ; *a*, the body of the bone; *b*, spinous process partly cut away; *c*, the canal for holding the spinal marrow; *d*, the concavity of the inter-vertebral joint; *e*, the foramen, or rather short canal, by which the inter-vertebral cavities communicate with each other.

Fig. 1. of Plate XIII. of the *Anatomy of Fishes*, represents the inferior parts of the skeleton of the thornback (*raja clavata*); *a*, the cranium; *b*, the cartilage which forms the middle of the snout; *c, c*, the oval cavities for containing the organs of smelling; *d, d*, the branches articulated upon the external part of these cavities; *e, e*, the two jaws; *f, f*, the cartilages analogous to the articular bones by which the jaws are connected to the cranium; *g*, the rim of cartilage that supplies the place of the lingual bone; *h*, the intermediate cartilage to which the lower extremities of the branchial arches are united; *i, i*, the inferior branches which seem to supply the place of the os hyoides; *k, k*, the superior branches of the same; *l, l*, the branchial arches; *m*, the cervical portion of the spine, consolidated into one piece; *n*, the dorsal portion of the spine; *o*, the caudal division; *p, p*, short processes from the sides of the dorsal vertebræ, that correspond to the ribs; *q*, the transverse bar that answers for clavicles and sternum; *r, r, r, r*, the branches of the scapulæ; the bodies of the scapulæ, and the connection of these parts with the spine, are in a great measure concealed from view; *s, s, s, s*, the rays of the pectoral fins; *t*, the transverse cartilage which bears the ventral fins, laid across the spine in its proper situation; *u, u*, the rays of the fin which more particularly resemble, in their figure and mode of articulation, the digits of other animals; *v, v*, the smaller rays of the same fins. The rays of the other fins, having no peculiarity of structure, are indicated by their position.

Fig. 2. of Plate XIII. exhibits a view of the articular surface of one of the dorsal vertebræ of the thornback; *a*, the body of the vertebræ; *b*, the canal for lodging the medulla spinalis; *c*, the spinous process; *d*, the concavity opposed to that of the adjoining vertebræ; *e*, the perforation in the centre of the vertebræ, by which the inter-articular cavities communicate with each other.

Muscles.

The muscles which move the jaws of fishes are commonly large, and calculated for powerful and extensive action.

They are more numerous and complicated in the cartilaginous than the osseous fishes. We shall first describe them in the ray genus.

The principal depressor of the posterior jaw is a single, flat, square muscle, which arises from the transverse bar that is analogous to clavicles, and is inserted into the posterior margin of the jaw. Cuvier also describes two small

muscles, one on each side of that just mentioned, which contribute to the depression of the jaw: they arise from the transverse bar and the skin, and are inserted near the commissure of the lips. These three muscles retract the mouth, as well as depress the lower jaw.

Three muscles close the jaws: the first arises from the external part of the base of the cranium; it passes over the superior jaw, and is lost in the aponeurosis which covers the principal muscle, at the external part of the mouth. The second muscle is a thinner slip; it arises from the fore-part of the lower jaw, passes in a circular manner round the angles of the mouth, somewhat like the *orbicularis oris*; then over the upper jaw, to the superior part of the end of which it is inserted. Both these muscles seem to have the power of bringing the jaws forwards on the head, as well as of shutting them. The third muscle is a large round-shaped mass, which encompasses the articulation and the ends of the two jaws: it appears externally like one muscle, but consists internally of three parts; one is inserted into the ring-like process at the end of the lower jaw; another into the external parts of both jaws, at their joint; and the third passes round the upper jaw, and is inserted by a tendon into the crucial ligament which goes to the lower jaw.

There are two very long muscles which come from the spine, and pass between the palate and the cranium, in order to be inserted into the superior jaw. These serve to bring the mouth forwards, as both jaws, from their connection with each other and the neighbouring parts, are protruded and retracted together.

A pair of very thick muscles arise from each side of the sternum; their fibres are directed obliquely forwards and outwards, and unite upon a strong tendon, which is inserted into the inferior extremity of the articular cartilage that sustains the jaw. They draw that extremity backwards and inwards, and consequently enlarge the angle this cartilage forms anteriorly with the base of the cranium: they carry both jaws downwards, and by bringing their extremities nearer to each other, thrust out or protrude the middle parts of the mouth. These muscles likewise maintain the articular cartilages in the above-mentioned position, and furnish fixed points for the jaws to move upon, when they are projected from the head.

Two other muscles, which are small, commence by tendon from the middle of the articular cartilage; proceed backwards, inwards, and downwards, in order to spread their fleshy fibres on the aponeuroses behind the lower jaw. They assist the preceding muscles in bringing the articular cartilage inwards and downwards.

The muscles of the jaws in the shark (*squalus*) resemble those of the ray genus.

In the surgeon (*acipenser sturio*) the muscles for protruding and retracting the jaws are very simple. The one which brings the mouth forwards comes from behind the eye: it is very strong, and passes backwards to be attached to the articular cartilage. The retractor is a much smaller muscle: it is situated between the cranium and the superior part of the articular cartilage.

The other muscles of the jaws of the surgeon resemble those of the ray and shark genera.

The muscles of the jaws in the genera *balistes*, *tetraodon*, *diodon*, and *signatus*, are described by Cuvier as having a complicated action. The bones of the face are extremely prolonged in these fishes, in order to form a prominent muzzle, at the extremity of which the two jaws are placed, and perform their movements.

One muscle, which fills the superior part of the fossa on the side of the muzzle, arises from a ligament which complete

pletes the anterior border of the orbit: its fleshy fibres, in passing from behind forwards, terminate in part upon the posterior border of the descending branch of the superior jaw, but are chiefly lost on a tendon which surrounds the extremity of that branch, and proceeds to the lower jaw, on which it is inserted above the articulation. This muscle moves the two jaws in opposite directions, and approximates the one to the other. In drawing backwards and upwards the extremity of the descending branch of the superior jaw, it depresses the portion of that jaw which is beyond the point of support. The same muscle likewise raises the lower jaw.

A second muscle fills the inferior portion of the fossa that is on the side of the muzzle, from the surface of which its fibres arise: they proceed obliquely forwards and inwards to an aponeurosis, which extends along the internal edge of the fossa, and of which the extremity goes to be affixed to the internal surface of the lower jaw. This muscle has the same action as the first.

The preceding muscle covers a third, which is smaller. It arises likewise from the surface of the fossa, and sends a slender tendon near to the posterior edge of the descending branch of the superior jaw. This muscle co-operates with the two others.

The inferior jaw is depressed, in these genera, by three muscles. The first is a single muscle, which is analogous to the *mylo-hyoideus*: it arises from the side of the hyoides, between the rays of the operculum, and is inserted into the inferior border of the lower jaw; the fibres converge, and go forwards to be inserted into the inferior edge of the lower jaw. The next two muscles are small; they arise from a fossa under the orbit; their tendons are inserted into the posterior edge of a cartilaginous plate, which is connected to the base of the cranium, behind the articular bone. This plate is attached to a long cartilaginous filament, which advances on the inside of the articular bone or cartilage, as far as the inferior and internal part of the lower jaw. In drawing the plate upwards and backwards, these muscles also bring the filament backwards, and thus depress the lower jaw.

The *moon fish* (*tetraodon mola*) has three muscles, similar to those last described, and a second cartilaginous plate.

In the genus *bahytes* there is a muscle which serves to elevate and draw backwards the piece analogous to the articular bones; it arises from the lower edge of the vomer, or the vault of the palate, and descends obliquely forwards to be inserted into the upper edge of that piece.

In *offeous* fishes, the lower jaw is depressed by a long slender muscle, but which, nevertheless, from its attachments and use, must be considered analogous to the *mylo-hyoideus*: it arises from both sides of the os hyoides and rays of the gill-cover, in two broad, thin, fleshy slips; these unite under the throat, and are inserted at the symphysis of the lower jaw; it spreads the membrane of the gill-cover when the jaw is fixed.

The lower jaw is elevated by two very strong portions of muscle, which in a degree overlap and intermix with each other; they occupy all the space corresponding to the articular bone, from which, and from the cranium at the back of the orbit, they arise: these two portions, which Cuvier considers as but one muscle, are inserted into the coronoid process of the lower jaw, into the ligament which passes from one jaw to the other, and in some fishes we have observed into a ligament which goes forwards to the inter-maxillary bones: besides, therefore, raising the lower jaw, these muscles depress the superior maxillary bones, and depress and retract the inter-maxillary bones, which form

the superior margin of the mouth, or what is called the upper lip in fishes.

Cuvier describes in the *eel* (*murena anguilla*) two layers of muscle which lie under the preceding, and are nearly inserted into the same point of the lower jaw: they arise from the orbiter fossa. He detected similar muscles in the *carp*, but did not find them in the *pike* (*esox lucius*), the *trout* (*salmo fario*), or the *salmon* (*salmo salar*); we have not observed them in any other fish.

There is a small muscle which is attached to almost the whole of the internal surface of the side of the lower jaw, and covers the vacancy which exists in the maxillary bone; it furnishes a strong tendon, which is fixed internally to the lower and anterior part of the articular bone; it assists the other muscles in raising the lower jaw, but if the mouth be previously opened widely, it seems to have the power of keeping the lower jaw in the depressed position.

The articular bone is moved by two muscles on each side; one arises from the cranium at the back and upper part of the orbit; its fibres pass obliquely downwards and forwards, and are affixed upon the external surface of the thin part of the articular bone, near its upper edge: the effect of its action is to elevate the articular bones and bring them outwards, by which the capacity of the mouth is increased, and the jaws retracted. The other muscle arises from the vomer, membranous septum of the orbit, and the middle line of the cranium: its fibres descend in a direct manner to the upper part of the thin portion of the articular bone, which it has the power of bringing inwards, and thereby abridges the cavity of the mouth, and protrudes the jaws.

Cuvier describes two muscles in the *carp* (*cyprinus carpio*), intended to retract the lips in this species, which has the bones of the face formed for carrying the mouth farther forwards than other fishes. The first of these muscles is shorter than the second; it arises partly from the anterior extremity of the articular bone, and in part from the posterior end of the maxillary bone: it ascends a little obliquely to be inserted into the most elevated point of the inter-maxillary bone by a slender round tendon, which crosses the tendon of the next muscle. The second retractor of the lips is much larger than the preceding: it is situated nearly horizontally, in the space comprised between the inferior edge of the orbit, and the concavity of the articular bone, from which it arises: it is inserted by a long flat tendon to the middle and posterior process of the inter-maxillary bone, which it draws directly backwards.

From the preceding description it will be perceived, that in addition to the motions of the jaws, by which the mouth is shut and opened, they are also susceptible of projection and retraction, and that the cavity of the mouth is altered with respect to its width or its length in the performance of these motions. These effects are not only convenient to fishes in the act of taking their food, but are necessary also for conveying it into the oesophagus. The muscles, however, most immediately concerned in deglutition, are those which move the branchial arches and pharyngeal bones, as will appear when these muscles come to be described.

The tongue of fishes scarcely appears to perform any motions distinct from the other parts of the mouth. Cuvier, it is true, has described two muscles on the tongue of the *conger* (*murena conger*), which are analogous to the *hyo-glossi*; they arise from the extremities of the os hyoides, and go forwards upon each side of the lingual bone, to which they are inserted: if these muscles act in conjunction they depress the tongue, but, if separately, the tongue is

drawn to either side. Cuvier likewise states that the tongue of the *conger* is contracted in its breadth by some transverse fibres, which pass from the edges to the middle part: we have not observed any muscles for moving the tongue in those species we have dissected, but we have often seen tendinous fibres pass from the os hyoides to the sides of the lingual bone.

The muscles intended to move the *branchial arches* and the *pharyngeal bones* in *officious* fishes are so numerous and complicated, that we almost despair of giving the reader a clear conception of them.

They may be divided into three sets or orders, besides some distinct muscles; the first is composed of a cluster of muscles, which connect the superior ends or abutments of the branchial arches, and the superior pharyngeal bones to the basis of the cranium. The second set consists of some muscles placed over the joints of the inferior ends of the arches, and the inferior pharyngeal bones, with the intermediate bones that are continued from the lingual bone; the third set is made by muscles which surround the posterior side of the last branchial arches, the pharyngeal bones, and the origin of the œsophagus.

In the first set there are seven muscles; all these, except one, arise together from the side of the head, immediately behind the orbit, at the joint of the articular bone.

The first muscle comes from the common origin already mentioned, and is inserted into the posterior side of the base of the short branch of the first branchial arch; it bends the joint of the arch, and brings the whole arch forwards.

The second arises from the same point, and goes to be attached to the posterior side of the short branch of the second branchial arch. It has the same effect as the preceding.

The third muscle arises from the base of the cranium, between the articulations of the scapula and articular bone, and is inserted into the posterior edge of the short branch of the last arch. It elevates the last arch, and thereby assists in opening the œsophagus.

The fourth comes from the common point of attachment, and terminates upon the footstalk of the three last branchial arches, and the small anterior pharyngeal bone; it tends to draw these bones outwards, and thus dilate the opening into the œsophagus.

The fifth muscle arises with the others, and proceeds to be affixed to the external edge of the principal pharyngeal bone. Its operation is similar to that of the last mentioned muscle.

The sixth arises from the common footstalk of the three last arches, and goes on to the external edge of the short branch of the second arch near its base. It contracts the arches, by bending the joint at the concavity or top of the arch, and that at the footstalk; it therefore tends to close the gills.

The seventh muscle has the same origin as the preceding; it is a stronger muscle, and is spread equally upon the anterior surfaces of the two last branchial arches; it concurs to produce the effect ascribed to the last mentioned muscle.

The second set of branchial muscles is made up of four pair, or eight slips on each side; four of these are longer than the others, and situated more obliquely and superficially.

The first arises from the ligament which connects the conjoined processes of the two posterior arches to the lower end of the first intermediate bone; it proceeds obliquely backwards, and is affixed to the inferior end or abutment of the

second branchial arch. The next three arise together from the conjoined processes of the two last arches already mentioned, one goes to be implanted into the inferior end of the third branchial arch, the next is inserted into the fourth branchial arch, and the fourth slip of muscle passes across the posterior surface of the last arch, and is inserted into the inferior pharyngeal bone.

The four other muscles of this set are short, lie in an obliquely transverse direction, and are in a great measure concealed by the preceding muscles; they are extended from the inferior ends of the branchial arches to the adjoining parts of the intermediate bones.

The effect of the action of each of these muscles is the same; they all tend to depress the lower part of the mouth, if the branchial arches be rendered fixed; and if not, they separate the arches from each other, and lower them, thus opening the gills, and widening the aperture of the œsophagus.

The circle which is made round the entrance into the œsophagus by the last branchial arches and the pharyngeal bones of each side, has on its posterior surface a chain of small muscles.

The two first arise from the junction of the footstalks of the inferior pharyngeal bones, and are inserted into the most external points of these bones. They approximate the pharyngeal bones, and bring them downwards.

The next pair arise from the outside of the termination of the preceding muscles, and are inserted near the middle of the posterior surface of the last arch. They approximate the two last arches by means of their connection with the inferior pharyngeal bones.

The third pair of muscles are extended across the joint of the last arches, and consequently, when they act, bring the branches of the arch more together.

The fourth muscles arise from the footstalks of the superior pharyngeal bones, and are inserted into the points of the superior abutments of the last arches. They make these abutments approach the superior pharyngeal bones, by which the arch is closed.

Besides these four pairs, there are single slips of muscle, which pass from the pharyngeal bones of one side to the other. The muscle connecting the superior pharyngeal bones is very strong. These complete the circle, and diminish it by approximating these bones.

There are further, a number of muscular fasciculi surrounding the orifice of the œsophagus in the manner of a sphincter. These fasciculi are strongest upon the sides, where they have also nearly a straight direction, by which they have the effect of contracting the joint of the last arch. There are likewise some fibres extended from the muscle that lies between the superior pharyngeal bones, to the sphincter of the œsophagus.

When all the muscles of this set co-operate, the opening into the œsophagus is abridged; or, if the animal wish it, entirely closed; from the connection between the last arch and the others, they are all brought close together, and the denticulated surfaces of the inside of the arches, and of the pharyngeal bones, are made to approach so nearly, as to prevent the escape of the prey which the fish may be in the act of swallowing.

There are four distinct and remarkable muscles on each side, which are materially concerned in the motions of the gills and pharynx.

The first are very thick and massy: they take their origin from the anterior edge of nearly the lower half of the scapula, and are inserted upon the sides of the broad, thin, heart-shaped bone which is situated under the throat of the fish. By means of the connection of this bone with the hyoidean

hyoidean branches, intermediate bones, &c. those muscles will open the pharynx, by depressing the tongue and branchial arches. If these parts, however, be kept fixed, they will bring the pectoral member forwards; they will also depress the lower jaw, in consequence of the connection the heart-shaped bone has with that part. Cuvier considers these muscles as analogous to the *sterno-hyoidei*.

The second muscles arise on each side from the anterior edge of the scapula, opposite to the middle of the muscles for raising the pectoral fins. They are thin slips; they pass through the substance of the muscles last described, and go to be inserted in the lowest part of the inferior pharyngeal bone. They depress the branchial arches, and thereby widen the pharynx.

The third pair of muscles arise by a small tendon from the anterior part of the scapula, opposite to the articulation of the clavicle with that bone, and proceed for some way before they reach the point of their insertion, which is the lowest part of junction of the inferior pharyngeal bones. They draw the pharyngeal bones downwards and backwards, and thereby contribute, with those last described, to open the pharynx, and render it of a round shape.

The fourth muscles arise from the second vertebra from the head, diverging a little in their course, as they proceed a considerable way forward, and are attached to the inside of the superior pharyngeal bones. They have the power of retracting these bones, and thus co-operate with the other muscles which dilate the entrance into the œsophagus. They likewise turn the superior pharyngeal bones, so as to oppose to each other their rough or denticulated surfaces. These muscles are strong, and remarkable also on account of their length: they arise as far back, in the *robbiting* (*gadus merlangus*), as the fifth vertebra from the cranium.

The preceding description of the branchial and pharyngeal muscles contains what we have observed in the *dory* (*zeus faber*). The structure of other *ossious* fishes, in this respect, does not appear to be materially different. In some of them, the bundle of muscles, by which the branchial arches and the pharyngeal bones are suspended to the cranium, is composed of a fewer number; and those for contracting the passage into the œsophagus are less distinct and strong. The most remarkable variation is met with in the *carp* (*cyprinus carpio*), in which the pharyngeal bones are constructed for breaking and dividing the food. In this fish, the inferior pharyngeal bones are not, as usual, attached to the last branchial arches, but are elevated behind these near to the cranium, to which they are suspended by a number of muscles, of which Cuvier has given the following description.

There are first two exceedingly strong muscles attached to the sides of the base of the cranium, behind the adductor of the operculum, and inserted into the superior extremity of these bones. They elevate the bones, and draw them a little outwards.

Two other muscles arise from the external angle of the glenoid cavity, which receives the superior pharyngeal bone, and go to be inserted along with the first muscles. They bring the superior extremity of the pharyngeal bone inwards.

Two strong muscles are affixed by their anterior extremity to the middle part of the pharyngeal bones, and proceed obliquely backwards and inwards to be inserted into the occipital apophysis. They draw the pharyngeal bones backwards.

The pharyngeal bones are approximated by a very strong single muscle, which Cuvier, both from considering its

structure and use, calls the *digastric adductor*. The two bellies of which it is composed arise from the middle part of each of these bones, and are inserted into a common tendon, placed in the interval of the anterior portion of those bones, and is there connected to the aponeurotic fibres which fill up that interval, assisted by some transverse fibres of the pharynx, which go from one pharyngeal bone to the other. This muscle is able to approximate the bones with much force, and to urge their teeth against the superior plate. The operation of these muscles belongs rather to the functions of mastication and deglutition than to those of the gills.

Two strong muscles arise from the internal surface of the scapula, and are inserted by a very strong tendon to the anterior extremity of the pharyngeal bones. These may bring the scapula forwards and inwards; or if it be fixed, they bring the two pharyngeal bones at the same time backwards and downwards.

Two other muscles, attached at one part to the inferior side of the anterior part of the pharyngeal bones, and at the other to the internal surface of the scapula, may likewise approximate the inferior extremities of the scapula from the middle line; but they can more easily separate the pharyngeal bones the one from the other.

Finally, there are two long slender muscles, which are extended from the inferior and anterior extremity of the pharyngeal bones to a process, which corresponds to the intermediate bone of the last arch. These bring the pharyngeal bones forwards.

The branchial muscles in the flat *chondropterygii*, and, as it would appear, in all the fishes with *fixed branchiæ*, are few and simply arranged. The cluster of muscles which connects the branchiæ with the head, and the small muscles which go from the branchial arches to the intermediate bone, do not exist in these fishes.

The slender muscles which go from the clavicle to the arches, in *ossious* fishes, are supplied in the *rays* by two very strong muscles, which arise posteriorly by two thick tendons from the transverse cartilage, and proceed obliquely forwards and inwards, under the middle cartilage of the branchiæ, into which they are inserted. In drawing this cartilage downwards and backwards, they will open all the branchial arches.

There are other muscles constructed to open and shut the branchiæ, which are peculiar to the *rays* and *shark* kind.

Between the anterior series of laminae and the rays of the branchiæ, a muscle is found, the fibres of which seem to separate on each side from the middle ray, being directed towards the others, but particularly towards their extremity, so that the effect of their action is to approximate the extremities of the rays, and consequently to separate and open the two ends of the arch. The action of this muscle is limited by several ligaments, which go from the base of the ray, nearest the extremity of the arch, towards the extremity of the succeeding ray.

This arch is closed by another muscle, which is short, thick, and cylindrical. It is situated transversely on the angle that is formed by the two pieces of the arch, where there are depressions of some depth, in which the two extremities of the muscle are implanted.

There is further, in these genera, a very strong muscle, which envelopes the gills, covering every part of them except that next the mouth: it has the effect of compressing or approximating the whole at once. The fibres are parallel, and have an oblique direction from before backwards. Five tendinous interfections are to be seen, which correspond to the external surface of the muscles already described,

which lie between the laminæ and rays of the branchiæ. The contraction of this sac-like muscle has the effect of expelling the water from the gills with considerable force.

The branchiæ of the *moon-fish* (*tetraodon nola*) are inclosed between two muscles; the one upon the external, and the other upon the internal side. These are analogous to the muscular sac of the *ray* and *shark* kind.

The operculum of the gills in *osseous* fishes is raised by one pair of muscles, and brought down upon the branchial aperture by two muscles on each side, and one common to both sides.

The elevator or abductor of the opercule arises from the external part of the base of the cranium, at the root or joint of the articular bone: it is a short, taper muscle, and is inserted into the head of the triangular bone of the gill-cover, which is joined to the articular bone. This muscle acts under the disadvantage of being inserted as far as possible from the edge of the bone that is to be raised: it must, however, be aided in producing its effects by the elevation of the articular bone.

The two muscles which shut the operculum are described by Cuvier as only one: they arise from the base of the cranium, almost immediately behind the preceding muscle, than which they form a thicker mass; they are inserted into the neck, or anterior part of the superior edge of the triangular bone.

The common muscle is attached internally to the rays and osseous plates of each gill-cover, between which the fibres cross from one side to the other. The effects of this muscle's motion are the approximation of the rays and the shutting down of both opercules.

The rays of the gill-covers are expanded, and the membrane branchiostegæ raised and spread out, by the mylohyoideus muscle which is attached to the osseous rays, and by a muscle composed of two portions, which Cuvier describes as being particularly plain in the *trout* (*salmo fario*): one portion arises from the lower edge of the posterior part of the os hyoides; the other arises from the internal surface of the five anterior rays, and is attached to the other rays by long tendinous filaments. Both portions unite in one tendon, which passes under the anterior extremity of the opposite branch of the hyoides, and is expanded under the lingual bone.

Besides these muscles, the *moon-fish* (*tetraodon nola*) has the operculum itself composed of several muscles. The principal one, which forms almost the whole of the opercule, is made by several layers of parallel fibres, which pass from one part of the scapula to another, and become very thin towards the free edge of the opercule. Two small muscles arise from each side of the thin edge of the opercule: they ascend upon the internal surface of the scapula, the one before and the other behind. These serve to lay down the gill-cover.

The very limited motions of the head, upon the spine of *osseous* fishes, are effected chiefly by the great lateral muscles; but the *flat chondropterygii* have muscles exclusively destined to raise and depress the head.

The principal elevator of the head is a long small muscle, which arises from the back of the shoulder, on the top of the cartilage which corresponds to the scapula, and the adjoining transverse process of the cervical spine: it sends a long tendon through a pulley on the side of the eye, which is lost in the anterior part of the snout.

On the lower part of the head there is a pair of muscles, similar to those for raising the head: they arise from the transverse cartilage, analogous to clavicles and sternum, at which place the muscle of each side is united; they proceed

forwards on each side of the mouth, and furnish tendons which pass in the gelatinous substance of the snout, at the anterior extremity of which they terminate. These muscles depress the head. Cuvier gives a somewhat different description than we have given of the foregoing muscles.

A third pair of muscles arise from the spinal column, and the anterior portion of the arch which sustains the large wings, and are inserted into the posterior extremity of the head. They raise the head.

The spinal muscles, except in the flat chondropterygii, are the most remarkable in the fish's body, whether we view them with respect to their bulk or their structure.

These muscles are analogous to those which lie along the spine of other animals; but, from the form of the skeleton in fishes, they are situated upon the sides of the body, and have consequently received the name of *lateral muscles*.

The size of the lateral or spinal muscles exceeds, in an extraordinary proportion, that of all the other muscles of a fish: they make the principal bulk of the animal, as they constitute, with the osseous fabric which sustains them, almost the whole of the organs of motion.

It is almost impossible to convey a clear idea of the composition of these muscles by description alone, it is so extremely complicated, and so different from the ordinary structure of the muscles in other animals.

The great spinal muscles of fishes in general consist of three portions, which, from their situation, deserve to be distinguished into the *superior or dorsal*, the *middle or vertebral*, and the *inferior or ventral*, portions.

The muscular fibres of which each of these masses is composed, are formed into successive *layers* or *rows*, by means of the interposition of thin aponeuroses. These tendinous interfections merely exhibit, on the external surface of the lateral muscles, the appearance of lines placed at short and determined distances from each other, and thus subdividing each portion into a number of regular compartments. The subdivisions or compartments have different forms or directions in each portion, which will be afterwards pointed out. The short rows of muscle that fill up the compartments appear, when viewed upon the external surface, to be all arranged in a longitudinal direction, or to follow one another in the line of the fish's body; but if accurately examined, they will be found to consist of flakes or pieces of muscle, which partake of the figure of a wedge and the bowl of a spoon, being thick at one edge and thin at the other, and concave on one side and convex on the other. The figure of the flakes is well exhibited by the application of heat, particularly in the genus *gadus*: in cooking the *whiting* (*gadus merlangus*) some attention and dexterity are necessary to prevent the muscular substance of the fish breaking into its primary flakes. The flakes are generally placed obliquely with respect to the line of the fish's body; that is, with their convex side next the head, and their thin edge next the spine; they overlap, or are received into each other; the muscular fibres composing the flakes appear, however, to be disposed in a longitudinal direction.

From the above account it will be seen, that the ultimate fibres of the great spinal muscles of fishes are extremely short and infinitely multiplied.

The lateral muscles are further distinguished from the others by being almost entirely deprived of red blood: this circumstance seems to depend entirely upon their limited action; as at their attachments to the head and tail, where the parts have a more extensive motion, the substance of the lateral muscles receives more red blood than at any other part.

The attachments of the superior or dorsal portion of the lateral muscles, are fixed at the anterior extremity to the

basis of the cranium; secondly in the middle, to the superior spines of the vertebræ, and the additional spines that sustain the dorsal fins; and lastly, at the posterior extremity, to the superior part of the root of the caudal fin. The layers of muscle which compose this portion are narrower than those of the other portions; they form gentle curves, or S like plexuses, in the longitudinal direction, which nearly coinciding with the course of their muscular fibres, gives them a good deal the appearance of common muscular fasciculi in other animals. The dorsal portion of the lateral muscles is unconnected along its superior margin, but the lower edge is slightly joined next the skin to the vertebral portion; and towards the tail these two portions become intimately connected, and concur to produce the tendons which are inserted into the base of the caudal fin.

The dorsal portion operates upon the tail in conjunction with the other lateral muscles of the body; it also moves the head backwards and upwards with its fellow of the opposite side.

The middle or vertebral portion of the lateral muscles lies a little obliquely along the side of the spine; it is attached below the last-mentioned muscle to the back of the cranium; it then winds along the vertebræ of the trunk, to the bodies of which it is slightly connected, but firmly to their superior spines: it is next attached to the bodies and inferior spines of the caudal vertebræ, and then passes over eight or nine of the last caudal vertebræ, to which it is connected by aponeuroses, and becomes confounded with the dorsal portion, and with it is inserted into the superior half of the base of the caudal fin.

The aponeurotic interfections of the vertebral portion of the lateral muscles are disposed in waving or curved lines, which tend obliquely backwards, and meet the corresponding interfections of the dorsal portion, with which they form angles that have their points directed backwards, and become more acute towards the tail, at the extreme part of which the interfections become parallel, and form distinct tendons, which are inserted into the caudal fin.

Where the vertebral portion arises from the cranium, there are some thin stripes of muscular fasciculi, which run backwards, crossing therefore the rows of the lateral muscle which they cover.

The effect of the action of the vertebral portion is nearly the same with that of the dorsal. The former muscle is, however, from its greater connection with the vertebræ, more immediately concerned in the flexion of the spine. The small longitudinal stripes of muscle from the cranium have but little power; they assist the principal parts of the lateral muscle in bending the head towards the side.

The ventral portion of the lateral muscle covers the one-half of the side of the fish, and with the corresponding portion of the other side entirely encompasses the cavity of the body. It is attached anteriorly to the back of the cranium under the scapula; to this bone itself; it is connected to both sides of the clavicle; it is attached inferiorly to the ligament or bones which supply the place of the sternum, and posteriorly to the large spine which forms the posterior boundary of the ventral cavity. The edge that lies over the row of bones which sustain the anal fin is unattached on the side of the spine; but the muscle is attached to the ribs which pass in the course of its interfection; therefore this part of the ventral portion is analogous to the intercostal muscles: it is then attached to the inferior spines of some of the caudal vertebræ next the ventral cavity, and to the bodies of about eight or nine of the most posterior caudal vertebræ; and lastly it produces a number of tendons, which are inserted into the lower half of the bones of the caudal fin.

The interfections of the ventral portions of the lateral muscle describe very faint curves on the fore part of the body, at which place also they are rather indistinct, but towards the tail they form V shaped lines, which come gradually closer to each other, until at length they compose parallel tendons, in the same manner as the conjoined vertebral and dorsal portions.

This portion of the lateral muscle, besides being a powerful flexor of the tail, compresses the ventral and branchial cavities, and is therefore analogous to the intercostal and abdominal muscle of other animals.

The preceding description is taken from the *dory* (*zeus faber*); a fish which has the lateral muscles particularly distinct and strong. In the other species we have dissected, we have found the structure so similar, that the *dory* may be given as a general example of the class.

In some of the *flat fishes* (*pleuronectes*) the ventral portion of the lateral muscle appears to be double, or to be composed of two parts which join each other in the line of the angle of the interfections, and therefore correspond to the dorsal and vertebral portions. Mr. Carlisle, in the Croonian Lecture for 1806, describes the ventral portions as being always of two masses, which he calls the ventral and abdominal fibres.

In the *mackerel* (*scomber scombrus*), the *herring* (*clupea harengus*), and some others, we have observed a layer of muscle of a dark colour, extended along the middle line of the body; if this layer be cut transversely, it exhibits the figure of a compressed triangle. It is lodged in a corresponding vacancy, which is formed along the junction of the other portions of the lateral muscle over the spine of the fish: this long stripe of muscle has probably no peculiar action, as the interfections of the adjoining parts are continued through it in the same direction as in other fishes.

The lateral muscles of the genus *ostracion* differ in some circumstances from those of other fishes. As the *ostracions* have the body rendered immovable by being enclosed in a hard horny shell or case, these muscles are not connected to the spine, but to the head and the tail only. Their texture also is not so complicated as in other instances, their fibres being principally longitudinal.

The internal surface of the case of the *ostracions* is lined with an aponeurosis only.

Cuvier describes an additional pair of muscles that are peculiar to the tail of these fishes; they are of a pyramidal figure; they arise from the inner side of the case, on the lower or abdominal side of the body, and are inserted by small tendons into the inferior part of the sides of the three last caudal vertebræ. They carry the tail to either side, and depress it.

The motion of swimming consists almost entirely in the flexion and subsequent extension of the spine of fishes; in the production of both which effects, the lateral muscles are the sole agents, by the one side or part acting alternately, or in opposition with another. The peculiar composition and arrangement of these muscles are designed to bestow extraordinary power and velocity of action, combined with a limited operation as to extent and duration. The weight of the column of water displaced by every impulse of a fish, during the act of swimming, and the celerity with which some species move through water, not even exceeded by that of the light of birds in so rare a medium as air, prove the powerful and rapid operation of the spinal muscles, while the limited capacity of flexion of the tail of fishes, and the exhaustion these animals experience when their muscular efforts are protracted, shew that the spinal muscles are incapable

pable of an extensive or long continued action. Mr. Carlisle has very ingeniously attributed the physiological properties of the lateral muscles to the arrangement of their fibres, and the minute ramification of their blood-vessels, which do not admit the red particles; and he contrasts this structure, and the kind of muscular power consequent upon it, with the organization and functions of the muscles of tardigrade animals. See Phil. Trans. part 1. 1806.

It has been already observed that the spinal muscles of the flat *chondropterygii*, or the ray genus, are excepted from the description of the general structure of these parts in other fishes. They are formed more upon the plan of the muscles of the tail of certain quadrupeds, than like those of their own class.

Cuvier describes the lateral muscles of the ray genus as being composed of two layers, and each layer consisting of two muscles. As we have not particularly dissected them, we shall adopt his description.

The superior lateral muscles arise from the middle of the vertebral column above the abdomen, by a fleshy head, covered with strong aponeuroses: this portion extends as far as the pelvis, and then detaches little tendinous branches, which pass through parallel sheaths, and proceed successively towards the middle line, where they are inserted into the upper part of each of the vertebræ of the tail. Fleshy fibres accompany these tendons to some distance, after their separations from the common fasciculus.

In the inferior part of the tail the superior lateral muscles receive accessaries from each side, but these are simple tendons, which seem only intended to guard against too violent an extension, either to one side or the other.

Each tendon of the superior lateral muscles pulls the vertebra of the tail, to which it is attached, in the direction of its own action, and the flexion, or general curvature of the tail upwards, is the result of their common contraction.

The inferior lateral muscles arise also from the lumbar vertebræ, like the preceding, but more externally. Their arrangement also is similar, with this difference, that their tendons make a kind of turn, and run under the tail, where they are inserted into each of the vertebræ. They also receive accessory tendons. They produce motions in an opposite direction to those of the superior muscles, that is to say, they bend the tail downwards. Their tendons are more slender than those of the former: They divide into two branches at their extremities, and each bifurcation affords a passage for that of the next vertebra, so that they mutually serve as sheaths; and are all, except the last, both perforating and perforated.

The spinal muscles consist of flakes, and are pale, as in the osseous fishes, although their form is different in this genus.

The dorsal, anal, and caudal fins are moved by a great number of small muscles. In the interval left between the dorsal portions of the lateral muscles, along the back, there are found some long slender muscles, extended from the neck to the first ray of the dorsal fin, and between the dorsal fins, where there exist more than one, and from the dorsal to the caudal fin. By means of the insertion of these muscles into the first ray of each of the fins they tend to raise and spread them.

The number of these muscles varies according to the existence or number of the dorsal fins. In the *gymnotus*, and some others which want the dorsal fin, there is only a single pair, which extends from the neck to the caudal fin. In the species which possess one dorsal fin, there are

two pairs, and in those that have two dorsal fins there are three pairs.

There are muscles corresponding to the above, placed upon the lower or ventral edge of fishes, intended for the expansion of the anal and caudal fins. Cuvier describes two pair of these in the *carp* (*cyprinus carpio*). The one arises from the junction of the bones which sustain the pectoral fins, and is inserted on each side into the ligamentous tissue which unites the two ventral fins; the little fleshy bellies, of which this pair of muscles is composed, are four or five in number, in form resembling beads, and placed at some distance from each other.

The other pair extend from the anal fins to the first rays of the caudal fin. These fleshy portions are still thinner, and their tendons much longer than those of the former pair.

The other motions of the dorsal and anal fins are accomplished by means of a number of slender muscles, resembling in their form and position the interossei of the hand. They lie upon these spinous bones, which are added to the spinous processes of the dorsal and caudal vertebræ, for the purpose of sustaining the dorsal and anal fins. There are two sets or series of these muscles, a superficial and a deep-seated; the first arises from an aponeurosis which lines the skin, and furnishes septa to form a sort of sheath to each of these muscles, and which, by adhering along the roots of the additional vertebral spines, makes a degree of sheath also for the free margins of the lateral muscles; these muscles are inserted into the bases of each of the radii of the fins. The immediate effect of their action is to bend the rays of the fin laterally, if those of one side only are employed; but, if both sides act, the rays are brought closer to the body; if already inclined that way, but if standing in a right angle with the body, these muscles may serve to sustain them, or keep them fixed in that position.

The second set lie under the preceding muscles, and are enclosed in the same sheath with them; they are each attached to two of the additional spinous bones for almost their whole length, and at their roots to the inter-muscular aponeurosis, already mentioned: their tendons are inserted into the sides of the bases of each ray, by which means they draw the rays of the fin out of a right line, and thus tend to expand the fins as well as bring them to either side of the body.

Cuvier describes a set of short oblique muscles for closing the rays of the fin, which we have not seen except on the caudal fins.

The flexion of the caudal fin is effected at the same time with that of the whole tail, by means of the great lateral muscles already described; but the rays of the caudal fin are expanded and contracted by particular muscles for the purpose.

Those that spread the caudal fin are concealed by the lateral muscles; they arise from some of the last vertebræ, spread in a fan-like manner, and are inserted into the roots of the rays: the outermost fasciculi come from the three vertebræ preceding the last, and terminate upon the five or six of the external or longest rays; those of the intermediate rays arise from the two last vertebræ.

The muscles which serve to approximate the rays of the caudal fin appear like a row of beads or barley-corns, lying obliquely over the joints of the rays and inter-articular bones, with the broad, thin termination of the last vertebra. These muscles of one side of the tail appear to pass in a different direction from those of the other side, or to decussate each other.

The single fins are evidently intended to increase the lateral

ral surfaces of fishes, during the act of swimming, and thereby communicate a greater impulse to the water. They are also useful in turning the fish, and particularly the caudal fin must act like the helm of a ship. Mr. Carlisle made the experiment of cutting off the different fins of living fishes in succession, with the view of determining their separate offices; he observed, that after the removal of the single fins there was an evident tendency in the fish to turn round, and the pectoral fins were kept constantly extended to obviate that motion.

The single fins may also be considered as instruments of defence to fishes, more especially when the rays of the dorsal fins terminate in sharp spines, which they do in a great number of species, and in those cases the muscles for erecting the rays are peculiarly strong.

In *osseous* fishes, the great lateral muscles supply the place of the abdominal muscles, as well as those which arise from the spine; but in the *ray* genus we find some muscles, which correspond a good deal with the abdominal muscles. The inferior parietes of the abdomen in those fishes are composed of some layers of muscles which are attached to the transverse cartilages and the posterior branches of the scapula, and to the pieces composing the pelvis; these fibres take a similar direction to that of the straight and oblique muscles of the belly, and those of each side are distinguished by an aponeurotic line, analogous to the linea alba. They tend to depress the wings, and bring the pelvis forwards and downwards.

The superior parietes of the abdomen are formed by two thin, broad muscles; one arises from the aponeurosis, under the skin of the back, and is inserted into the back of the posterior branch of the scapula; the other arises from the aponeurosis of the muscles of the dorsal spine, and the back of the pelvis, and is inserted along the middle of the posterior branch of the scapula; these muscles are concerned in the elevation of the wings.

The muscles of the pectoral fin are simple in both the cartilaginous and the osseous fishes.

In the osseous fishes there is, in some species, a small, short muscle, situated on the internal and back part of the portion of the scapula, where that bone is connected to the cranium. It has the effect of bringing the scapula closer to the head.

There is likewise a small taper muscle which arises from the front of the clavicle, and is inserted into the posterior sharp process of the scapula; it brings the scapula backwards, and the clavicle forwards and inwards.

There are two sets of muscles situated upon the broad and thin portion of the scapula for moving the rays of the pectoral fin. The external set consists of three muscles, two of these are partially covered by the other; the two uppermost may be divided into a great number of fasciculi, which send tendons to the bases of the rays of the fin; the most inferior of the external set sends tendons only to some of the most inferior or external rays of the fin. The internal set consists of two muscles much resembling the two first that are placed externally; they send tendons into the roots of the rays on the inside. By all these muscles the rays of the fin are raised from the body and brought closer to it, turned forwards, and the edge presented to the water.

In the genus *ray*, besides the muscles already mentioned in describing other parts, which act upon the pectoral member, there is a very short muscle which goes from the last transverse process of the cervical spine to the top of the shoulder; it appears to raise the scapula. There is also a muscle extended along the concave side of the posterior branch of the scapula; its fibres arise from a tendon which is stretched from above the joint to the point of that branch;

they are inserted into the edge of the fin. The use of this last appears to be to bring the posterior branch of the scapula nearer the body; this motion is attended with the expansion of the rays of the fin.

The muscles which act immediately upon the rays of the wings in the flat *chondropterygii* are as numerous as the rays themselves; they altogether compose two great layers of fasciculi, somewhat resembling the muscles of the single fins of osseous fishes; one layer is placed upon the superior surface of the wings, the other upon the inferior; they thus cover the whole fin, arising from the external side of the scapula, and extended to almost the very edge of the fin. Their office is to raise and depress the wings.

The muscles which move the rays of the ventral fin in osseous fishes are situated upon the external and internal surfaces of the pelvic bones. On the external surface there are three or more fasciculi, which in approaching the bases of the rays form lesser fasciculi, one of which is inserted into each ray; the external muscles elevate the fin, and from their oblique direction and mode of attachment they also tend to close the rays. There is but one muscle usually on the internal surface of the pelvic bone; with its fellow, it fills up all the space left between the two flat surfaces of the bones of the pelvis. These muscles have the effect of depressing the rays of the ventral fin, and at the same time of expanding them, so as to present a broader surface to the water.

In the *chondropterygii* the external rays of the ventral fin, more especially the outermost, have their muscles in distinct fasciculi, which are capable of drawing the rays in all directions. These muscles might be compared with those that act upon the lower extremities of mammalia: the small rays of the ventral fins have fasciculi closely applied to them in the same manner as those of the pectoral fin in these fishes.

The chief uses of the pectoral and ventral fins are to turn and stop in swimming, and to preserve the position of the fish; therefore we observe, they are always employed when the animal wishes to continue nearly in one place. When the motion of the fish also is very gradual through the water these fins are sometimes the only instrument employed in swimming. From the experiments made by Mr. Carlisle of cutting off the fins in a living fish, it would appear that the pectoral fins are useful in ascending, and that they serve to keep the head uppermost: when both the pectoral and abdominal fins were removed, he found that the fish had a tendency to roll and could not ascend at all.

Air Bladder.

This singular organ is peculiar to the class of fishes. Anatomists have ascribed various functions to it; we have, however, chosen to place it amongst the instruments of motion, for reasons which will be given hereafter.

The air bag is wanting in several species of fishes, and has been supposed to be absent in some others, in which it really exists. It is not met with in any of the *chondropterygii*, in the genus *lophius*, in the *monacanth* (*tetraodon mola*); it is supposed to be wanting in the *ammodytes tobianus*, the *stromateus paru*, the *callionymus draconculus*, the *blennius superciliosus*, and *blennius viviparus*, &c.; in the genera *cepola*, *echeuis*, and *cottus*. It is absent in the flat fishes (*pleuronectes*), and in the mackerel (*scomber scombrus*); we have not found it in the *weaver* (*trachinus draco*). Bloch appears to have extended the list of fishes in which this organ is absent farther than is right; he denies its existence in the *electrical eel* (*gymnotus electricus*), although Mr. Hunter described it in that fish. Redi also itated it to be wanting

in the *uraeostopus feuber*, in which Cuvier has found an air-bag resembling that of the carp (*cyprinus carpio*.)

The air-bag is always situated upon the inferior surface of the dorsal vertebræ; sometimes, as in the genus *gadus*, it adheres firmly and intimately to the spine. At other times, as in the genera *salmo*, *esox*, &c. it sends processes to the ribs and the spaces between them.

In the *dory* (*zeus faber*) it is connected to the spine by ligaments which arise from the bag, but is not continuous with it.

In the carp (*cyprinus*) the anterior portion of the bag only is attached to a descending process of the second dorsal vertebræ. In the *sturgeon* (*acipenser sturio*), the *eel* (*murena*), the *herring* (*clupea*), and many other fishes, the bag is unconnected with the spine, and preserved in its proper position by its peritoneal coat, and the duct which communicates with the œsophagus or stomach.

The structure of the parietes of the air-bladder is extremely curious. It has two proper coats and a peritoneal covering; the internal proper coat is in general a fine delicate membrane, which, in many cases, is not closely adherent at every part to the other coat; it appears to be double, and the innermost layer to be, in some places, loose, and capable of being moved upon the surface of the other.

The external proper coat is in many cases incomplete or wanting in some parts of the air-bag: thus, in the genus *gadus* there is only the membranous tunic along the upper surface of the bladder, which corresponds to the bodies of the vertebræ; the intimate connection with the external parts of the spine rendering a stronger integument in this place unnecessary; this coat also appears to be wanting in the posterior bladder of the carp (*cyprinus carpio*). It is absent also upon the posterior end of the air-bag in the *dory* (*zeus faber*), but in this instance it is supplied by a thick, soft, fleshy-looking tunic, which has considerable strength.

The external proper coat has a most peculiar structure: it is very close in its texture, resembling, when cut through, the ligamentum nuchæ of mammalia; it is of a beautiful silvery white colour, and the inner surface glistens like polished metal; from these characters we should wish to give it the name of the *argentine coat*; it is tough, but possesses very little elasticity, which it appears to lose entirely upon being stretched. This coat is generally thick, but does not seem to be strong in proportion; it tears with the application of a much slighter force than would be required to rupture a tendon or ligament of the same degree of thickness. Cuvier states its consistence to be so considerable in the *ostracions* as not to shrink when the bag is emptied of its air; it is also very strong in the genera *silurus* and *gadus*; in other instances, as in the *pike*, *herring*, *eels*, *carp*, &c. it is as thin as a membrane: in the *licbir* (*polypterus niloticus*) this coat exhibits some oblique fibres, which Cuvier is disposed to consider muscular; it is the argentine coat which is so intimately united to the external parts of the vertebræ in the *cod*.

An opinion prevails that it is unwholesome or dangerous to eat the air bag of fishes, which probably arises from the indigestible nature of the external coat.

The *cobitis fossilis* is distinguished by having the parietes of the air-bag composed of bone; the ossæous covering appears to supply the place of the external proper coat in this fish, and is lined like it by membrane.

The *peritoneal* coat does not always entirely cover the air-bladder; in those instances, when the latter adheres to the spine, it only passes over the inferior surface of it.

In certain fishes the air-bladder contains a remarkable vascular apparatus; this is always situated on the inner side of

the inferior or abdominal parietes of the bladder, it appears to be enclosed between the duplicatures of the internal proper coat of the bag, the innermost of which is extremely thin where it covers the surface of the vascular apparatus.

There is great variety in the figure of the vascular organ in the *cod* (*gadus morhua*); it is a broad patch, somewhat of a heart-shape, composed of a number of short foliated processes standing close to each other. In the *cobiting* (*gadus merlangus*) these processes are finer, less regular, and not so close together, and look like the vascular sereddy membrane produced by the deposition of lymph on an inflamed surface.

In the *mullet* (*mugil cephalus*) there are a number of granular vascular bodies spread over an oval surface, about two inches long and one inch and a half broad; these are fed by an artery of some size, which, after entering the bag, sends branches to each of these little masses.

In the *eel* and *conger* (*murena anguilla* and *murena conger*) there are two spheroidal vascular bodies placed at a little distance from each other.

In the *dory* (*zeus faber*) there are four vascular bodies, situated nearly at equal distances from each other; they are narrow, rounded upon the surface, and are composed of smaller irregular-shaped masses, which give them a granular appearance; each body is coiled or twisted like a piece of intestine, and they are all connected together by the blood-vessels which pass through a hole formed in the lower parietes of the bag for the purpose, and on entering the bag branch off regularly to supply each of the vascular bodies.

In the *gadus polachius*, Cuvier states that the inner surface is entirely covered with long and numerous vascular filaments.

Whatever may be the form and arrangement of the vascular bodies, they agree in one circumstance: they receive so great a supply of red blood that every point is coloured, the whole appearing of an uniform crimson colour, as if it were dyed. There is no other organ of the animal body, with which we are acquainted, that possesses the same species of vascularity, except the *choroid gland* of the eye of fishes; but even this part falls short in the degree of vascularity.

It may be stated in a general way, that in those fishes which want a distinct vascular apparatus, there is either a communication between the air-bladder and the stomach or œsophagus, or the internal membrane of the bag receives a considerable number of blood-vessels. In some cases, however, when these provisions exist, the inner surface of the air-bladder is abundantly supplied with blood-vessels. In the *licbir* (*polypterus niloticus*), for instance, the vessels form innumerable filæ, which colour a great part of the surface of the bag.

It has been commonly supposed that the vascular bodies, and the vessels distributed upon the inner surface of the bladder, are destined to secrete the air with which it is filled. This fact, which has been called in question by some physiologists, is fully proved by the structure observed in the vascular bodies of *eels* (*murena*), and the *sea perch* (*perca labrax*). In the former, the vascular bodies exhibit on their surface a fine net-work of vessels containing air; and in the *sea perch*, besides the usual vascular body on the inner part of the bag, there are two others placed externally on each side, and extended from the base to the point of the cone-shaped bladder of this fish. There arise from these a great number of little air-vessels, which unite into several principal trunks that penetrate the parietes of the bladder, and open into its cavity by thirty or forty orifices on each side, arranged in a line.

As the offices of these singular organs are so satisfactorily demonstrated, they might with propriety be called *air-glands*. The circumstance of the vascular bodies secreting air is a most interesting fact in physiology, and serves to explain the production of gaseous matter from the secreting surfaces in other classes of animals.

The communication which the air-bladder has, in several fishes, with the stomach is one of the most curious circumstances in the history of this organ. It has been supposed, by some anatomists, to be intended to discharge the contents of the bag; but we are more disposed to think that it is designed to admit air, which is furnished by the surface of the alimentary canal. In no instance has any fish been observed to expel air by the mouth or anus; and if it were retained in the stomach, the specific gravity of the animal would remain the same, and consequently the supposed purpose would not be answered. On the other hand, the secretion of air from the surface of the stomach is a well ascertained fact, with respect to many other animals, and may be presumed by fair analogy to take place also in fishes. Another argument may be drawn from the surface of the air-bag being commonly found less vascular in those instances where this communication exists.

The duct, which serves to convey the air from the alimentary canal into the bladder, has been observed to exist in certain species of the genera *acipenser*, *murena*, *perca*, *salmo*, *esox*, *cyprinus*, *clupea*, *silurus*, and *polypterus*. It varies with respect to its size and figure, and the places at which it arises and terminates. In the *eel* (*murena anguilla*), the *conger* (*murena conger*), and the *murena belena*, it passes from the anterior part of the stomach to the middle of the bladder, between the two air-glands: it becomes wider as it approaches the bladder. In the *pike* (*esox lucius*), the *trout* (*salmo fario*), the *salmon* (*salmo salar*), and the *sturgeon* (*acipenser sturio*), the opening into the bag is situated near its anterior extremity. In these fishes it is short and wide, particularly in the *pike* and *sturgeon*: in the latter it is so wide, that a finger will pass through it; and so short, that it appears like a ring rather than a duct. It arises from the œsophagus in the *salmon*, and from the beginning of the stomach in the *sturgeon*. It opens into the anterior third of the bag in the *silurus*. The duct is extremely long and small in the *carp* (*cyprinus carpio*), and passes from the termination of the œsophagus to the anterior part of the posterior portion of the air-bag. In the *herring* (*clupea harengus*) the posterior or funnel-shaped extremity of the stomach gives origin to a slender duct, which enters the air-bag at about one-third from its posterior extremity.

The orifice into the œsophagus is not furnished with any valves to prevent the admission of extraneous substances; but when it is wide, it is encompassed by some muscular fibres, which perform the office of a sphincter. This structure is well seen in the *sturgeon* and the *bichir* (*polypterus niloticus*): in the former, the short duct has a muscular coat of circular fibres; and in the latter, the orifice is surrounded by a sphincter. When the duct is very small, the contraction of the ordinary muscular fibres of the alimentary canal seems to be adequate to the shutting of the orifice.

In whatever manner the orifice of the air-duct be constructed, its opening or closing is unquestionably regulated by the will of the animal.

Having stated the general structure of the air-bag, and the parts connected with it, we shall enumerate the peculiarities of its form which have been observed in different fishes.

The air-bladder in some instances consists of two parts or chambers, communicating with each other. In the *bichir*

(*polypterus niloticus*, Geoffroy), it forms two large cylindrical sacs, of which the one is much longer than the other, extending the whole length of the abdomen; they only unite when they communicate with the œsophagus; the *tetraodon oblongus* also has the bag of two portions, but of the same figure and magnitude; they lie together, and unite at their anterior extremity. In the *gadus polackius* the two portions of the bag are of unequal size, they are situated parallel to each other, and are cojoined in their middle. In the *carp* (*cyprinus*), and the *uranoscopus scaber*, the bag consists of two sacs, the one placed behind the other, and separated by a contraction, which leaves a small aperture of communication between them.

The air-bladder is single in all other fishes, except the foregoing examples, and exceedingly various with respect to its form, even in species of the same genus. It has the figure of an elongated cone, with the base turned forwards, in the *sturgeon* (*acipenser sturio*), the *salmon* and *trout* (*salmo salar* and *salmo fario*), the *pike* (*esox*), the *dory* (*zeus faber*), &c.; it is long, conical, and fringed posteriorly in the *salmo eperlanus*; short and oval in the *murena belena*, narrow and more elongated in the *common eel*, the *conger*, and the *signatus acus*; it is long and pointed at both ends in the *herring*, (*clupea harengus*). In the *cod* (*gadus morhua*), it is pointed posteriorly, notched or divided into a number of lobules along the sides, straight at the anterior part, from the corners of which two vermiform processes go off, which are considerably convoluted. Cuvier describes these processes as two ducts, leading into the œsophagus, but they terminate in blind extremities; it is bifurcated anteriorly in the *ling* (*gadus morhua*), long and slender in the *hake* (*gadus merluccius*); it is oval in many of the genus *labrus*. In the *anableps tetrophthalmus* it is small anteriorly, and enlarged behind; in the *cypracion cubicus*, it is irregular, slightly notched before, and a little contracted in the middle; the *cypracion quadricornis* has the same figure, with two processes on the sides. In the genus *sturus* the air-bag has the form of a heart, and contains internally a number of transverse septa, which are incomplete upon the sides. In many of the genus *diodon* also similar partitions have been observed to exist.

The air bag in some fishes possesses two muscles; they are short thick layers, which pass downwards on each side of the anterior part of the bag. In the *dory* (*zeus faber*) they have an oval form, and have no foreign attachments, but belong entirely to the parietes of the bag. In the *cod* (*gadus morhua*) there are two muscles on each side, which are affixed to the two first lobules, or facculated portions of the air bladder, and have their superior extremities inserted into the spine. Cuvier states that these muscles exist in the *mermyrus labialis*, and in the *cypracion cubicus*, in which last species they are extremely thick. He supposes that the use of the muscles is to compress the air-bag, and, by diminishing the bulk of the air it contains, increase the specific gravity of the fish. They appear, however, to be incompetent to such an effect, as they can only act upon the anterior portion of the bag; they are, therefore, probably destined to urge the air from the fore-part of the bladder, when the animal has occasion to descend in the water.

It is to be regretted that the different experiments, which have been instituted to ascertain the chemical properties of the air contained in this organ, have afforded such contradictory results: scarcely any two of them coincide with each other. Thus, La Cépède has stated that he discovered hydrogen gas in the air-bag of the *tench* (*cyprinus tinca*). Fourcroy found azotic gas in that of the *common carp* (*cyprinus carpio*). Fischer met with carbonic acid gas. Dr. Bischoff, in examining the air-bag of the *juvénal fish* (*ni-*

phias gladius), sometimes found it to contain oxygen, and at others fixed air. Others have stated that the air-bag of the *carp*, &c. is filled with atmospheric air. Some later experiments on the subject have been communicated to the French National Institute by M. Biot. He ascertained that the contents of this organ varied from pure azote to $\frac{87}{100}$ ths of oxygen; but there existed no hydrogen. He stated that fresh-water fish, which frequently swim near the surface, afforded the least proportion of oxygen; and he thought that this gas was in greater quantity, according to the depth of water from which the fish came.

Biot's experiments are very interesting, as they go some way towards reconciling the contradictory accounts of other physiologists, and may perhaps be considered as explaining the different degrees of purity observed at different times in the air of the bag in the same individual.

Anatomists are as much at variance with respect to the uses of the air-bag, as they differ in their accounts of its contents. Needham supposed that the air produced in the blood was deposited in the bladder, and afterwards carried into the stomach, in order to assist digestion. Vicq d'Azyr adopted a similar opinion: he thought the bladder was subservient to digestion, and that it received the finer kinds of food. Fischer imagined this organ an accessory one to the gills, besides forwarding the motion of the animal in its element: he conceived that the fish came to the surface for the purpose of swallowing atmospheric air, which afterwards passed through the pneumatic duct into the bladder, and, when spoiled by remaining in contact with the vascular bodies or blood-vessels, was expelled through the same channel.

It is impossible to conceive speculations more absurd or more easily overturned, than the preceding. Each of these opinions supposes that there is always a communication between the air-bag and the alimentary canal, which, as before stated, is ascertained to exist in but a small number of fishes: but if this obstacle did not exist, both the theories of Needham and Vicq d'Azyr are still extremely improbable. The admixture of air with the alimentary substances would interrupt, instead of promoting their digestion. It would be utterly impossible for any process similar to respiration to be carried on in a close sac; as the air could not be renovated, its operation would cease, and to suppose the secretion of oxygen into the air-bag, and the absorption of the carbonic acid gas produced there, is perfectly preposterous; as well might an animal respire in a close vessel.

The true and only use of the air-bladder appears to be to diminish the gravity of the fish in relation to its bulk, and thereby enable it to continue buoyant, or ascend in the water with little or no muscular effort: this is the popular notion; and hence the common name of *swimming bladder* or *swim* are used; in confirmation of which opinion it may be remarked, that those fishes have the largest air-bags which swim rapidly, and frequently ascend and descend in the water; that when it is wanting we can almost always discover some other modification or conditions in the organs of locomotion which are adapted to fulfil the same purposes, and that when such provisions do not exist, the fish commonly grovels at the bottom of the water. Thus the *shark* genus is furnished with a long and powerful tail, and the pectoral fins are in general of some size. In the *mackerel* (*scomber scombrus*) the skeleton and muscular substance are both light, and the tail is particularly strong; the *gar fish* (*esox lucius*), which has a light skeleton, and muscular substance very like the *mackerel*, has an extremely small air-bag. The flat fishes swim by means of a continual beating or flapping of the water with their broad surfaces, in a manner exactly analogous to flying.

Lastly, the *lamprey* (*petromyzon*), which wants the air-bag and has a tail badly formed for swimming, generally lies buried in the mud at the bottom of the water.

To these observations we shall add some experiments we made upon one occasion on living fishes, the *goach* and *gudgeon* (*cyprinus rutilus* and *cyprinus gobio*), which, in our opinion, put it beyond all doubt that the air-bladder is an organ of motion. A knife was plunged past the spine into the air-bladder; upon the air rushing out, the fishes descended to the bottom of the vessel of water, and there remained. In order to ascertain whether the infliction of such a wound could have any effect, a similar one was made upon other living fishes, taking care not to penetrate the air-bladder, but they afterwards ascended and descended as usual: an air-bladder was next removed from the body of one fish, and attached to the external part of the body of another fish, which had previously sunk to the bottom in consequence of the air being extracted from its bag by a wound; it now became as unable to descend in the water as it was before to rise, and was detained at the surface in despite of all its efforts to escape to the bottom of the vessel.

Two conclusions are to be drawn from the foregoing experiments: 1st, that the air-bag is absolutely necessary to the locomotion of those fishes, to which it naturally belongs; 2dly, that in the body of the living fish some change is produced in the bulk or quantity of the air contained in the bag to enable the fish to descend.

Some anatomists have accounted for the diminution of the volume of air in the bag, by supposing it to be carried into the stomach or œsophagus, and thence expelled, but this could only take place in those few fishes which have a duct of communication between those parts.

Others have supposed that the air-bag is diminished by being compressed at the will of the animal, either by the great lateral muscles, or those situated at the anterior part of the bag: it seems, however, very doubtful whether the action of either of these muscles can materially affect the whole bag; but if this were granted, it might be still objected, that in some instances the air-bag is so thin as not to be able to sustain much compression without danger of being ruptured, and that in other instances its parietes are so thick as to resist a moderate degree of compression, and in the *colitis fossilis*, it being an ossaceous sac, it is incompressible.

Shall we suppose that the gaseous contents of the bag are increased and diminished, as occasion may require, by secretion and absorption? There appears but one objection to this supposition, which is the rapidity that would be necessary in effecting those changes in the quantity of the air. It may be remarked, however, that air is secreted, under some circumstances, in the human stomach almost instantaneously; the secretion of saliva and the tears is, perhaps, equally rapid: the vascular action which conveys the flush to the cheeks surpasses in velocity any of the voluntary motions of animals: it is, therefore, not inconsistent with some of the well known phenomena of the vascular system to suppose that the volume of air in the swimming bladder of fishes may be regulated according to necessity, by the vessels distributed to the parietes of the bag, or, perhaps, by those of the stomach, when these two parts communicate. It would be improper, however, to adopt this opinion upon the mere ground of its being possible: future experiments must determine what really are the means employed by fishes to alter their gravity.

Plate XIV. of the *Anatomy of Fishes*, contains the illustrations of the structure of the air bag. Fig. 1. represents the air-bladder of the *dory*, (*zeus faber*) turned inside out, in order to bring into view the internal coat and air glands,

glands, &c. : *a*, the anterior part of the bag ; *b*, the posterior part : the argentine coat is seen through the internal membrane, and at *b* the fleshy looking coat which supplies its place ; the inner membrane adheres most loosely at this part ; *c, c, c, c*, the four air-glands or vascular bodies ; *d*, the blood vessel which is distributed to them with the accompanying vein ; *e, e*, the muscles seen through the inner coat.

Fig. 2. exhibits the air-gland of the cod (*gadus morhua*) ; *a*, the surface presented to the cavity of the bag.

Fig. 3. shows the air bladder of the eel, (*murena anguilla*) divided longitudinally, and the parietes spread out ; *a*, the argentine coat ; *b b b b*, the internal membrane with its blood-vessels ; *c, c*, the two air-glands ; on the left side the inner membrane is raised to uncover the gland, and bring into view the network of the air vessels upon it at *d* ; *e, e*, portion of the duct which goes to the stomach.

Fig. 4. represents a portion of the œsophagus and stomach of the sturgeon (*acipenser sturio*) laid open, with a part of the air-bag attached to it ; *a*, the œsophagus ; *b*, the stomach ; *c*, the air-bladder ; *d*, the duct leading from one into the other, surrounded by an annular muscle ; *e*, the orifice of the duct.

Fig. 5. is the double air-bag, with its duct in the carp (*cyprinus carpio*) inflated and dried ; *a*, the anterior portion of the bag ; *b*, the posterior chamber with thinner parietes ; *c*, the duct passing some distance before it terminates in the alimentary canal, a portion of which is preserved at *d*.

Fig. 6. exhibits the stomach and air-bag of the herring (*clupea harengus*) ; *a*, the anterior part of the stomach ; *b*, the posterior or infundibular portion, from the extremity of which a duct is seen going off to the air-bag *c*, which is long and pointed at both ends.

Fig. 7. is a view of the air-bag in the *silurus felis*, cut open to show the partitions of the interior, which produce a cellular appearance.

Electric Organs.

These parts, and the very singular faculty they bestow, have been observed to exist but in a very small number of species ; there are only five fishes which are at present known to possess the electric property. The *torpedo* (*raja torpedo*), the *electric eel* (*gymnotus electricus*), the *silurus electricus*, the *Indian eel* (*trichiurus indicus*), and the *tetraodon electricus*.

The parts which produce the electric phenomena have been described by several naturalists in the *torpedo* and *gymnotus*, but most minutely and correctly by the late Mr. Hunter ; and the electric apparatus of the *silurus electricus* has been described and delineated within these late years by M. Geoffroy the French naturalist, but no account has yet been given, as far as we know, of these organs in the electric species of *trichiurus* and *tetraodon*.

Before entering upon the consideration of the phenomena exhibited by the electric fishes, we shall give a description of the organs by which they are produced in the *torpedo*, the *electric eel*, and the *silurus electricus* ; and with respect to the two first, as the subject is peculiarly interesting, we shall copy the detailed and accurate account published by Mr. Hunter in the Philosophical Transactions.

"The electric organs of the *torpedo* are placed on each side of the cranium and gills, reaching from thence to the semi-circular cartilages of each great fin, and extending longitudinally from the anterior extremity of the animal, to the transverse cartilage which divides the thorax from the abdomen ; and within these limits they occupy the whole space between the skin of the upper and of the under surfaces ;

they are thickest at the edges near the centre of the fin, and become gradually thinner towards the extremities.

"Each electric organ, at its inner longitudinal edge, is unequally hollowed, being exactly fitted to the irregular projections of the cranium and gills. The outer longitudinal edge is a convex elliptic curve. The anterior extremity of each organ makes the section of a small circle ; and the posterior extremity makes nearly a right angle with the inner edge.

"Each organ is attached to the surrounding parts by a close cellular membrane, and also by short and strong tendinous fibres, which pass directly across, from its outer edge, to the semi-circular cartilages.

"They are covered, above and below, by the common skin of the animal ; under which there is a thin fascia spread over the whole organ. This is composed of fibres, which run longitudinally, or in the direction of the body of the animal. These fibres appear to be perforated in innumerable places ; which gives the fascia the appearance of being fasciculated ; its edges all around are closely connected to the skin, and at last appear to be lost, or to degenerate into the common cellular membrane of the skin.

"Immediately under this is another membrane, exactly of the same kind, the fibres of which in some measure decussate those of the former, passing from the middle line of the body outwards and backwards. The inner edge of this is lost with the first described ; the anterior, outer, and posterior edges are partly attached to the semi-circular cartilages, and partly lost in the common cellular membrane.

"This inner fascia appears to be continued into the electric organ by so many processes, and thereby makes the membranous sides or sheaths of the columns, which are presently to be described ; and between these processes the fascia covers the end of each column, making the outermost or first partition.

"Each organ of the fish under consideration is about five inches in length, and at the anterior end three in breadth, though it is but little more than half as broad at the posterior extremity.

"Each consists wholly of perpendicular columns, reaching from the upper to the under surface of the body, and varying in their lengths, according to the thickness of the parts of the body where they are placed, the longest column being about an inch and an half, the shortest about one-fourth of an inch in length, and their diameters about two tenths of an inch.

"The figures of the columns are very irregular, varying according to situation and other circumstances. The greatest number of them are either irregular hexagons, or irregular pentagons ; but, from the irregularity of some of them, it happens that a pretty regular quadrangular column is sometimes formed. Those of the exterior row are either quadrangular or hexagonal ; having one side external, two lateral, and either one or two internal. In the second row they are mostly pentagons.

"Their coats are very thin, and seem transparent, closely connected with each other, having a kind of loose network of tendinous fibres, passing transversely and obliquely between the columns, and uniting them more firmly together. These are mostly observable where the large trunks of the nerve pass. The columns are also attached by strong inelastic fibres, passing directly from the one to the other.

"The number of columns in different torpedos of the size of that now offered to the society, appeared to be about 470 in each organ, but the number varies according to the size of the fish. These columns increase, not only in size,

but in number, during the growth of the animal, new ones forming perhaps every year, on the exterior edges, as there they are much the smallest. This process may be similar to the formation of new teeth, in the human jaw, as it increases.

“Each column is divided by horizontal partitions, placed over each other, at very small distances, and forming numerous interstices, which appear to contain a fluid. These partitions consist of a very thin membrane, considerably transparent. Their edges appear to be attached to one another, and the whole is attached by a fine cellular membrane to the inside of the columns. They are not totally detached from one another; I have found them adhering, at different places, by blood vessels passing from one to another.

“The number of partitions contained in a column of one inch in length, of a torpedo which had been preserved in proof spirits, appeared, upon a careful examination, to be one hundred and sixty; and this number in a given length of column appears to be common to all sizes in the same state of humidity, for by drying they may be greatly altered; whence it appears probable that the increase in the length of a column, during the growth of the animal, does not enlarge the distance between each partition in proportion to that growth; but that new partitions are formed, and added to the extremity of the column from the fascia.

“The partitions are very vascular; the arteries are branches from the veins of the gills, which convey the blood that has received the influence of respiration. They pass along with the nerves to the electric organ, and enter with them; then they ramify, in every direction, into innumerable small branches upon the sides of the columns, sending in from the circumference all around upon each partition small arteries, which ramify and anastomose upon it; and passing also from one partition to another, anastomose with the vessels of the adjacent partitions.

“The veins of the electric organ pass out, close to the nerves, and run between the gills, to the auricle of the heart.

“The nerves inserted into each electric organ, arise by three very large trunks from the lateral and posterior part of the brain. The first of these, in its passage outwards, turns round a cartilage of the cranium, and sends a few branches to the first gill, and to the anterior part of the head, and then passes into the organ towards its anterior extremity. The second trunk enters the gills between the first and second openings, and, after furnishing it with small branches, passes into the organ near its middle. The third trunk, after leaving the skull, divides itself into two branches which pass to the electric organ through the gills; one between the second and third openings, the other between the third and fourth, giving small branches to the gill itself. These nerves having entered the organs, ramify in every direction between the columns, and send in small branches upon each partition where they are lost.” Phil. Trans. vol. 63, p. 481.

Plate XV. of the *Anatomy of Fishes*, exhibits a view of the upper or back surface of the *torpedo*, on which the electric organ of each side is uncovered by raising the integuments, in order to shew the extensive portion of the body of the fish, which these parts occupy: *a, a*, the integuments turned back, displaying on their inside an hexagonal network, which was the continuation of the columns into the skin; *b, b, b, b*, the ends of the column applied to the integuments. An exactly similar appearance presents itself on raising the skin of the inferior or opposite surface of the body of the fish.

In Plate XVI. of the *Anatomy of Fishes*, fig. 1. shews

the electric organ of the *torpedo* on the right side, divided horizontally into nearly two equal parts at the place where the nerves enter; the upper half being turned outwards.

a a, b b, c c, d d, the corresponding parts of trunks of the nerves as they emerge from the gills, and ramify in the electric organ.

a a, the first or anterior trunk arising just before the gills.

b b, the second or middle trunk, arising behind the first gill.

c c, the anterior branch of the third trunk, arising behind the second gill.

d d, the posterior branch of the third trunk, arising behind the third gill.

Fig. 2. of the same plate, exhibits a perpendicular section of the *torpedo*, a little behind its inspiratory openings.

a a, the upper surface of the fish.

b, b, the muscles of the back, as divided by the section.

c, the medulla spinalis.

d, the œsophagus.

e, the left gill, split to expose the course of a trunk of a nerve through it.

f, the breathing surface of the right gill.

g, g, the fins.

h, h, the perpendicular columns which compose the electric organ, with a representation of their horizontal positions.

i, one of the trunks of the nerves, with its ramifications.

“The *gymnotus electricus* may be considered, both anatomically and physiologically, as divided into two parts; viz. the common animal part; and a part which is superadded, viz. the *peculiar organ*. I shall at present consider it only with respect to the tail; as the first explains nothing relating to the other, nor any thing relating to the economy of fish in general.

“The first, or common animal part, is so contrived as to exceed what was necessary for itself, in order to give situation, nourishment, and most probably the peculiar property to the second. The last part, or peculiar organ, has an immediate connection with the first, the body affording it a situation; the heart, nourishment; and the brain, nerves, probably its peculiar powers. For the first of these purposes, the body is extended in length, being much longer than would be sufficient for what may be called its progressive motion. For the real body, or that part where the viscera and parts of generation are situated, with respect to the head, as in other fish, is extremely short; so that, according to the ordinary proportions, this should be a very short fish. Its great length, therefore, seems chiefly intended to afford a surface for the support of the peculiar organ; however, the tail part is likewise adapted to the progressive motion of the whole, and to preserve the specific gravity; for the spine, medulla spinalis, muscles, fin, air-bladder, are continued through its whole length.

“Besides which parts, there is a membrane passing from the spine to that fin which runs along the belly or lower edge of the animal. This membrane is broad at the end next to the head, terminating in a point at the tail. It is a support for the abdominal fin, gives a greater surface of support for the organ, and makes a partition between the organs of the two opposite sides.

“The organs which produce the peculiar effect in the electric eel constitute nearly one-half of that part of the flesh in which they are placed, and perhaps make more than one-third of the whole animal. There are two pair of these

organs, a *larger* and a *smaller*; one being placed on each side. The large pair occupy the whole lower or anterior, and also the lateral part of the body, making the thickness of the fore or lower parts of the animal, and run almost through its whole length; *viz.* from the abdomen to near the end of the tail. It is broadest on the sides of the fish at the anterior end, where it incloses more of the lateral parts of the body, becomes narrowest towards the end of the tail, occupying less and less of the sides of the animal, till at last it ends almost in a point.

These two organs are separated from one another at the upper part by the muscles of the back, which keep their upper or posterior edges at a considerable distance; below that, and towards the middle, they are separated by the air-bag, and at their lower parts they are separated by the middle partition.

They begin forwards, by a pretty regular edge, almost at right angles with the longitudinal axis of the body, situated on the lower and lateral parts of the abdomen. Their upper edge is a pretty straight line, with small indentations made by the nerves and blood-vessels, which pass round it to the skin. At the anterior end they go as far towards the back as the middle line of the animal; but in their approach towards the tail they gradually leave that line, coming nearer to the lower surface of the animal.

The general shape of the organ, on an external or side view, is broad at the end next to the head of the animal, becoming gradually narrower towards the tail, and ending there almost in a point. The other surfaces of the organ are fitted to the shape of the parts with which they come in contact; therefore, in the upper and inner surface it is hollowed, to receive the muscles of the back.

There is also a longitudinal depression on its lower edge, where a substance lies, which divides it from the small organ, and which gives a kind of fixed point for the lateral muscles of the fin. Its most internal surface is a plane adapted to the partition which divides the two organs from one another. The edge next to the muscles of the back is very thin, but the organ becomes thicker and thicker towards its middle, where it approaches the centre of the animal. It becomes thinner again towards the lower surface, or belly; but that edge is not so thin as the other.

Its union with the parts to which it is attached is in general by a loose, but pretty strong cellular membrane, except at the partition, to which it is joined so close, as to be almost inseparable.

The small organ lies along the lower edge of the animal nearly to the same extent as the other. Its situation is marked externally by the muscles which move the fin under which it lies. Its anterior end begins nearly in the same line with the large organ, and just where the fin begins. It terminates almost insensibly near the end of the tail, where the large organ also terminates.

It is of a triangular figure, adapting itself to the part in which it lies. Its anterior end is the narrowest part; towards the tail it becomes broader; in the middle of the organ it is thickest; and from thence becomes gradually thinner to the tail, where it is very thin.

The two small organs are separated from one another by the middle muscles, and by the bones upon which the bones of the fins are articulated.

The large and the small organ on each side are separated from one another by a membrane, the inner edge of which is attached to the middle partition, and its outer edge is lost on the skin of the animal.

To expose the large organ to view, nothing more is

necessary than to remove the skin which adheres to it by a loose cellular membrane. But to expose the small organ it is necessary to remove the long row of small muscles which move the fin.

The *structure* of these organs is extremely simple and regular, consisting of two parts; *viz.* flat partitions or septa, and cross divisions between them. The outer edge of these septa appear externally in parallel lines nearly in the direction of the longitudinal axis of the body.

These septa are thin membranes, placed nearly parallel to one another. Their lengths are nearly in the direction of the long axis, and their breadth is nearly the semidiameter of the body of the animal. They are of different lengths, some being as long as the whole organ. I shall describe them as beginning principally at the anterior end of the organ, although a few begin along the upper edge, and the whole, passing towards the tail, gradually terminate on the lower surface of the organ; the lowermost at their origin terminating soonest. Their breadths differ in different parts of the organ.

They are in general broadest near the anterior end, answering to the thickest part of the organ, and become gradually narrower towards the tail; however, they are very narrow at their beginnings or anterior ends. Those nearest to the muscles of the back are the broadest, owing to their curved or oblique situation upon these muscles, and grow gradually narrower towards the lower part, which is in a great measure owing to their becoming more transverse, and also to the organ becoming thinner at that place.

They have an outer and an inner edge. The outer is attached to the skin of the animal, to the lateral muscles of the fin, and to the membrane which divides the great organ from the small; and the whole of their inner edges are fixed to the middle partition formerly described, also to the air-bladder, and three or four terminate on that surface which inclose the muscles of the back. These septa are at the greatest distance from one another at their exterior edges near the skin, to which they are united; and as they pass from the skin towards their inner attachments they approach one another. Sometimes we find two uniting into one. On that side next to the muscles of the back, they are hollow from edge to edge, answering to the shape of those muscles; but become less and less so towards the middle of the organ, and from that, towards the lower part of the organ, they become curved in the other direction. At the anterior part of the large organ, where it is nearly of an equal breadth, they run pretty parallel to one another, and also pretty straight; but where the organ becomes narrower, it may be observed, in some places, that two join or unite into one; especially where a nerve passes across. The termination of this organ at the tail is so very small, that I could not determine whether it consisted of one septum or more.

The distances between these septa will differ in fishes of different sizes. In a fish of two feet four inches in length, I found them $\frac{1}{2}$ th of an inch distant from one another; and the breadth of the whole organ, at the broadest part, about an inch and a quarter, in which space were thirty-four septa.

The small organ has the same kind of septa, in length passing from end to end of the organ, and in breadth passing quite across: they run somewhat serpentine, not exactly in straight lines. Their outer edges terminate on the outer surface of the organ, which is in contact with the inner surface of the external muscle of the fin; and their inner edges are in contact with the centre muscles. They differ very much in breadth from one another; the broadest being equal to one side of the triangle, and the narrowest scarcely broader than the point or edge. They are pretty nearly at

equal distances from one another; but much nearer than those of the large organ, being only about $\frac{1}{6}$ th part of an inch asunder: but they are at a greater distance from one another towards the tail, in proportion to the increase of breadth of the organ.

“The organ is about half an inch in breadth, and has fourteen septa. These septa, in both organs, are very tender in consistence, being easily torn. They appear to answer the same purpose with the columns in the torpedo, making walls or butments for the subdivisions, and are to be considered as making so many distinct organs.

“These septa are intersected transversely by very thin plates or membranes, whose breadth is the distance between any two septa, and therefore of different breadths in different parts; broadest at that edge which is next to the skin; narrowest at that next to the centre of the body, or to the middle partition which divides the two organs from one another.

“Their lengths are equal to the breadths of the septa between which they are situated. There is a regular series of them continued from one end of any two septa to the other. They appear to be so close as even to touch. In an inch in length there are about 240, which multiplies the surface in the whole to a vast extent.

“The nerves in this animal may be divided into two kinds; the first, appropriated to the general purposes of life; the second, for the management of this peculiar function, and very probably for its existence. They arise in general from the brain and medulla spinalis, as in other fish; but those from the medulla are much larger than in fish of equal size, and larger than is necessary for the common operations of life.

“The nerve which arises from the brain, and passes down the whole length of the animal, (which, I believe, exists in all fish,) is larger in this than in others of the same size, and passes nearer to the spine. In the *common eel* it runs in the muscles of the back, about midway between the skin and spine. In the *cod*, it passes immediately under the skin. From its being larger in this fish than in others of the same size, one might suspect that it was intended for supplying the organ in some degree; but this seems not to be the case, as I was not able to trace any nerves going from it to join those from the medulla spinalis, which run to the organ.

“This nerve is as singular an appearance as any in this class of animals; for surely it must appear extraordinary, that a nerve should arise from the brain to be lost in common parts, while there is a medulla spinalis giving nerves to the same parts. It must still remain one of the inexplicable circumstances of the nervous system.

“The organ is supplied with nerves from the *medulla spinalis*, from which they come out in pairs between all the vertebrae of the spine. In their passage from the spine, they give nerves to the muscles of the back, &c. They bend forwards and outwards upon the spine, between it and the muscles, and send out small nerves to the external surface, which join the skin near to the lateral lines. These ramify upon the skin, but are principally bent forwards between it and the organ, into which they send small branches as they pass along. They seem to be lost in these two parts. The trunks get upon the air-bladder, or rather dip between it and the muscles of the back, and continuing their course forwards upon that bag, they dip in between it and the organ, where they divide into smaller branches; then they get upon the middle partition, on which they continue to divide into still smaller branches; after which they pass on, and get upon the small bones and muscles which are the

bases for the under-fin, and at last they are lost on that fin. After having got between the organ and the above-mentioned parts, they are constantly sending small nerves into the organs; first into the great organ, and then into the small one; also into the muscles of the fin, and at last into the fin itself. These branches, which are sent into the organ as the trunk passes along, are so small, that I could not trace their ramifications in the organs.

“In this fish, as well as in the *torpedo*, the nerves which supply the organ are much larger than those bestowed on any other part for the purposes of sensation and action; but it appears to me, that the organ of the *torpedo* is supplied with much the larger proportion. If all the nerves which go to it were united together, they would make a vastly greater chord than all those which go to the organ of this eel. Perhaps when experiments have been made upon this fish, equally accurate with those made upon the *torpedo*, the reason for this difference may be assigned.

“How far this organ is vascular I cannot positively determine; but from the quantities of small arteries going to it, I am inclined to believe that it is not deficient in vessels.

“The arteries arise from the large artery which passes down the spine; they go off in small branches like the intercostals in the human subject, pass around the air bladder, and get upon the partition together with the nerves, and distribute their branches in the same manner.

“The veins take the same course backwards, and enter the large vein, which runs parallel with the artery.” Paul. Transf. vol. lxx. p. 395.

Plate XVII. fig. 1. of the *Anatomy of Fishes*, exhibits the whole of the two organs in the *gymnotus electricus* on each side, the skin being removed as far as these organs extend: *a*, the lower surface of the head of the animal; *b*, the cavity of the belly; *c*, the anus; *d*, the fin; *e*, the back of the fish where the skin has not been removed; *ff*, the fin which runs along the lower edge of the fish; *ggg*, the skin turned back; *h, h, h*, the lateral muscles of the above fin removed and carried back with the skin, to expose the small organ; *i*, part of the muscle left in its place; *k k k*, the large organ; *lll*, the small organ; *m n m m*, the substance which divides the large organ from the small; *n*, at this place the above substance is removed.

In Plate XVIII of the *Anatomy of Fishes*, fig. 1. shows a section of the whole thickness of the *gymnotus electricus*, near the upper part, a little magnified. The skin is removed as far back as the posterior edge of the organ, and the other parts immediately belonging to it, such as the medulla spinalis. There are several pieces or sections taken out of the organ, which expose every thing that has any relation to it. At the upper and lower ends of the figure, *ff*, the organ is entire, the skin only being removed; *aa*, the body of the animal near the back, covered by the skin; *bb*, the belly-fin covered also by the skin; *c*, part of the skin removed from the organ, and turned back; *d, d*, the muscles which move the fin laterally, and which immediately cover the small organ; *e*, the middle muscles of the fin, which lay immediately between the two small organs; *ff*, the outer surface of the large organ, as it appears when the skin is removed; *g*, the small organ, as it appears when the lateral muscles are removed; *h, h*, the cut ends of the muscles of the back, which have been removed to expose the deeper seated parts; *b*, the cut ends of the large organ, part of which has also been removed to expose the deeper seated parts; *k*, the cut end of the small organ; *l*, a part of the large organ, the rest having been removed; *m*, the cut end of the above section; *n*, a section of the small organ; *oo*, the

the middle partition which divides the two large organs; *p*, a fatty membrane, which divides the large organ from the small; *q*, the air-bladder; *r*, the nerves going to the organ; *s*, the medulla spinalis; *t*, the finzular nerve.

Fig. 2. of Plate XVIII. of the *Anatomy of Fishes*, is a transverse section of the electric eel, exposing at one view all the parts of which it is composed: *a*, the external surface of the side of the fish; *b*, the under-fin; *c, c, c, c*, the cut ends of the muscles of the back; *d*, the cavity of the air-bladder; *e*, the body of the spine; *f*, the medulla spinalis; *g*, the large artery and vein; *h, h*, the cut ends of the two large organs; *i, i*, the cut ends of the two small organs; *k*, the partition between the organs.

The structure of the electric organ is less complicated in the *silurus electricus* than in the *torpedo* or *gymnotus*. In this fish, Geoffroy describes it to be extended all round the body of the animal, immediately below the skin: it is formed by a considerable collection of cellular tissue, so thick and compact, that on the first view it might be taken for a stratum of lard; but when closely inspected, it is observed that this organ is composed of real tendinous or aponeurotic fibres interwoven with each other, and which, by their different crossings, form a reticulation, the meshes of which are not distinctly visible without the help of a magnifying glass. The small cells of this reticulation are filled with an albuminogelatinous matter, exactly resembling that met with in the other electric fishes. All communication is prevented in the inside by a very strong aponeurosis, which extends over the whole electric reticulation, and which adheres to it so closely that it cannot be separated without tearing it. It is further covered by a thick layer of fat, which also contributes to insulate the organ.

The nerves which are distributed to the electric organ of the *silurus* differ from those of the *torpedo*, and the *electric eel*.

They proceed from the brain; and are the same which are found in all fishes, under the lateral line of the body; but these two nerves of the eighth pair in the *silurus electricus* have a direction and volume which are peculiar to that species: they descend, approaching each other, on their issuing from the cranium, towards the body of the first vertebra, which they traverse. They first introduce themselves through an orifice, peculiar to each other, and then issue on the opposite side by one aperture: after re-ascending they suddenly separate, and proceed under each of the lateral lines. They are then found lodged between the abdominal muscles, and the aponeurosis, which extends over the electric reticulation. In the last place, they send beneath the skin large branches, which proceed to the right and left of the principal nerve. These branches are in number twelve to fifteen on each side; they pierce the aponeurosis, which lines the interior surface of the reticular tissue, and are lost in the latter. *Bulletin de la société Philomatique*, tom. iii. p. 169; and an extract from *Annales du Muséum N^o 1*, in *Phil. Mag.* vol. xv. p. 126.

In Plate XVII. of the *Anatomy of Fishes*, fig. 2. represents the *silurus electricus*, with the organ exposed, by a large portion of the integuments being raised; *a*, the aponeurosis, which extends under the whole of the electric organ; *b*, the thickness of the reticulation; *c, c*, the nerve of the eighth pair going to the electric apparatus; *d, d*, abdominal muscles.

The substance which is found to fill the columns of the *torpedo*, the interstices of the *gymnotus*, and the muscles of the *silurus*, is a peculiar combination of albumen and gelatine; it is of the same nature with the contents of what Monroe has improperly called the mucous ducts in fishes, and that transparent substance which

envelopes the spawn of frogs; it does not dissolve, but becomes more solid when immersed in water, in consequence of the coagulation of its albuminous part; we have submitted it to the action of tannin, with which it combines, and forms an insoluble compound like gelatine.

The phenomena exhibited by electric fishes are of so extraordinary a nature that they have engaged the attention of every physiologist who has had the opportunity of observing them; but although every occasion has been embraced to make experiments upon the subject, much investigation is still required to arrive at the explanation of the electric faculty, and even to determine disputed points of fact. The very rare occurrence of procuring any of these animals alive in this country prevents us from adding any thing to the stock of knowledge already obtained upon the subject, we can therefore only quote the observations and experiments of other physiologists.

The preceding description of the electrical apparatus in three species would seem to prove, that a similar system of organization belongs to all fishes which enjoy the electric property. The effects of this structure are also similar, and differ chiefly with respect to the degree. All the electric fishes are capable of exciting in other animals a sensation resembling that produced from the shock of an electrical jar. The *gymnotus* is endowed with the greatest power of this kind; the *torpedo* next, and the *silurus* the least of the three.

The *gymnotus* is said, by Garden, to grow sometimes, in Surinam, 20 feet long, and to be able to give shocks which prove instantaneously fatal to any person receiving them.

Mr. Humbolt states, that a *torpedo*, about 14 inches long, communicated shocks which reached above the elbow, and were difficult to bear even by a person accustomed to receive shocks from an electrical machine; whilst, on the other hand, Walsh found, in about 200 shocks, that only one was strong enough to pass beyond the elbow. Much of the force of the shock depends upon the natural strength of the animal and its vigour at the moment of the experiment; it is said to have very little electric power in winter; it is always much diminished in consequence of the fish remaining for any time out of the water. The shocks, however, do not appear to be lessened in strength by repetition, unless the animal be otherwise exhausted. Thus Ingehouz observed, "that when the shocks of the *torpedo* followed each other very fast, they were stronger at last than in the beginning."

Electric fishes are capable of repeating the shocks very frequently in a short space of time. Mr. Walsh reckoned fifty in a minute and a half given by the *torpedo*; and upon another occasion he calculated, that 100 were delivered in about five minutes.

When the *torpedo* administers a shock it is always observed to deprets the eyes and drop the triangular curtain which covers the pupil, and generally to make some movement of the lateral fins. The other electric fishes do not accompany these shocks by any visible muscular effort.

The *torpedo* also differs from the others in sometimes benumbing the part which touches it. Mr. Walsh accounts for the production of numbness by supposing the shocks to be very minute, and so closely following each other as not to be distinguishable, which may be effected by a successive discharge of the numerous columns of the organ, in the manner of a running fire of musketry. In this continued effort, as well as the instantaneous shock, the eyes of the *torpedo*, usually prominent, are withdrawn into their sockets: it is from the benumbing property of the *torpedo* that it derives its name.

The faculty in these fishes of exciting by the touch, the sensation

fenation of a shock, or of numbness, in other animals, has been naturally and generally referred to the principle of electricity; even the Arabs, (according to Geoffroy) who always distinguished every animal by a generic and specific name, considering only the extraordinary property of the *torpedo* and *silurus electricus*, and comparing it with physical electricity, called both fishes by the same name, *riad* or *raach*, which is also employed in the Arabian language to signify thunder.

Most physiologists have considered the electric organs of fishes as resembling exactly the Leyden jar, or rather a battery of them: they have compared the nerves and albumino-gelatinous substance to the metals, and the aponeuroses to the glass; thus supposing the electric organ to consist of conducting and non-conducting substances, and that when the equilibrium is restored between them, the shock is produced.

Unquestionably there are many circumstances in which the common electric shock, and that obtained from fishes agree, but there are other points in which they materially differ.

The sensations occasioned by artificial and animal electricity are similar.

The shock from an electric fish is only communicable through what are called conducting substances, and is also intercepted by the non-conductors; thus it may be received through the medium of wire of different metals, wood, water, and the animal substance; while a person touching it with glass, sealing-wax, &c. receives no shock, notwithstanding the fish gives evidence of the discharge by the motion of the eyes, &c.

The shock will be transmitted to a number of persons taking hands; those at the extremities completing the ring by touching the fish. In this manner Walsh has communicated a shock to four or five people at the same moment, who experienced exactly the sensation of a shock from an electric jar, except that it was weaker. Dr. Williamson gave shocks to ten or twelve persons at once by an *electric eel*.

The effect of the electric fishes differs from common electricity in several circumstances. However strong the shock may be, it never has been seen to produce the least noise or luminous appearance. Most experimentalists also agree, that the shock will not pass through the smallest portion of air; the conducting substances must be in actual contact with each other.

Williamson screwed two pieces of wire in opposite directions into a board, leaving an interval between their points of the $\frac{3}{8}$ th part of an inch, his assistant and himself held the opposite ends of the wire, and established a communication with the *eel* by means of their other hands, but no shock passed. On repeating the experiment and screwing the wires so as to bring their points within the distance of the thickness of double post paper of each other, the shock was felt by both persons, but still no spark was discernible, which we conceive renders the accuracy of the experiment doubtful.

Dr. Bancroft indeed asserts, that in Guiana the *electric eel* shocked his hand at the distance of some inches from the water; a result, however, so very different from the observation of all other experimentalists appears more than questionable.

The electricity of fishes has not the effect of attracting floating substances. When a person is insulated, and touches the fish, he receives a shock as at other times, but gives no appearance of excess of electricity, however long he may keep up his communication with the animal. A Leyden

phial also, being put into contact with an electric fish, never becomes charged.

The electric organ differs from the Leyden phial, as Volta has very properly observed, by being entirely composed of conducting substances. The aponeuroses and membranes which form its various surfaces are not of an insulating nature, like glass, resin, silk, &c. They cannot be exposed to friction, nor disposed and charged in the manner of the small plates of Franklin, or electrophores. Volta, therefore, concludes that the electric organs do not act upon the principle of a Leyden jar, or an electrophore or condenser, but that they entirely resemble the Galvanic pile, in which conducting substances become exciters of electricity, by being placed in a particular relation with respect to each other.

It would appear that the electric phenomena of fishes are produced in a manner differently from every species of physical electricity. The former are not accompanied with any chemical changes, they do not affect our organs of sense, by any display of light, exhalation of odour, or explosive sound. Their mode of operation is not regular and uniform, or governed by external influence, but depends upon the life, and even upon the volition of the animal; for all experimentalists agree in stating that the electric fishes regulate the strength and frequency of the shocks at pleasure. There is no appearance of accumulation or of diminution of the electric power, except what arises from the will of the animal; the last shocks which one of these fishes administers being often more strong and frequent than the first.

The nerves seem to be the principal agents in the exercise of the electric faculty, as they are always found larger in the organs than would be required in parts of the same magnitude, for any species of sensation or voluntary motion.

The great error of physiologists has always been to account for the operations of organized beings, upon the principles which regulate the phenomena of inanimate matter. We are led to make this observation from comparing the electric faculty of fishes, with the property of exhibiting light in some animals, and the power of generating heat, which is found in all living bodies; these three functions, although producing different results, appear to be very similar in their nature, and are equally inexplicable by the laws of physical and chemical attractions; the strongest proof of which may be found in the want of success, which has followed all the attempts that have hitherto been made to explain them upon these principles.

Of what use is the electric property to those fishes which possess it? Drs. Williamson and Garden state, that it is employed to kill, or at least stupefy other fishes, upon which they prey.

The former relates, amongst his experiments on the *electric eel*, that some small fishes being thrown into the same water where it was swimming, it immediately killed and swallowed them; but a larger fish being thrown in, it was also killed, although it was too large for the *eel* to swallow; another fish was thrown into the water at some distance from the *eel*, it swam up to the fish, but presently turned away, without offering it any violence. After some time it returned, when, seeming to view it for a few seconds, it gave the fish a shock, upon which it instantly turned up its belly and continued motionless; at the same instant Dr. Williamson received a shock in his hand, which had been previously introduced into the water. A third fish was thrown into the water, to which the *eel* gave such a shock that it turned on its side, but continued to give signs of life; the *eel* seeming to observe this as it was turning away, immediately returned and struck it quite motionless. The *eel* never attempted to swallow any of these fish after the first, although he killed many of them.

them. When any of the larger fishes that had been shocked, although apparently dead, were removed into water in another vessel, they presently recovered. Phil. Transf. vol. 65. p. 97.

Dr. Garden gives precisely the same account of the electric eel killing or benumbing its prey, and states that it kills, by repeated shocks, fish which are larger than it can swallow.

It seems, therefore, that the electric property is not an useless one to those fishes which possess it: besides being the means of securing their prey, it must also form an excellent defence for them against the larger fishes, who might otherwise devour them. For a more detailed account of the torpedo, and *gymnotus electricus*, we refer the reader to Franc. Redi Exper. Nat. 1666. *Observazioni intorno alle Torpedini*, de Steof. Lorenzini, 1678.—Kœmpf. *Amœn. Exot.* 1712.—A letter from Jno. Walsh, esq. to Dr. Franklin, on the electric property of the *torpedo*, in Phil. Transf. vol. 63. p. 461.—Experiments and observations on the *gymnotus electricus*, or *electric eel*, by Dr. Hugh Williamson, Phil. Transf. vol. 65, p. 94.—Account of the *gymnotus electricus*, by Dr. Alex. Garden, Phil. Transf. vol. 65. p. 102.—Experiments made at Leghorn on the *torpedo*, by Dr. John Ingenhouz, Phil. Transf. vol. 65, p. 1.—Bancroft's Natural History of Guiana.—*Histoire Naturelle des Poissons*, par Læcpepe, tom 2.—A Letter from Professor Volta to sir Joseph Banks, on the electricity excited by the apposition of different conducting substances, in Phil. Transf. for 1800, part. 2.—Memoir on the Comparative Anatomy of the electric organs of the *torpedo*, the *gymnotus electricus*, and the *silurus electricus* by E. Geoffroy, in vol. 5 of the *Annales de Museum National*.—Experiments on the *torpedo*, by Messrs. Humbolde and Gay Lussac. in *Annales de Chemie*, No. 166.

FISH, *Migration of*, denotes their departure from some parts of the ocean and their removal to other parts; and also to rivers at certain seasons of the year, for the purpose of depositing their spawn, or of obtaining the means of subsistence.

The migration of certain kinds of fish in shoals and infinite multitudes, to certain coasts at certain times of the year, is a thing of great advantage to mankind, as it gives opportunities of taking them with great ease, and in vast quantities; but the reason of these periodical returns of the several kinds does not seem much understood, though a little observation would probably clear it up. There is a small insect common in many seas, but peculiarly plentiful on the coasts of Normandy in the months of June, July and August. This is well described by Rondeletius, under the name of the sea-caterpillar: and at this time of the year it is so frequent in the place before mentioned, that the whole surface of the water is covered with it as with a scum. This is the season of the year when the herrings come also in such prodigious shoals to those coasts. The fishermen complain much of these nasty vermin, which disturb their fisheries; but they do not consider that it is to these alone that their fisheries are owing; for it is evident that the herrings feed on these creatures greedily, by the vast quantity found in all their stomachs: and it is highly probable, nay scarcely to be doubted, that the reason of those fish coming up in such numbers is to feed on them; probably, if observation was made, the same would be found to be the case in all the other places where the herrings come in the same sort of plenty. The mackerel come down in the same numbers regularly at certain times of the year, and for the same sort of reason. This fish is an herb-eater, and is particularly fond of that sea-plant called by naturalists the narrow-leaved purple palmated sea-wrack; this grows

in great abundance on the coasts of England, and many other places, and is in its greatest perfection in the beginning of the summer, though some times later than others, according to the severity or mildness of the winter. The whole occasion of these fish coming in such quantities is to feed on this plant; and those who would attend to its growing up, would know when to expect the mackerel better than those who listen for thunder for the signal of them. The tunnies come at certain seasons to the coasts of Provence and Languedoc, in the same shoals that herrings and mackerel do to other places. This seems to be on another occasion; the fish called by the French the emperor, and by the same confounded with the sword-fish, is the great enemy of these fish, and in summer is so plentiful in those seas, that they find no way of saving themselves, but by flying to the shallow waters, where the other cannot easily follow them; hence they frequent the shores. The pilchards caught upon the coasts of Brittany, and making a considerable article of commerce for that province, are yet a stronger proof of the natural means that bring fish in shoals to certain places, than any other. These fish evidently come for food, and that not natural to the place, but prepared for them by the inhabitants.

The people of Brittany purchase from Norway the offal and entrails of all the large fish caught in the northern seas; this is of late years become a regular and considerable article of trade; they cut these to pieces, and strew them in vast quantities over the whole surface of the sea along their coasts, at times when the winds do not fit so as to blow it off. This always brings together the pilchards in as vast shoals as the herring and mackerel come in other places; and the fishermen catch them in such quantities, as to be able to supply all the maritime places in the neighbourhood, with them, at a small price. The salmon, a fish bred in rivers, yet going at certain times to the sea, is another of those fish which come up at times in vast shoals. See SALMON. We may here add that the desire of food urges fish of one species to follow those of another, upon which they prey, through immense tracts of ocean, even from the vicinity of the pole down to the equator. Thus the cod from the banks of Newfoundland pursues the whiting, which is driven before it even to the southern shores of Spain; and the cachelot, a species of whale, is said, in the same manner, to pursue a shoal of herrings, and to swallow great numbers at a mouthful.

In the Philosophical Transactions, N^o 463. sect. 1. we have a method of preparing specimens of fish, by drying their skins, as practised by Dr. Gronovius.

FISH, *Black*. See PERCA nigra and SILURUS *Anguillaris*.

FISH, *Petrified*, in *Natural History*. The remains of scabrous or finny fish in the strata, are not very commonly found, compared with the vast numbers and variety of shell-fish whose remains are found; but some very perfect specimens do occur in different strata. Dr. Townson (*Philos. of Mineral*. p. 106.) seems to consider fishes as peculiar to some particular kinds of strata; in which, however, he is evidently mistaken, though often they are found in slaty limestone, in the quarries of La Boica and Pappenheim; see W. Martin's *Outlines*, &c. p. 26, and 79. Mr. Kirwan (*Geol. Ess.* pages 234, 235, 239, 245, and 253.) mentions fish as having been found in different parts of the world in gypsum, in marlite, in argillite, in swine-stone, and in argillaceous sand-stone. On the mountains of Castrava, great diversity of fishes are found, in a white laminated stone. And in the blue mas, or water limestone strata of England, beautiful specimens of flattened fish are said to be found, at Barrow on Soar, in Leicestershire, (the other Barrow near

Bredes.

Bredon in the same county has quarries of the yellow or magnesia limestone, a circumstance not always adverted to, in speaking of barrow lime, and in other places on its range. Mr. Graydon (Irish Transactions, vol. v. p. 310.) supposes the monte bolca fish to have been suddenly interred by being enveloped in a diffusion of lime, arising from immense masses of calcareous stone, ejected in a calcined state, by subaqueous volcanoes. To us it seems more probable that these squamal fish were destroyed by the original creation of the matter which now entombs them, whose diffusion in the water wherein they lived, occasioned their fall to the bottom and extension on their flat side when dying, in the position in which they now appear on the lamina of the lower stone, before the upper one, which entombs them, was produced by the precipitation of the stony matter from the fluid that had occasioned their death; and on similar principles, we think it easy to account for all the fossil reliquia, or relics of the primary creation of organized beings, see RELIQUIA; under which title, we propose to give the heads of Mr. W. Martin's excellent mode of arranging extraneous fossils, from his work above quoted.

FISH, with regard to commerce, is distinguished into *dry, pickled, green, and red*. *Dry or salt fish*, is that which is salted, and dried either by the heat of the sun, or by fire. Such principally are the cod, stock-fish, herring and pilchard. See FISHERY. *Green fish*, is that lately salted, and which yet remains moist: as green cod, &c. *Pickled fish*, is that boiled and steeped in a pickle made of salt, vinegar, &c. as salmon, cod, herring, mackarel, pilchard, anchovy, and oysters. *Red fish*, is some fresh fish broiled on the gridiron, then fried in oil of olives, and barrellled up with a proper liquor, as new olive oil, vinegar, salt, pepper, cloves, and laurel leaves, or other herbs. The best fish thus prepared are sturgeon and tunny.

FISH, considered as a food, makes a considerable article in the furniture of the table; and the breeding, feeding, catching, &c. of them, constitute a peculiar art of no small moment in the economy of a gentleman's house and garden. To this relate the ponds, stews, &c. described in their proper places. See FISH-POND, STEW, &c.

FISH, *Blowing of*, is a practice similar to that of blowing flesh, poultry, and pigs, and adopted for the same deceitful purposes. The method of blowing fish, especially cod and whittings, is by placing the end of a quill or tobacco-pipe at the vent, and pricking a hole with a pin under the fin which is next the gill; thereby making the fish appear to the eye large and full, which, when dressed, will be flabby, and little else than skin and bones. But this imposition may be discovered by placing the finger and thumb on each side of the vent, and squeezing it hard; the wind may be perceived to go out, the skin will fall in, and the fish appear lank and of little value.

FISH, *Breeding of*. See FISH-POND.

FISH, *Castration of*, is a method first practised by Mr. Tull, in order to prevent the excessive increase of fish in some of his ponds, where the numbers did not permit any of them to grow to an advantageous size. But he afterwards found, that the castrated fish grew much larger than their usual size, were more fat, and always in season. This operation may be performed both on male and female fish; and the most eligible time for it is when the ovaries of the female have their ova in them, and when the vessels of the male, analogous to these, have their seminal matter in them; because at this time, these vessels are more easily distinguished from the ureters, which convey the urine from the kidneys into the bladder, and are situated near the seminal vessels on each side of the spine; which, without sufficient attention,

may be mistaken for the ovaries, especially when these last are empty. The time least proper for this operation, is just after they have spawned, because the fish are then too weak and languid to bear with success, so severe an operation; however, with skill and care, it may be performed almost at any time. When a fish is to be castrated, it must be held in a wet cloth, with its belly upwards; then with a sharp pen-knife, having its point bent backwards, the operator cuts through the integuments of the rim of the belly, taking care not to wound any of the intestines. As soon as a small aperture is made, he carefully inserts a hooked pen-knife, and with this dilates this aperture from between the two foreskins, almost to the anus. He then, with two small blunt silver hooks, five or six inches long, and of this form , by the help of an assistant, holds open the belly of the fish; and with a spoon or spatula, removes carefully the intestines from one side. When these are removed, you see the ureter, a small vessel, nearly in the direction of the spine, and also the ovary, a larger vessel, lying before it, nearer the integuments of the belly. This last vessel is taken up with a hook of the same kind with those before mentioned, and, after detaching it from the side far enough for the purpose, divided transversely with a pair of sharp scissors, care being taken that the intestines are not wounded or injured. After one of the ovaries has been divided, the operator proceeds to divide the other in the same manner; and then the divided integuments of the belly are sewed with silk, the stitches being inserted at a small distance from one another. Mr. Tull observes farther, that the spawning time is very various; that trouts are full about Christmas; perch in February; pikes in March, and carp and tench in May; and that allowance must be made for climates and situation, with regard to the spawning of fish. When the fish are castrated, they are put into the water where they are intended to continue; and they take their chance in common with other fish, as though they were not castrated. With tolerable care, few die of the operation. Phil. Trans. vol. xlviii. part ii. art. 106.

FISH, *Eyes of*. See EYES and ANATOMY OF FISH.

FISH, *Fecundity of*, has been taken notice of by various writers, who have furnished instances of it in some particular species that have been thought surprising. M. Petit is said to have found in the carp 342,144 eggs; and Leuwenhoeck, in a cod of middling size 9,354,000. But Mr. Harmer has lately pursued the investigation of this curious subject with peculiar attention and accuracy, and extended his enquiries to a greater variety of species than any other person. The method which he adopted was that of weighing the whole spawn very exactly; he then took a piece weighing a certain number of grains, and carefully counted the eggs contained in it; and by dividing the number of eggs by the number of grains, he found, nearly, how many eggs there were in each grain. His computation of the number of eggs extended no farther than to those which he could distinguish with his naked eye; though by this limitation, he omitted many eggs, discoverable by a microscope, that might justly have been counted. The weights he used were avoirdupoise, and he reckoned 437½ grains to an ounce.

The following table exhibits the general result of his enquiries: the first column contains the names of the fish which he examined; the second, their weight; the third, the weight of their spawn; and the fourth their fecundity; and the fifth the time of the year when each species of fish was examined. He has also added other columns, exhibiting the portion of spawn weighed, and the number of eggs found in a grain, and the result of examining several varieties

ties of the same species of fish of different weights, which the curious reader may consult. See Phil. Transf. vol. lvii. for 1767. art. 30. p. 280.

Abstract of the Table.

Fish.	Weight. oz. dr.	Weight of spawn. Grains.	Fecundity. Eggs.	Time.
Carp	25 3	2571	203109	April 4.
Cod-fish	—	12540	3686760	Dec. 23.
Floander	24 4	2200	1357400	Mar. 14.
Herring	5 10	480	36960	Oct. 25.
Lobster	36 0	1671	21699	Aug. 11.
Mackarel	18 0	1223 $\frac{1}{2}$	546681	June 18.
Perch	8 9	765 $\frac{1}{2}$	28323	April 5.
Pike	56 4	5100 $\frac{1}{2}$	49324	April 25.
Prawn (127 grains)	—	—	3806	May 12.
Roach	10 6 $\frac{1}{2}$	361	815 $\frac{1}{2}$	May 2.
Shrimp (39 grains)	—	7	6807	May 3.
Smelt	2 0	149 $\frac{1}{2}$	3 $\frac{1}{2}$ 27 $\frac{1}{2}$	Feb. 21.
Soal	14 8	542 $\frac{1}{2}$	100362	June 13.
Tench	40 0	—	383252*	May 28.

* N. B. Part of the spawn of this fish was accidentally lost, and therefore this number is considerably too small. Such an amazing increase, if allowed to attain maturity, would overstock nature; and even the ocean itself would not be able to contain, much less to provide for its inhabitants. But this surprising fecundity is wisely directed to two important purposes; it preserves the species among innumerable enemies, and it serves to furnish the rest with sustenance adapted to their nature.

Fish, *Feeding of*. 1. In a stew, thirty or forty carps may be kept from October to March, without feeding; and by fishing with trammels, or flews, in March or April, you may take from your great waters, to recruit the flews; but you must not fail to feed all summer, from March to October again, as constantly as cooped chickens are fed; and it will turn to as good an account.

2. The constancy and regularity of serving the fish conduce very much to their well eating, and thriving.

The care of doing this is best committed to the gardener, who is always at hand, and on the spot.

3. Any sort of grain boiled is good to feed with, especially peas and malt coarse ground; the grains after brewing, while fresh and sweet, are also very proper; but one bushel of malt, not brewed, will go as far as two of grains; chippings of bread, and orts of a table, steeped in tap-droppings of strong beer, or ale, are excellent food for carps. Of these the quantity of two quarts to thirty carps, every day, is sufficient; and to be so fed morning and evening, is better than once a day.

There is a sort of food for fish that may be called accidental, and is no less improving than the best that can be provided; and this is when the pools happen to receive the wash of commons, where many sheep have pasture; the water is thus enriched by the soil, and will feed a much greater number of carps than otherwise it would do; and farther, the dung that falls from cattle standing in water in hot weather, is also a very great nourishment to fish. See farther on the method of feeding carp, and the advantages resulting from it, under the article FISH-PONDS.

The best food to raise pikes to an extraordinary fatness is eels; and without them it is not to be done, but in a long time. Setting these aside, small perches are the best meat. Breams put into a pike-pond breed exceedingly;

and are fit to maintain pikes; which will take care they do not increase over much; the numerous fry of roaches and rudds, which come from the greater pools into the pike-quarters, will likewise be good diet for them.

Pike in all streams, and carp in hungry spring waters, being fed at certain times, will come up and take their meat almost from your hand.

The best feeding place is towards the mouth of the pond, at the depth of about half a yard; for by that means the deep will be kept clean and neat, the meat thrown into the water, without other trouble, will be picked up by the fish, and nothing will be lost; yet there are several devices for giving them food, especially peas; as a square board like a trencher, supported by four strings, one at each corner, with leads at the bottom for sinking it, on which the food may be let down into the water.

When fish are fed in the larger pools or ponds, where their numbers are great, malt boiled, or fresh grains, is the best food. Thus carps may be fed and raised like capons, and tench will feed as well; but perch are not for a stew in feeding-time.

Fish, *Generation of*. The general opinion of the world as to the generation of fish, is, that the female deposits her spawn or eggs, and that the male after this ejects the sperm or male semen upon it in the water, by which it is fecundated. The supposed want of the organs of generation in fish, has given an apparent probability to this; but Linnæus is very decided against it. He affirms that there can be no possibility of the impregnation of the eggs of any animal out of its body.

To confirm this, the general course of nature, not only in birds, quadrupeds, and insects, but even the vegetable world, has been called in to his assistance, as proving that all impregnation is performed whilst the ova are in the body of the parent, and he supplies the want of the organs of generation by a very strange process, affirming that the males eject their semen always some days before the females deposit their ova or spawn, and that the females swallow this, and have their eggs by that means impregnated by it. He says, that he has often seen three or four females at this time frequently gathered about the male, and greedily snatching up into their mouth the semen he ejects: he mentions some of the efoeces, some perch, and some of the cyprinii, in which he had seen this process. Mr. Tul asserts, that he has frequently seen fish in actual copulation, and that this is generally done before the ova arrive at maturity. Phil. Transf. vol. xviii. part ii. art. 106. p. 873. See *Anatomy of Fish*.

Fishes have different seasons for depositing their spawn; some, that live in the depths of the ocean, are said to choose the winter months; but, in general, those with which we are acquainted choose the hottest months in summer, and prefer such water as is somewhat warmed by the beams of the sun. They then leave the deepest parts of the ocean, which are the coldest, and shoal round the coasts, or swim up the fresh water rivers, which are warm, as they are comparatively shallow. When they have deposited their burdens they return to their old stations, and leave their progeny to fight for themselves. The spawn continues in its egg-state in some fish longer than in others, and thus in proportion to the animal's size. *L. g.* In the salmon, the young animal continues in the egg from the beginning of December till the beginning of April; the carp continues in the egg for above three weeks; the little creel fish from China is produced in less time. All these, when excluded, at last escape by their minute and agility. They rise, sink, and swim much more readily than grown fish, and they can escape into shallow waters when pursued. But with all these advantages, scarcely

scarcely one in a thousand survives the imminent perils of its youth.

FISH, *Generical names of.* See **GENERIC** *Name.*

FISH, *Gilding of.* See **GILDING.**

FISH, *Hearing of.* See *Anatomy of FISH.*

FISH, *Isinglass.* See **HUSO.**

FISH, *Island.* See **ISLAND-fish.**

FISH, *Milt of.* See **MILT.**

FISH, *Needle.* See **NEEDLE-fish.**

FISH, *Nostrils of.* See *Anatomy of FISH.*

FISH, *Royal.* See **ROYAL FISHES.**

FISH, *Shell.* See **SHELL** and **CONCHOLOGY.**

FISH, *Stealing of,* by persons armed and disguised, is felony without benefit of clergy by 9 Geo. I. cap. 22. See **BLACK act.** And by 5 Geo. III. cap. 14. the penalty of transportation for seven years is inflicted on persons stealing or taking fish in any water, within a park, paddock, orchard, or yard; and on the receivers, aiders, and abettors; and a forfeiture of five pounds to the owner of the fishery is made payable by persons taking or destroying (or attempting so to do) any fish in any river or other water within any inclosed ground, being private property.

FISH, *Swimming of.* See **SWIMMING of fish,** **Air-bladder,** and *Anatomy of FISH.*

FISH, *Teeth of.* See *Anatomy of FISH.*

FISH, in *Astronomy.* See **PISCES.**

FISH-days. See **ABSTINENCE.**

FISH, in *Heraldry.* See **HERALDRY.**

FISH Bay, in *Geography,* a bay on the S. coast of Africa. S. lat. $34^{\circ} 30'$. E. long. $22^{\circ} 30'$.—Also, a bay on the W. coast of Africa. S. lat. $16^{\circ} 40'$.—Also, a bay on the N. E. coast of the island of St. Matthew, in the Mergui Archipelago.

FISH, *Little,* a bay on the W. coast of Africa. S. lat. $15^{\circ} 20'$.

FISH Creek, a river of Virginia, which runs into the Ohio. N. lat. $39^{\circ} 31'$. W. long. $81^{\circ} 5'$.—Also, a river of Maryland, which runs into the Chesapeake. N. lat. $38^{\circ} 38'$. W. long. $76^{\circ} 42'$.

FISH River, a river of West Florida, which runs into Mobile bay. N. lat. $30^{\circ} 30'$. W. long. $87^{\circ} 50'$.

FISH River, *Great, Rio l'Infanta* of the Portuguese, a river of Africa, which rises in the country of the Hottentots, beyond the Snowy mountains, and, in its long course, collects a multitude of streamlets, most of which are constantly supplied with water. On each side of its mouth is a rocky and open shore, but the projecting cheeks form a small cove or creek, which was frequented by the Portuguese shortly after their discovery of the Cape; though from the boisterous appearance of the sea upon the bar that evidently crosses the entrance of the river, it is difficult to conceive how they could trust their ships in such an exposed situation; and is, indeed, they were so small as to be able, at high water, to cross the bar, in which case they might lie, at all seasons, in perfect security. Great fish river is now considered as the eastern boundary of the Cape colony.

FISHBORN CREEK, a river on the N. side of the Isle of Wight, which runs into the sea. N. lat. $50^{\circ} 44'$. W. long. $1^{\circ} 4'$.

FISHER, JOHN, in *Biography,* a worthy English Catholic prelate, was born at Beverly in Yorkshire in the year 1459. His father dying when he was very young, he was placed under the instructions of a priest of the collegiate church in his native town. In the year 1474 he was entered a student at Michael house, Cambridge, a college that is now incorporated into Trinity-college. He took his degrees in the

year 1488 and 1491. In 1495 he was appointed one of the proctors of the university, and in a few months afterwards he was chosen master of Michael house, and entered into holy orders. He soon became distinguished on account of his great learning; and attained the high office of vice-chancellor of the university. Scarcely had he performed the duties of chancellor two years, when he was selected as chaplain and confessor to Margaret countess of Richmond, the king's mother. He so entirely gained the confidence of this lady that she committed herself and family to his government and direction. By his advice she established a divinity professorship at Oxford and one at Cambridge; and founded Christ's and St. John's colleges in the latter university. In 1501 he was admitted doctor in divinity, and in the following year the lady Margaret's first divinity professor in Cambridge. In 1504 he was raised to the bishopric of Rochester, and was afterwards frequently offered more valuable fees, which he refused, observing, that "though others have larger revenues, I have fewer souls under my care, so that when I shall have to give an account of both, which must be very soon, I would not desire my condition to have been better than it is." Fisher was now chosen chancellor of the university of Cambridge, and was much engaged in superintending the building of Christ's and St. John's college, being the most active agent and executor of the late countess of Richmond. When St. John's college was finished Fisher went to Cambridge, and opened it with due solemnity, and was commissioned to draw up a body of statutes for its government. The bishop afterwards proved a valuable benefactor to the college, and was the means of the appointment of that illustrious man, Erasmus, to lady Margaret's professorship of divinity, and afterwards to the Greek professor's chair. To the innovations proposed by Luther, bishop Fisher was decidedly hostile: he not only endeavoured to prevent the propagation of Lutheranism in his own diocese, and in the university of Cambridge, but wrote and preached with the utmost zeal against it. He is generally thought to have had a principal share in the composition of the work ascribed to Henry VIII. and published with his name, in defence of the "seven sacraments," against Luther, though Burnet and others are not disposed to give it to the bishop. Fisher at this period was very high in favour with the king, and so zealous in his opposition to the tenets of Luther, that he formed a design of going to Rome to concert measures with the pope for opposing their progress; but he was diverted from his design by cardinal Wolsey's convocation of a synod of the whole clergy of England for the same purpose. In this assembly he appeared in the character of a zealous advocate for reformation in the manners of the clergy; and some of his speeches on this and other important occasions are preserved in the Biographia Britannica. About the year 1527 the king applied to him for his opinion on the subject of his marriage with Catherine, his brother's widow. This was the rock on which he found red. So long as his sentiments were congenial with those of the monarch he was in the highest esteem; but now he gave a determination which did not correspond with his passions; he declared honestly, and without any reserve, "that there was no reason to question the validity of the marriage, since it was good and lawful from the beginning." The bishop had made up his mind on the business, and nothing could divert him from an avowal of it on all proper occasions, though he probably foresaw that his own ruin would be the consequence of his unyielding integrity. When the divorce came to be argued before the two legates, Campeggi and Wolsey, bishop Fisher, who was one of the queen's coun-

cil, exerted himself with much zeal in her behalf, presenting the legates with a book which he had written in defence of the marriage. The bishop did not stop here; he opposed the king in some other of his projects, and resisted a motion made for the suppressing of the smaller monasteries, and granting their revenues to the crown. The speech which he delivered on this occasion was received with great applause by those who adhered to the papal church, and with equal disapprobation by the advocates of the reformation. Some expressions which he used so much offended the house of commons, who complained to the king of the reflections which the bishop had cast on the representatives of the people, that the king sent for the prelate, and having heard his defence, dismissed him with an admonition, "to be more temperate in future." In the year 1530 he was twice in imminent danger of his life. His first escape was from poison which a man by the name of Rouse threw into some gruel preparing for the bishop's dinner: his second was from a bullet fired into his library where he usually sat. After this the bishop retired to Rochester, where he spent most of his time. In 1531 the question was agitated as to giving Henry VIII. the title of supreme head of the church of England: the bishop took the negative side of the question, and opposed the project with all his zeal. He next offended his sovereign by giving credit, or at least listening to the enthusiastic visions of Elizabeth Barton, the pretended holy maid of Kent. This woman, who was only an instrument in the hands of designing persons, carried on her impostures with a view of alienating the affections of the people from the king, and exciting insurrections against his government. The bishop, it was very evident, had no ill design in the part he took; but finding the prophets, as she was then denominated, was devoted to the interests of the queen; and having heard much of the sanctity of her manners, of the visions which she saw, and of the predictions which she uttered, and which were said to be realized, he conceived she was designed by providence to display and make triumphant the doctrines and authority of the church of Rome, over the principles of Lutheranism, which were rapidly spreading in England. Fisher accordingly listened to her prophecies, and concealed one of them which seemed to affect the king, or at least to strike a blow at his authority. She announced to her adherents, that if Henry should proceed in his divorce, and marry another wife, he would not be king seven months afterwards. The woman was apprehended, and in the hope of pardon confessed the particulars of her imposture, and named all those who had encouraged her delusions. The bishop was urged to make submissions to the king as the only way of assuaging his anger; he refused, and in 1534 a bill of attainder was passed against Elizabeth Barton and her accomplices. Bishop Fisher still refused to submit, and was adjudged guilty of misprison of treason, and condemned to forfeit all his goods and chattels to the king, and to be imprisoned during his majesty's pleasure. It is not certain that the act was enforced against him; but when the act was passed to annul the king's marriage with Catherine of Arragon, and to confirm that with Anne Boleyn, and enjoining all to take the oaths accordingly, bishop Fisher, instead of uniting with his brethren, left the capital. Opportunity was, however, given him again and again to consider the oath, till at length he absolutely refused; and was attainted in the parliament which met in 1534, and his bishopric was declared void. The bishop was thrown into the Tower, where he was treated with much severity, and, as it should seem, from some of his letters, scarcely allowed the common necessaries of life. Here he would probably

have been permitted to have ended his days, had not a cardinal's hat been conferred on him by pope Paul III. which so enraged the king, that he swore it should never be permitted to enter his dominions; and if Fisher were determined to wear it, it should be on his shoulders, for he would not leave him a head for the purpose.

From this time his destruction was resolved on, and the tyrant sent the solicitor-general, Rich, whose name is rendered infamous by undertaking the business, to pump out of him his secret opinions with regard to the supremacy, declaring he had the king's authority to say that no ill use whatever should be made of the communication, which he sought merely on account of the high opinion he entertained of his judgment and integrity. The bishop gave an unreserved decision on the subject, which the solicitor carried to his master; and on the instant a special commission was issued for trying him for high treason. Rich was the chief and indeed the only evidence that could affect the life of the venerable prisoner, and yet a jury, as infamous as the evidence, found him guilty. The bishop pathetically appealed to the court on the occasion, "I pray you, my lords, consider that by all equity, justice, wordly honesty, and courteous dealing, I cannot be directly charged with treason, though I had spoken the words indeed, the same not being spoken maliciously, but in the way of advice and counsel, when it was requested of me by the king himself; and that favour the very words of the statute do give me, being made only against such as shall maliciously gainsay the king's supremacy, and none other: wherefore, although by the rigour of the law you may take occasion to condemn me, yet I hope you cannot find law, except you add rigour to that law to cast me down, which hereby I hope I have not deserved." To Rich he addressed himself, "Mr. Rich, I cannot but marvel to hear you come in to bear witness against me of these words, knowing in what secret manner you came to me." He then assured the court that he (Rich) had told him, the king wished him to declare, that on the honour of a king, whatever he should say by this his secret messenger, he should reap no peril or danger therefrom, nor should any advantage be taken against him for the same. Still the court gave sentence, and, notwithstanding the honour of a king was opposed to it, Henry confirmed the bloody decree, and the worthy prelate was beheaded on Tower Hill on the 22d of June 1535, at the age of seventy-six. Erasmus represents him as a man of the greatest integrity, of deep learning, incredible sweetness of temper, and grandeur of soul. By friends and by enemies he was regarded as a pious and charitable man, not only learned himself, but a great encourager of learning. His chief work was a "Commentary on the seven penitential Psalms." Biog. Brit.

FISHER, in *Zoology*. See *MUSTELA Zibellina*.

FISHERMAN'S COVE, in *Geography*, a harbour on the S. coast of Pitt's Archipelago, within Nepean's sound. N. lat. 53° 18'. E. long. 23° 53'.

FISHERROW, a town of Scotland, in the county of Edinburgh, at the mouth of the Esk, in the frith of Forth, opposite to Musselburgh.

FISHER'S CANAL, a branch of an inlet leading from Fitzhugh's sound, on the W. coast of North America, so called by Capt Vancouver in 1793. At the entrance N. lat. 51° 57'. E. long. 232 7'.

FISHER'S ISLAND, an island in the Atlantic, in Long island sound, near the S. coast of Connecticut. It is about ten miles in length and two in breadth, with a good soil, favourable for rearing sheep and producing wheat and other grain. It is annexed to the township of South-hold, in

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Suffex county, on Long island. N. lat. 41° 12'. W. long. 72°.

FISHERSFIELD, a township of America, in the state of New Hampshire and county of Hillsborough, incorporated in 1763, containing 526 inhabitants; about 16 miles easterly of Charlestown.

FISHERY, a commodious place for fishing; or a place wherein great quantities of fish are caught.

The principal fisheries of Europe for salmon, herring, cod, and mackarel, are along the coasts of England, Scotland, and Ireland; for cod, on the banks of Newfoundland; for whales, about Greenland; for pearls, in the East and West Indies, &c.

FISHERY also denotes the commerce of fish; more especially the catching of them for sale. The fishery makes a principal branch of the British commerce. A great quantity of vessels and seamen are employed therein; and besides what is spent at home, large sums are yearly returned, merely for herring, cod, and pilchards, exported to Spain, Italy, and several parts of the Mediterranean, and the islands of the Archipelago.

Yet are our countrymen reproached, and with a good deal of justice, for their remissness in this branch of trade. The advantageous situation of our coasts might be of immense benefit to us, did we not let our neighbours overreach us therein. The Dutch, French, Hamburgers, &c. have been accustomed to come yearly in large shoals, and not only take the fish from our own coasts, but sell them to us for our money, when they have done.

Scotland suffers incredibly on this score: no country in Europe can pretend to rival it in the abundance of the finest fish, wherewith its numerous harbours, loughs, rivers, &c. are stored. In the river Dee, it is said, an hundred and seventy head of salmon is not very extraordinary for a single draft of a net; and the pickled salmon sent hence is allowed the best in Europe. The Scottish islands, especially those on the western side, do certainly lie the most commodiously for carrying on the fishing trade to perfection.

King Charles I. directed his attention to the Scottish fisheries in 1630 and 1633, in conjunction with a company of merchants under his royal commission and patronage, and encouraged by his bounty. With this view he ordered Lent to be more strictly observed; prohibited the importation of fish taken by foreigners, and agreed to purchase from the company his naval stores, and the fish for his fleets: but the civil wars soon set this plan aside. The company had built two storehouses or magazines; one on the small island of Hermetra, on the north side of North Uist, and the other upon a small island in Loch Madie, a celebrated bay of the above-mentioned North Uist. King Charles II. in 1661, made a like attempt; and was joined in it by the duke of York, lord Clarendon, and several other persons of rank and fortune. In prosecution of the design the most salutary laws were enacted by the parliaments of England and Scotland, in virtue of which all materials used in, or depending upon, the fisheries, were exempted from all duties, excises, and other imposts. In England the company was authorized to set up a lottery, and to make a voluntary collection in all parish churches; and other encouraging measures were adopted. Some Dutch families were invited, or permitted, to settle at Stronaway; but whilst the plan appeared to be judiciously formed and likely to succeed, the king having a pressing occasion for money, was persuaded to withdraw what he had employed in the fishery, at which the merchants joined with him, being displeased, did the like themselves. In 1677, a new royal company was established in England, at the head of which were the duke of

York, the earl of Derby, &c. Besides all the privileges which former companies had enjoyed, the king granted this new company a perpetuity, with power to purchase lands; and also 20*l.* to be paid them annually out of the customs of the port of London, for every dogger or buss they should build and send out, for seven years to come. A stock of 10,980*l.* was immediately advanced, and afterwards 1600*l.* more. This small capital was soon exhausted in purchasing and fitting out busses, and other incidental expences. The company, however, made a successful beginning, and one of their busses or doggers took and brought home 32,000 cod-fish; other vessels had also a favourable fishery. But most of the busses, having been built in Holland, and manned with Dutchmen, the French, then at war with Holland, took six out of seven vessels, with their cargoes and fishing tackle; and the company, being in debt, sold, in 1680, the remaining stores, &c. A company of merchants raised a new subscription of 60,000*l.* under the privileges and immunities of the former charter. But this attempt proved abortive by the king's death and the troubles of the next reign. Soon after the revolution the business was again resumed on a more extensive scale, the proposed capital being 300,000*l.*: but this scheme failed. Since the Union, several efforts have been made to retrieve it; and in 1750 there was a corporation settled on that footing by parliament, called "the Society of the Free British Fishery," for the term of twenty-one years, under the direction of a governor, president, vice-president, council, and other officers, who were empowered to make bye-laws, &c. and to raise a capital of 500,000*l.*, and the Scotch fishery, encouraged by fishing-chambers, erected in several cities, which establishments promised a more permanent duration. See *Herring FISHERY*.

FISHERY, *Anchovy*. See *ANCHOVY*.

FISHERY, *Cod*. The cod is a fish of passage, pretty large, with a great head, and teeth in the bottom of the throat; its flesh white; its skin brownish on the back, white under the belly, and covered with a few thin, transparent scales.

It is excellent food when fresh; and, if well prepared and salted, will keep a long time. The fish, thus prepared, is commonly eaten among us in Lent, &c. under the denomination of *salt-fish*, or *stock-fish*.

There are two kinds of salt cod; the one called *green*, or *cubite*; and the other *dried*, or *cured*; though it is the same fish, only differently prepared.

They are also distinguished by the places from whence they are brought, as well as by the manner of curing, into *Aberdeen-fish*, *Iceland-fish*, *green-fish*, *stock-fish*, *North-sea cod*, *poor Jack*, and *barrelled cod*.

Green cod.—The chief fisheries for green cod are in the bay of Canada, on the Great and Little Bank, near the coast of Newfoundland, the isle of St. Peter, or Pierre, and the isle of Sable; and thither vessels are yearly sent from divers parts both of America and Europe.

The vessels used herein are from a hundred to a hundred and fifty tons burden; and these will bring thirty or thirty-five thousand fish a-piece.

The most essential articles in this fishery are the persons who know how to open the fish, to cut off the heads, and to salt them; upon the ability of which last the success of the voyage chiefly depends.

Several authors will have it, that the Biscayans, in pursuing their whales, made the first discovery of the Great and Little Banks of cods at Newfoundland, Canada, &c. a hundred years before Columbus's time; and that it was a Biscayan

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Biscayan Newfoundlander that gave the first intimation thereof to Columbus.

Others say, that the Great Bank was discovered by a native of St. Malo's, named Cartier. England claimed an exclusive right to the North American seas, in virtue of the discovery of those seas by Sebastian Cabot, in the service of Henry VII. But be the discoverer of what name or nation he may, the discovery is certainly highly valuable; there is not a trading nation in Europe but allows the commerce of cod-fish to be one of the most secure and gainful that is known.

The best, largest, and fattest cod are those taken on the southern and western sides of the Great Bank, which is a kind of submarine mountain, stretching from N.E. to S.W., one hundred and fifty miles long, and fifty broad, and at the distance of twenty-five leagues from Newfoundland: those on the north side are generally much smaller. The water on the bank is from 22 to 50 fathoms; on the outside from 60 to 80; on the lesser banks much the same. A great swell and thick fog generally mark the place of this bank. The chain of lesser banks lies between Newfoundland and Cape Cod in New England; as the Green, French, Porpoise, and Sable Banks, and also Brown's and St. George's. Besides these banks, the whole coast of Newfoundland, New England, Nova Scotia, and Labrador, is one continued fishery.

The best season for this fishery is from the beginning of February to the end of April; at which time the cod, which, during the winter had retired to the deepest part of the sea, return to the Bank, and grow very fat.

Those caught from March to June keep well enough; but those taken in July, August, and September, soon spoil. The fishing is sometimes done in a month, or six weeks; and sometimes it holds four or five months. As Lent draws on, if the fishermen have but half their cargo, they strive who shall make homeward the first; the market being then the best.

Some will thus make a second voyage, before others have got loading for the first. Each fisher only takes one cod at a time; and yet the more experienced will take from three hundred and fifty to four hundred per day; but this is the most; for it is very fatiguing work, both on account of the weight of the fish, and of the extreme cold which reigns on the Bank.

The wages usually allowed the captain and sailors is one third of the cod they bring home sound.

They salt the cod on board. The head being cut off, the belly opened, and the guts taken out, the salter ranges them in the bottom of the vessel, head to tail; and having thus made a layer thereof, a fathom or two square, he covers it with salt; over this he lays another layer of fish, which he covers as before: and thus he disposes all the fish of that day, taking care never to mix the fish of different days together.

By that time the cod has lain thus to drain three or four days, they are moved into another part of the vessel, and salted afresh. After this they are no more to be touched, till the vessel has its burden.

Sometimes they put them up in barrels, for the convenience of carriage.

Dry Cod.—In the fishing of dry cod, vessels of all sizes are used; though such are generally chosen as have large holds, because this sort of fish incumbers more than it burdens.

As cod is only to be dried by the sun, the European vessels are obliged to put out in March or April, to have the benefit of the summer for drying. Indeed, we send

vessels for cod in June and July; but those only buy what had been fished and prepared by the inhabitants of Newfoundland, and the neighbouring parts; in exchange for which, we carry them meal, brandies, biscuits, pulle, molasses, linen, &c.

The principal fishery for dry cod is along the coast of Placentia, from Cape Rose to the Bay des Experts; in which compass there are divers commodious parts for the fish to be dried in.

The fish intended for this use, though of the same kind with the green cod, is yet much smaller; whence it is the fitter to keep, as the salt more easily penetrates it.

The method of fishing is much the same in both; only this latter is the more expensive, as it takes up more time, and employs more hands; and yet scarce half so much salt is spent in this as in the other.

When several fishing vessels meet, and intend to fish in the same port, he whose shallop first touches ground, becomes entitled to the quality and privileges of admiral; he has the choice of his station, and the refusal of all the wood on the coast at his arrival. (10 & 11 W. III. c. 25.)

As fast as the captains arrive, they unrig all their vessels, leaving nothing but the shrouds to sustain the masts; and in the mean time the mates provide a tent on shore, covered with branches of fir, and sails over them; with a scaffold, fifty or sixty feet long, and about one-third in breadth.

While the scaffold is making ready, the crew are fishing; the process of which, as it is described by Mr. Pennant in his "Arctic Zoology," is as follow:

The boats or shallops are 40 feet in the keel, rigged with a main-mast and fore-mast, and lug-sails; furnished with four oars, three of which row on one side, and the other (which is twice as large) belays the other three, by being rowed sideways over the stern, by a man who stands up for that purpose, with his face towards the rowers, counteracting them, and steering at the same time as he gives way to the boat. Each of the men in this boat is furnished with two lines, one at each side of the boat, each furnished with two hooks; so that sixteen hooks are here constantly employed, which are thought to make a tolerable good day's work of it, if they bring in from five to ten quintals of fish, though they have stowage for, and sometimes bring in thirty. Two hundred quintals are called a saving voyage, but not less. The bait is small fish of all kinds: herring, capaline, lance, tom cod or young cod; the first of which they salt, and keep for some time, in case of scarcity of the rest; but these are much less eagerly taken by the fish when salted. In case small fish cannot be gotten, they use sea-fowl, which are easily taken in vast numbers, by laying nets over the holes in the rocks where they come to roost in the night. If neither small fish nor birds are to be procured, they are forced to use the maws of fish which they catch; but this is the worst bait of any.

When the fish are taken they are carried to the stage, which is built with one end over the water, for the convenience of throwing the offals into the sea, and for their boats being able to come close to discharge their fish. As soon as they come on the stage, a boy hands them to the header, who stands at the side of a table next the water, and whose business it is to gut the fish and cut off the head, which he does by pressing the back of the head against the side of the table, which is made sharp for that purpose, when both head and guts fall through a hole in the floor into the water. He then shoves the fish to the splitter, who stands opposite to him; his business is to split the fish, beginning at the head, and opening it down to the tail;

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tail; at the next cut he takes out the larger part of the back-bone, which falls through the floor into the water. He then shoves the fish off the table, which drops into a kind of hand-barrow, which, as soon as it is filled, is carried off to the salt-pile. The header also flings the liver into a separate basket, for the making of train oil, used by the carriers, which bears a higher price than whale oil.

In the salt-pile the fish are spread upon one another, with a layer of salt between them. Thus they remain till they have taken salt, and then the salt is washed from them by throwing them off from shore in a kind of float, called a "pound." As soon as this is completed, they are removed to the last operation of drying them; which is done on standing flakes, made by a slight wattle, just strong enough to support the men who lay on the fish, supported by poles, in some places as high as twenty feet from the ground; here they are exposed, with the open side to the sun; and every night, when it is bad weather, piled up five or six in a heap, with a large one, his back or skinny part uppermost, to be a shelter to the rest from rain, which hardly damages him through his skin, as he rests slanting each way to shoot it off. When they are tolerably dry, which in good weather is in a week's time, they are put in round piles of eight or ten quintals each, covering them on the top with bark. In these piles they remain three or four days to sweat; after which they are again spread, and, when dry, put into larger heaps, covered with canvas, and left till they are put on board.

When prepared they are sent to the Mediterranean, where they fetch a good price; but are not esteemed in England, for which place another kind of fish is prepared, called by them "Mud-fish," which, instead of being split quite open, like their dry-fish, are only opened down to the navel; they are salted and lie in salt, which is washed out of them in the same manner with the others; but instead of being laid out to dry, are barrelled up in a pickle of salt boiled in water.

The train oil is made from the livers; and it is so called to distinguish it from whale or seal oil, which they call fat oil, and is sold at a lower price (being only used for lighting of lamps) than the train oil, which is used by the carriers. It is thus made: they take a half-tub, and, boring a hole through the bottom, press hard down into it a layer of spruce boughs, upon which they place the livers, and expose the whole apparatus to as sunny a place as possible. As the livers corrupt, the oil runs from them; and, straining itself clear through the spruce boughs, is caught in a vessel set under the hole in the tub's bottom.

The sounds and tongues are salted at the same time with the fish, and barrelled up: the roes or eggs, being salted and barrelled up, serve to cast into the sea to draw fish together, and particularly pilchards.

By the definitive treaty between Great Britain and France in 1763, the French, who are allowed to fish in the gulf of St. Lawrence, are now absolutely deprived of the powerful fortifications of Cape Breton, and of the possession of Canada and all its dependencies; and are entitled to no possessions contiguous to Newfoundland, except the small islands of St. Peter's, or Pierre, and Miquelon, ceded by the sixth article of the said treaty to his most Christian majesty as a shelter for the French fishermen; and his most Christian majesty engages not to fortify the said islands, to erect no buildings upon them, but merely for the convenience of the fishery, and to keep upon them a guard only of fifty men for the police. And by the eighteenth article of the same treaty, it is expressly stipulated between Great Britain and Spain, that his Catholic majesty desists, as well for himself

as for his successors, from all pretensions which he may have formed in favour of the Guipuscoans and other his subjects, to the right of fishing in the neighbourhood of Newfoundland.

The French, by the treaty of 1783, were to enjoy their fisheries on the northern and western coasts; the inhabitants of the United States having the same privileges as before their independence: and the preliminaries of October, 1801, confirm the privileges granted to the French.

By 43 Geo. III. c. 154. a bounty of 3*s.* per quintal shall be paid on the importation of pickled salmon and dry cod from the island of Newfoundland; the master and mate of every ship so importing making oath, at the port of importation, that such fish was taken and cured by British subjects carrying on the fishery at Newfoundland or Labrador; and such fish may be exported without repayment of the bounty. For other regulations of this fishery, see 10 & 11 W. III. c. 25; 26 Geo. III. c. 26; 27 Geo. III. c. 19; 29 Geo. III. c. 53.

Of all the migrating fishes, herrings excepted, the cod is the most valuable to mankind. This fish, we may here observe, is fond of cold climates, and is supposed to reside chiefly between the latitudes of 66° and 45°. Those that are taken north and south of these latitudes are either few in number, or bad in quality. They are found as far north as Greenland, but they are small and emaciated. In Europe they chiefly frequent the coasts of Iceland, Norway, the Baltic, the islands and main land of Scotland. After passing these latitudes, they decrease in number. The English fishermen take them on the Dogger-bank, the Well-bank, and the Cromer, lying on the east side of the kingdom, opposite to Norfolk, Lincoln, and Yorkshire. Of these the Dogger-bank is the most extensive and valuable for white fish in general, as we learn from the account transmitted to Mr. Pennant by Mr. Travis, surgeon in Scarborough. The Dogger-bank lies 12 leagues from Flamborough-Head, and 16½ from Scarborough; the north side of the bank stretches off E.N.E. between 30 and 40 leagues. The fishermen seldom find any cod, fry, or other round fish upon the bank itself, but upon the sloping edges and hollows contiguous to it. The shifting sand on the top of the bank affords them no subsistence; and the shallow agitated water allows them no rest. It is in the hollows between the Dogger and the Well-bank that the cod are taken which supply the London market. The shore along the coast on the one hand, and the edges of the Dogger-bank on the other, like the sides of a decoy, give a direction towards our fishing grounds to the shoals of cod, and other fish, which migrate annually from the northern ocean into our seas; and the great variety of fishing grounds near Scarborough, extending upwards of 14 leagues from the shore, afford secure retreats and plenty of proper food for all the various kinds of fish, and also suitable places for each kind to deposit their spawn in.

The best bait for all kinds of fish is fresh herring cut in pieces of proper size; and next to these, the lesser lampreys, small haddocks cut in pieces, sand-worms, muscles, and limpets; and, in defect of these, bullock's liver. The hooks are smaller than those used in Iceland and Newfoundland; being 2½ inches long in the shank, and near an inch wide between the shank and the point. The line is made of small cording, and is always tanned before it is used. The best weather for succeeding in fishing is a half calm, when the waves are just curled, with a silent breeze.

In our seas the cod-fish begin to spawn in January, and deposit their eggs in rough ground among rocks. Some continue in the roc till the beginning of April. These fishes

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fishes in general recover sooner after spawning than any other; and, therefore, it is common to take some good ones all the summer. Those of a middling size are most esteemed for the table, and are selected by their plumpness and roundness, especially near the tail; by the depth of the pit behind the head, and by the regular cordulated appearance of the sides, as if they were ribbed. The cod, and other fish of this genus, are in highest season in the winter; but even then, the glutinous parts about the head lose their delicate flavour after the cod hath been 24 hours out of the water. The general weight of these fish on the Dogger-bank is from 14 to 40 pounds.

The Scottish white fishery, comprehending cod, ling, hake, tusk, coal-fish, haddocks, and whittings, and flat fish, as turbot, skate, soles, and flounders, abound so universally around the Scottish shore, that the whole northern sea, from the Dogger-bank in lat. 54° to the northern extremity of Iceland in lat. 67°, and from the coast of Norway eastward to unknown latitudes on the west, may be considered as one great fishery, in which Scotland, as lying in the centre, has manifestly the advantage over all other nations. The white fishery may be supposed to comprehend the eastern coast fishery from Berwick to the Pentland firth, the Shetland or N.E. fishery, and the Hebride or N.W. fishery. The most considerable of the banks in the eastern fishery, called by way of pre-eminence the "Long Fortys," stretches in a parallel line with the east coast, from the county of Durham to Kinnaird's head, at the entrance of the Murray firth; thus affording an uninterrupted line of fisheries almost from one extreme of the kingdom to the other, and in some parts at a very inconsiderable distance from the shore. The Shetland fisheries are carried on by two different methods; *viz.* by boats accompanied with decked vessels, and by boats only. Those of the first class go out of sight of land, where, in 90, 100, and 120 fathoms water, they get the largest fish. When they arrive on the fishing grounds, they set their long lines, each line of 56 fathoms having 15 hooks; and these lines are joined to one another, till the number of hooks amounts to from 600 to 1200. In the fishery by boats of 2 tons burden, and 6 men each, they fish in summer at the distance of 7 to 15 leagues from land, and in winter at the distance of 3 leagues. The summer fishery is carried on from the 1st of June to the 1st of August; the boats go out three times a week, and continue 24 hours each time. The large boats carry from 100 to 120 lines; each line being from 54 to 60 fathoms in length, and hung with 15 hooks at 20 feet distance from one another. In winter they use hand lines, when long ones cannot be managed. They bait with a small fish called pollocks, when at sea; and if these cannot be procured, they use cod, turbot, haddocks, or any other fish. The Hebride or N.W. fishery extends from the head of the Solway firth to the coast of Iceland, lying at the distance of 400 miles N.W. from the Long island in the Hebrides. The principal bank in the fishing grounds, lying between the Hebrides and the main land, begins near the mouth of Garloch in Ross-shire, and is supposed to stretch in a N.W. direction, towards the Butt of the Lewis, and possibly beyond that cape. This abounds in all the varieties of white fish. A chain of small banks stretches along the east side of the Lewis, from 3 to 5 miles off the shore, and is carried on by the natives both in summer and winter. The whole coast of Sky is also one continued fishery; and the seas of the South Hebrides present a number of fishing banks, which our limits will not allow us to recite. But the most extraordinary and valuable bank is called by the old natives the "Mother-bank," and lies

between Mull on the east, and Barra and South Uist on the west. There is a bank between the islands of Coll and Colland Tirey, in the direction of the small island of Ganna, which lies in the centre. A valuable bank lies between the islands of Mull, Coll, and Ardamurchan, on the main land of Argyleshire. In the fount of Mull there is a small bank, which stretches from Aros to Scalarda's bay. There is an inexhaustible fishery along the coast of Argyleshire, called the Inner Sound; a bank lies between Loch Tarbat in Jura, and the isle of Colonsa, 16 miles long and 1 broad. Another lies in the channel between Jura and Hay on the west, and the main land of Knapdale on the east. Those which we have enumerated are the principal banks of the Hebrides, on the west side of the Mull of Cantire. On this side of the cape, within the firth of Clyde, there is a good fishing ground around the craig of Ailfa; from whence a large bank stretches from Ballintrae in Ayrshire, and thence, along the coast, to the Mull of Galloway, where it is lost in the Irish channel. Another bank stretches in a N.W. direction towards Sunda island, and from thence towards Knapdale, off the north side of Arran. Such is the immense scene of improvements, with regard to the Scottish white fisheries, that presents itself to those who are anxious to promote the British fisheries. In some respects the Scottish fisheries have the advantage of those of Newfoundland. The banks of Newfoundland lie at the distance of 2500 to 3000 miles from London, Bristol, Liverpool, Dublin, Cork, and Glasgow; and can only be frequented during the months of February, March, April, May, and June: whereas the Scottish fisheries, when the proposed navigations shall be opened, will, upon a medium, be within a week's sailing of these commercial emporiums, which they can supply in seasons when the Newfoundland fishery cannot be carried on.

The Irish white fisheries are chiefly cod, ling, hake, coal-fish, and haddock. In these fisheries the Irish are very expert, being trained to the business by their fishing on the banks of Newfoundland, as well as the bays of that island; to which fisheries some thousands of Irishmen resort every season, and from whence they return with a small pittance to their families. White fish abound on the west coast of Ireland; but no regular fishery has yet been established with success. See more on this subject in Knox's View of the British Empire, &c.

FISHERY, *Coral*. See CORAL.

FISHERY, *Herring*. The herring is a small salt-water fish, with a blueish back, and a white silvered belly, not unlike a little shad fish; whence it is called in Latin *alga minor*. Rondeletius calls it *barengus*.

It is a popular error to believe the herring to be the *balec* of the Romans. The *balec* was no particular fish, but a kind of sauce, made of any kind of salt-fish. The modern herring seems to have been unknown to the ancients: it is neither the *balec*, nor *balex*, nor *manis*, nor *sencomani*, nor the *gerres*, of Pliny. See Rondelet. de Piscib. Maria. lib. v. cap. 13. and Vossius de Idolol. See HERRING.

Herrings are chiefly found in the North sea. In those inaccessible seas, that are covered with ice during a great part of the year, the herrings find a quiet and safe retreat from all their numerous enemies: there neither man, nor their still more destructive enemy, the sun-fish, or the cachalot, the most voracious of the whale kind, dares to pursue them. It is true, there are fisheries elsewhere, but none so copious.

They usually make two fishing seasons for herrings: the first in June, July, and August; the second in autumn. The latter of these is the more considerable, on account

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of the fogs, which are very favourable to this kind of fishing.

The herrings usually keep at some distance from the coast in July and August; and it is at this time only that the fishers follow them in the open sea. About the end of August, and until the middle of September, they come into shallow water, where they remain for some time in the bays and inlets of the coast; and this is termed the ground draw. It hath been observed, that the arrival of the herrings on the coast of Shetland is certain, and almost to a day, on or before the 22d of June. As they invariably follow a southern course, after leaving the Shetland islands, they reach the Hebrides in July, and keep pressing forward till the beginning of September, when they go into deep water.

Fresh shoals appear in November, and continue till January; but whether these herrings be the remains of the former shoals, in their return from the circumnavigation of Britain and Ireland, or a new migration from the frozen regions, is a matter of uncertainty.

It is commonly said, that nobody ever saw a herring alive, and that they die the minute they are taken out of the water; but there are instances to the contrary.

The herring is a fish of passage; so that it is allowed to catch them on holidays and Sundays; in the Decretal there is an express chapter to this effect. They go chiefly in shoals, and are fond of following any fire, or light; and in their passage they resemble a kind of lightning themselves.

The winter rendezvous of the herrings is probably the icy sea, within the arctic circle; as this sea swarms with insect food in greater abundance than in our warmer latitudes. From this sea the great colony of these fishes sets out about the middle of winter; and this colony is composed of such numbers as to exceed the power of imagination. But they have no sooner left their retreats than they have to encounter with a multitude of enemies. The sun-fish and eel-hat devour them in great abundance; and besides, the porpus, the grampus, the shark, cod-fish, haddock, pollocks, and the numerous tribe of dog-fish find them an easy prey, and desist from making war upon one another. To these enemies we may add innumerable flocks of sea-fowl that chiefly inhabit the northern regions towards the pole, which watch the outset of their perilous migration, and spread among them extensive ruin. In this state of danger, the defenceless emigrants crowd closer together, as if they could thus secure themselves against the attacks of their enemies. The main body begins to separate, at a certain latitude, into two great divisions; one of which moves to the west, and pours down along the coasts of America, as far south as Carolina, and becomes so numerous in the Chesapeak bay as to be a nuisance to the shores. The other division takes a more eastern direction towards Europe, and falls in with the great island of Iceland about the beginning of March. Upon their arrival on that coast, their phalanx, which hath already suffered considerable diminution, is nevertheless found to be of such extent, depth, and closeness, as to occupy a surface equal to the dimensions of Great Britain and Ireland; but subdivided into columns of 5 or 6 miles in length, and 3 or 4 in breadth; each line or column being led, according to the ideas of fishermen, by herrings of more than ordinary size. The herrings swim near the surface, sinking occasionally for 10 or 15 minutes. The forerunners of those who visit the British kingdoms appear off Shetland in April or May, and the grand body begins to be perceived in June. Their approach is known to the fishers by a small rippling of the water, the reflection

of their brilliancy, and the number of soot geese, or gannets, and other aerial persecutors, who are eager to devour them, and who, with the marine attendants, may serve to drive shoals of them into bays and creeks, where many thousands of them are taken every night from June till September. Although the Shetland islands break and separate the grand body of the herrings into two divisions, they still continue their course towards the south. One division proceeds along the east side of Britain, and pays its tribute to the Orkneys, the Murray firth, the coasts of Aberdeen, Angus, and Fife, the great river Forth, the coast of Scarborough, and particularly the projecting land at Yarmouth, the ancient and only mart of herrings in England, where they appear in October, and are found in considerable quantities till Christmas. The other division pursues its course from the Shetland islands, along the west side of Britain; and these are observed to be larger and fatter than those on the east side. After passing the Shetland and the Orkney isles, they crowd in amazing quantities into the lakes, bays, and narrow channels of the shires of Sutherland, Ross, and Inverness; which, with the Hebride isles, especially the Long island, form the greatest stationary herring fishery in Britain; that upon the coast of Shetland excepted. Sometimes this shoal, in its southern progress, edges close upon the extensive coast of Argyleshire; fills every bay and creek; and visits, in small detachments, the firth of Clyde, Lochline, and other lakes within the entrance of that river; the coast of Ayrshire, and of Galloway, to the head of the Solway firth. This shoal proceeds from the western shores of Scotland towards the north of Ireland; where, meeting with a second interruption, they are again divided into two brigades. One shoal passes down the Irish channel, visits the isle of Man, and affords an occasional supply to the east coast of Ireland, and the west coast of England, as far as the Bristol channel. The other shoal skirts along the west coast of Ireland, where, after visiting the lakes of Donegal, it gradually disappears, and is finally lost in the immensity of the Atlantic. Herrings, it is observed, are not seen in quantities in any of the southern kingdoms, as Spain, Portugal, or the south parts of France, on the side of the ocean, or in the Mediterranean, or on the coast of Africa.

"Were we inclined," says a well-known writer, "to consider this partial migration of the herring in a moral light, we might reflect with veneration and awe on the mighty power which originally impressed, on this most useful body of his creatures, the instinct that directs and points out their course, that blesses and enriches these islands, which causes them at certain and invariable times to quit the vast polar deeps, and offer themselves to our expecting fleets."—"This impression was given them, that they might remove for the sake of depositing their spawn in warmer seas, that would-mature and vivify it more assuredly than those of the frigid zone. It is not from defect of food that they set themselves in motion, for they come to us full of fat, and on their return are almost universally observed to be lean and miserable. What their food is near the pole, we are not yet informed; but in our seas they feed much on the oniscus marinus, a crustaceous insect, and sometimes on their own fry. They are in full roe to the end of June, and continue in perfection till the beginning of winter, when they begin to deposit their spawn. Though we have no particular authority for it, yet, as very few young herrings are found in our seas during the winter, it seems most certain that they return to their parental haunts beneath the ice, to repair the vast destruction of their race during summer, by men, fowl, and fish."

It has been generally supposed that the Hollanders were the

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the first who began the herring-fishery, and observed the several seasons of their passage. Their first regular fishing is fixed to the year 1163. It is recorded, however, in the Batavian annals, that the Scots sold their herrings to the inhabitants of the Netherlands as early as the ninth century. This traffic laid the foundation of a commercial alliance between the two countries, which subsisted, to their mutual advantage, during many ages. Although many laws were enacted during the reigns of James III. IV. V. and VI. for recovering the fisheries of the eastern side of the kingdom, which the Dutch had engrossed, greatly to the prejudice of the rightful owners; yet it is well known, that since the first establishment of the herring fishery, the Dutch have enjoyed the principal part of it, and it has very much contributed to their advancement and prosperity in former times. Our seas were their "original mines," as they themselves have acknowledged.

In the year 1313 we have an account of the seizure of a ship of Lynn, in the port of Bergen, which had been fishing on the Norway coast for herrings. (Rymer's Fœd. vol. iii. p. 400.) And as ladings of herrings carried to a distance must have been salted, it is plain that salted herrings, either wet or else dried, called red herrings, were in those times a merchantable commodity in foreign parts. And in 1338 we have an account of fifty lasts of herrings shipped from Portsmouth for the use of the army and fleet of Edward III. in Gascony, which must have been salted, either wet or dried. (Fœd. vol. vii. p. 12.) And they were barrelled and salted at the port of Whitby in Yorkshire, in 1394. Fœd. vol. vii. p. 778.

But the present method of pickling them was not discovered till the year 1416, though others date it from the year 1397. Willughby, in his History of Fishes, observes, that Will. Buekelfz, or Bachalen, a native of Bier Uliet, near Sluys, who died in 1397, rendered his name immortal by the discovery of the secret of curing and pickling herrings, which he might probably have learned from the people of Yarmouth, and other parts of England, where herrings were not only salted and dried for red-herrings, but salted and barrelled up wet, at different times, from the year 1306 to 1360. Willughby says, that the emperor Charles V. coming to the Low Countries, made a journey to the isle of Bier Uliet, with the queen of Hungary, on purpose to view the tomb of this first barreller of herrings. It may be allowed, however, that Bachalen, or Benckelen, might have made some improvement in the practice; which his countrymen afterwards contributed to perfect. By their ingenuity and perseverance they reduced the whole business of the fisheries into a regular system, which it would be the interest of other states to follow. They have likewise been wisely aided from time to time by their respective provincial legislatures, not only in every privilege and support, but also a well digested body of laws and regulations, extending to the most minute circumstance, from the commencement of the out-rit to the export of the herrings.

Yarmouth has been long famous for its herring-fair, which was regulated by an act, commonly called the statute of herrings, in the thirty-first year of Edward III.

This politic monarch, with a view of promoting the herring trade, became a purchaser of their fish; and, in 1358, fifty lasts of herrings were shipped at Portsmouth for the use of his army and fleet in France. This practice was adopted by his successors down to queen Elizabeth, who also enforced the ecclesiastical laws respecting the observance of Lent in favour of the fisheries. Indeed Yarmouth owed its rise to the fishery, for the place where

it now stands was only a sand-bank in the sea, which in process of time became dry land, and drew thither fishermen from various parts of England, and also from France and the Low Countries, for the purpose of catching herrings. The commencement of this fishery appears, from several concurring circumstances, to have taken place soon after the landing of Cerdic, the Saxon, in 495. (See YARMOUTH.) The Yarmouth herrings maintained their reputation, and the inhabitants were reckoned the best curers in Europe, so that the Dutch were in the number of their foreign customers. The Yarmouth people have greatly the advantage over the Dutch, in being nearer the herring shoals, and also in being plentifully supplied with wood; whereas the Dutch are obliged to smoke their herrings with turf or straw. The fishing commences here about the twenty-first of September, and continues till the twenty-fifth of November. The fishing grounds are from 10 leagues N. of Yarmouth to the South Foreland. Their smacks or vessels carry from thirty to fifty tons, and each is equipped with 90 or 100 nets, which are replaced about the middle of the season by a fresh set, of the same quantity and dimensions. Each vessel is furnished with a well, into which the fish are conveyed by a sort of machine, as soon as they are disengaged from the nets; the bottom of the well being fall of holes, through which the blood and water are discharged. There are two apartments called wings, one on each side of the well, into which the men throw the herrings with scoops; a third throws in the salt, while a fourth and fifth throw up the herrings to the furthest part of the wings. By these means they are preserved till each vessel hath got in 10 or 12 lasts, when the vessel returns to Yarmouth road, and the fish is removed ashore in small boats, and conveyed to the fish-house. Here they are salted on the floor, in which state they lie for two days; they are then washed in large vats of fresh water, put on the spits, and dried with many fires of billet-wood. If the herrings are intended for exportation, they are kept in this state from four to six weeks, when they are packed in casks of 32 gallons; each cask containing 1000 herrings. One last of salt cures three lasts of herrings. This ancient fishery is now much on the decline; and the town has suffered much on this account.

The Dutch began their herring-fishery on the twenty-fourth of June, and employed no less than ten or eleven hundred vessels therein. These vessels are a kind of barks, called *huffes*, carrying from forty-five to sixty ton, and two or three small cannon.

Before the establishment of the Society of the Free British Fishery, the number of Dutch vessels employed in this fishery was more considerable, and amounted to fifteen hundred or two thousand.

None of them were allowed to stir out of port without a convoy, unless there were enough of them together to make eighteen or twenty-pieces of cannon; in which case they were allowed to go in company. Before they put out, they made a verbal convention; which had the same force as if it were in writing.

These regulations of the admiralty of Holland were partly followed by the French, and other nations; and partly improved and augmented with new ones; and that no fisher should cast his net within an hundred fathoms of another boat; that while the nets were cast, a light should be kept on the hind part of the vessel; that when a boat was by any accident obliged to leave off fishing, the light should be cast into the sea; that when the greater part of a fleet left off fishing, and cast anchor, the rest should do the same, &c.

By the act for encouraging the British white herring-fish-

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ery, in 1750, it is required, that the buffes employed in this fishery, entitled to the bounty of 30s. per ton, shall be decked vessels, built in Great Britain, after the commencement of the act; and that each of them shall carry twelve Winchester bushels of salt, for every last of fish which such vessel is capable of holding, and as many more new barrels as such a ship is capable of carrying, and two fleets of tanned nets; *i. e.* every vessel of seventy tons shall have one fleet of nets, each thirty yards full on the rope, and seventeen fathoms deep, and others in proportion; and be provided with one other fleet of fifty like nets, on board a jagger or tender, which is to attend the said fishery. Every such bufs properly manned and furnished, shall proceed either to Brasseley's Sound in Shetland, and be at the rendezvous of the said fishery there, on or before the eleventh day of June, but shall not shoot their net till the thirteenth, and shall continue following the shoal and fishing, as they move southward, to the first of October; or to Campbeltown in Argyleshire, and be at the rendezvous of the said fisheries on or before the first day of December, unless they shall have sooner completed their loading of fish.

By 26 Geo. III. c. 81. continued by a subsequent act, a bounty of 20s per ton shall be paid annually to the owner of every decked vessel, not less than fifteen tons burden, manned and navigated according to law, employed in the British white herring-fishery under certain regulations, and with the alterations made by 42 Geo. III. c. 79. Every bufs or vessel to be entitled to the above bounty shall be built in Great Britain, and have on board (in new barrels) twelve bushels of salt for every last of fish, which such ship can carry, and also 250 square yards of netting, and not less than five men for the first fifteen tons, and one additional man for every additional five tons; and shall clear out from some port in Great Britain between June 1st and November 20th in the same year, and proceed immediately to the said fishery, and continue fishing three months, unless its cargo be completed. On its return the officer of the customs shall examine the condition and lading of the ship; and after other documents being produced the commissioners of the customs in England, or the commissioners of the customs or excise in Scotland, shall cause payment to be made to the owner or owners, or his or their assigns, the sum of 20s. per ton, according to the admeasurement of such bufs or vessels. For every barrel of herrings twice packed and completely cured, which shall, during one year, be landed from any vessel entitled to the aforesaid bounty of 20s. per ton, there shall be a bounty of 4s. But if the number of barrels of herrings imported shall, in one year, exceed the proportion of $2\frac{1}{2}$ barrels of herrings, packed and cured as aforesaid, for every ton burden of such vessel, then there shall be paid for every barrel so exceeding the said proportion a bounty of 1s. only. For all herrings which shall be landed from any boat or vessel not entitled to the bounty of 20s. per ton, and which shall afterwards be properly salted and cured, there shall be paid a bounty of 5s. per barrel. For the encouragement of the fishery, called the Deep sea fishery, over and besides the bounties before granted, there shall be paid the following premiums; *i. e.* for the greatest quantity of herrings caught by the crew of any one vessel, entitled to the forementioned bounties of 20s. per ton, and 4s. and 1s. per barrel, and imported by such vessel between June 1st and November 31st in any one year, the premium of eighty guineas; for the next greatest quantity sixty guineas; and for the next forty guineas; and for the next twenty guineas. By 36 Geo. III. c. 81. the curers of fish in Great Britain were allowed to

take salt, for the purpose of curing fish, but by the 38th of Geo. III. which subjects salt to the excise duties, and enacts new regulations, this act may be considered as virtually repealed, at least as to its principal clauses. There are other provisions included in the stats. 27 Geo. III. c. 10. 35 Geo. III. c. 56, all which provisions and powers contained in preceding acts are revived by stat. 42 Geo. III. c. 79, except as to the bounties, which bounties by this act are as follow: From the 5th of April 1803, one-half of the bounty of 20s. per ton, and one-half of the bounties granted by the preceding acts for every barrel of herrings landed from any raft or vessel, in respect of which a bounty of 20s. per ton is granted by the said acts, shall cease and determine. For other regulations of the herring fishery, see HERRING.

The manner of fishing has nothing particular in it. The nets wherein the fish is drawn should regularly have their meshes an inch square, that none of the lesser fry may be taken.

The commerce of herring, both white, *i. e.* pickled, and red, is very considerable; but there are so many different sorts, prepared in such different ways, and different places, that it is hard to say any thing precise thereupon.

The white herrings cured by the Dutch used to be in the greatest repute; they were distinguished into four kinds, according to their sizes. The goodness of this commodity consists in its being fat, fleshy, firm, white; being never caught but when in season, chiefly in the month of July; being taken alive out of the nets; being salted the same day it is taken, and with good salt, and well barrelled.

The Irish herrings have been esteemed the next in value after those of Holland; and principally those of Dublin, which are scarce inferior to the best herrings of Rotterdam or Enkuyfen.

It was about the year 1764, that the Irish parliament began to frame such laws, and to grant such aids as the nature of the fisheries suggested. The principal fisheries of this country are in Loch Sully, the Rosses, Killebegs, and Inverbay, on the coast of Donegal; and an inferior kind of herrings is occasionally taken on the coast of Sligo and Mayo, as far southward as Broadhaven. The fishery at Inverbay begins in July, and continues till the beginning or sometimes the end of September. The other fisheries commence in November, and end in January. The herrings taken by the British vessels are preferred, on account of their being gutted, and cured in barrels of 32 gallons. The Irish ungutted herrings, on the other hand, are in some parts of the coast salted in holes dug in the earth, till the fishers have an opportunity of selling them to the buffes; they are then packed or piled up in the hold of the vessel, and are thus carried to Cork, and other ports, when they are put into barrels of 28 gallons, and exported to the West Indies. Of the winter herrings taken in Loch Sully, 500 will fill a barrel; and of the early herrings, 800. The buffes are from 20 to 100 tons burden, and are under certain parliamentary regulations, respecting netting, and the number of men. The nets are tanned with a mixture of tar and fish oil, in the proportion of five parts of tar and one of oil; and improvements have been made in the method of working the nets.

The Scotch herring is not so well prepared, gutted, salted, or barrelled, as the Dutch; and yet its taste is excellent, that of those caught on the western coast especially; nor is it to be doubted, but that if the Scots were as careful in these circumstances as their neighbours, their herrings would be the best in the world.

The whole coast of Scotland may be considered as one
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continued fishery, distinguished, however, by the names of the Shetland, or northern fishery, that on the east side of the kingdom from the Pentland firth to Berwick, and the western or Hebride fishery. The principal town on the Shetland islands is called Lerwic, situated on a narrow channel of the Main-land, called Brassa or Brassey-found. Hither the Dutch and other foreigners have been accustomed to resort to the fisheries at the appointed seasons, when Lerwic hath had all the appearance of a continued market or fair. The eastern fisheries along the eastern shores of Scotland, though less considerable than those on the coasts of Shetland, might with proper attention be of great national benefit. But though the whole line of coast from Caithness to Berwick is the occasional resort of herrings, in their autumnal voyage southward, yet in this course of 300 miles, (including the Murray firth,) there is not a fixed or stationary fishery, such as that at Yarmouth, Donegal, and Gottenburgh, where the herrings arrive almost to a certainty, and generally at the same period of time. The shores on the eastern side of Scotland, that have been most generally explored, and that have produced the greatest quantity of herrings, are those of the Forth and the Murray firth. The herring fishery in the Forth was conducted formerly by open boats, which amounted to the number of 6 or 800, and many thousand barrels of herrings were annually exported, besides supplying the home demand. The coast fishing on the Murray firth was conducted on the same plan, governed by the same regulations, and proportionally beneficial to that populous, though remote part of the kingdom. It employed from 5 to 700 boats. These fisheries, at present in a low state, might be extended to any degree; and also the deep water fishery, to the distance of 20 miles from the coast, where the herrings are larger and fatter than those taken in the Forth, or near the shores, and are nearly equal to the herrings taken in deep lochs of the West Highlands. This deep water fishery should be carried on by buxles or decked vessels, from 20 to 80 tons burden, which ought to be at the Shetland islands early in the season, and the produce should be speedily carried to the proper markets; whilst the buxles may continue the fishery down the channel till the end of the season. In this manner the markets would be constantly supplied, greatly to the benefit of the merchant, the fishers, and the labouring poor, along the whole coast. The Hebride, or western fishery, was frequented in very early times by the French and Spaniards, who trafficked there with the natives for fish; whence we may conclude that the natives were fishers, and that foreigners were the carriers. It is probable that the fishery was then carried on by little open boats, or berlins, such as the Highlanders generally use at the present day. This fishery was the thoroughfare, as we may call it, of the great western shoal of herrings, in their annual tour from the Shetland islands to Ireland, which, in the opinion of some writers, they environ, and from whence they return by the opposite channel, in the same manner as the eastern shoals environ Great Britain, and return north by the western channel. This Hebride fishery, considering the manner in which it was conducted, may be justly styled the school of navigation; and on this account, as well as for its produce, deserves British encouragement. As a nursery of seamen, the boat fishery will exceed that of the buxles with regard to numbers of persons employed; but, on the other hand, it cannot be put into competition with the buxles in respect of nautical knowledge.

The herring fished in England is inconsiderable; the fish being too dry for the market. However, at Yarmouth and Leosloff they have in former times taken and cured

about 50,000 barrels of red-herrings in a year; and very large quantities are also caught at the mouth of the Thames by the fishing-smacks of London, Folkestone, Dover, Sandwich, &c. for the London markets, and near the sea-coast of Kent and Suffex for general consumption. Some shoals are also forced, by the great swell of the Atlantic, into the Bristol channel, and particularly into the Bay of Barnstaple, where they have been sometimes taken and cured for exportation, in very considerable quantities.

Curing and preparing herrings.—1. For *white* or *pickled herrings*: as soon as the herrings are taken out of the sea, one of the crew, appointed for this office, cuts them open, and takes out the guts, and every thing but the milts and roes, which are always to be left in the body of the fish. Then washing them in fresh water, they are left the space of twelve or fifteen hours in a tub full of strong brine made of fresh water, and sea-salt.

When they are taken out, they drain them; and when well drained, put them up in barrels; taking care to dispose and range them evenly, in rows, or layers, pressing them well down, and strewing a layer of salt both at top and bottom.

When the barrel is full, they stop it up very close, that no air may get in, nor any brine out; either of which is very prejudicial to the fish.

The Dutch, after opening and gutting the herrings, cure and salt them by lining or rubbing their inside with salt; they are then packed, with handfuls of salt between each row, and stopped up close.

2. For *red-herrings*: the fish being caught, they proceed to wash, gut, and lay them in brine, as for pickled herrings; only they let them lie double the time in brine, *viz.* twenty-four hours; inasmuch as they are to take all their salt here, whereas the other kind takes half its salt in the barrel.

When the herrings are taken out of the brine, they spit them, *i. e.* firing them by the head on little wooden spits, and thus hang them in a kind of chimney, made for the purpose; and when the chimney is as full as it will hold, which less than ten or twelve thousand seldom effects, they make a little fire underneath, of brush-wood, which yields a deal of smoke, but no flame.

Here the herrings remain till sufficiently smoked and dried; which ordinarily is in twenty-four hours. Then they are taken down and barrelled up for keeping.

Their goodness consists in being large, fresh, fat, oily, soft, and pliable, their outside of a yellow, golden colour; their having roes, or milt, within them, and being well salted and barrelled. See HERRING.

FISHERY, Ling. This fish abounds near the Scilly isles, and on the Yorkshire coast. In the latter situation they are in perfection from the 1st of February to the 1st of May, and some till the end of that month. In June they spawn, depositing their eggs in the soft oozy ground of the mouth of the Tecs. At that time the males separate from the females, and resort to some rocky ground near Flambeorough Head, where the fishermen take great numbers without ever finding any of the female or roed fish among them. While a ling is in season its liver is very white, and abounds with a fine flavoured oil; but when the fish goes out of season the liver becomes red, like that of a bullock, and affords no oil. When the fish is in perfection, a very large quantity of oil may be melted out of the liver by a slow fire; but if a violent sudden heat be used for that purpose they yield very little. Great quantities of ling are salted for exportation, as well as for home consumption. When it is cut or split for eating, it is cut measure 7.6 inches or upwards from

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the shoulder to the tail; if less than that, it is not reckoned a sizeable fish, and consequently not entitled to the bounty on exportation; such are called *drizzles*, and are in season all summer. The usual size of a ling is from three to four feet; but some have measured seven feet.

FISHERY, Lobster. Lobsters are taken along the British channel, and on the coast of Norway, whence they are brought to London for sale; and also in the frith of Edinburgh, and on the coast of Northumberland.

By 10 & 11 W. III. cap. 24. no lobster is to be taken under eight inches in length, from the peak of the nose to the end of the middle fin of the tail; and by 9 G. II. cap. 33. no lobsters are to be taken or destroyed on the coast of Scotland from the first of June, to the first of September, on pain of 5*l*.

FISHERY, Mackerel. The mackerel is a salt-water fish, without scales. Its body is round and fleshy; terminating almost in a point, at each extreme.

Some persons, well skilled in naval architecture, hold its figure the most commodious for swimming of all others, and propose it as a model for the building of ships.

It is ordinarily about a foot long; when in the water it appears yellow, and when out of it of a silver white, excepting four streaks, or speckles, of a deep blue, on the back and sides. Its usual weight is about two pounds. During winter a film grows on the eyes of this fish; in the spring they are half blind; and in summer the film is cast. See **MACKAREL**.

The mackerel is a summer fish of passage, found in large shoals in divers parts of the ocean, not far north; but especially on the French and English coasts.

The fishing is usually in the months of April, May, and June, and even July, according to the place. They enter the English channel in April, and proceed up to the straits of Dover, and the mouth of the Thames, as the summer advances; so that by June they are on the coasts of Cornwall, Suffex, Normandy, Picardy, &c. where the fishery is most considerable. An inferior sort is also taken during the harvest months. They are an excellent food, fresh, but their taste and flavour are much impaired a few hours after they are taken; and not to be despised when well prepared, pickled, and put up in barrels; a method of preserving them chiefly used in Cornwall.

Naturalists have observed, that the water wherein mackerel have been boiled, often yields a light, after stirring it a little. See **FIRE**, and *luminousness of the SEA*.

The fish is taken two ways; either with a line, or nets: the latter is the more considerable, and is usually performed in the night time. The rules observed in the fishing for mackerel are much the same as those already mentioned in the fishery of herrings.

There are two ways of pickling them: the first is, by opening and gutting them, and filling the belly with salt, crammed in as hard as possible with a stick; which done, they range them in strata or rows, at the bottom of the vessel, strewing salt between the layers.

In the second way, they put them immediately into tubs full of brine, made of fresh water and salt; and leave them to steep, till they have imbibed salt enough to make them keep; after which they are taken out, and barrelled up, taking care to press them close down.

Mackerel are not cured or exported as merchandize, except a few by the Yarmouth and Leith merchants, but are generally consumed at home; especially in the city of London, and the sea-ports between the Thames and Yarmouth, east, and the Land's End of Cornwall, west. By stat. 35 Geo. III. c. 54. the curers of mackerel in Great Bri-

tain may import any quantity of foreign salt, or take any quantity of British salt, from any salt-works and salt-pits, and remove coast-wise the salt so imported, or taken for the purpose of curing mackerel (or any cod, ling, hake, or salmon, being taken in the mackerel fishery) for home consumption, duty free, except the customs due on importation, in as full a manner as the herring and pilchard fishery are enabled to do for home consumption. For every barrel of white mackerel, twice packed, and completely cured, containing 32 gallons, which shall be exported from Great Britain into any parts beyond seas, (except into any part of the Mediterranean) a bounty of 2*s*. 8*d*. shall be paid; and for every barrel of mackerel which shall be landed from any boats or vessels, and which shall be properly salted and cured, shall be paid a bounty of 1*s*.

FISHERY, Oyster, is principally carried on at Colchester, in Essex; Faversham and Milton, in Kent; the Isle of Wight; the Swales of the Medway; and Tenby, on the coast of Wales. From Faversham, and adjacent parts, the Dutch have sometimes loaded a hundred large hoys with oysters in a year. They are also taken in great quantities near Portsmouth, and in all the creeks and rivers between Southampton and Chichester; many of which are carried about by sea to London and to Colchester, to be fed in the pits about Wavenhoe, and other places. By 31 G. III. c. 51. if any person shall within any net, trawl, dredge, or any other engine, take or catch any oyster or oyster brood, within the limits of any oyster fishery in this kingdom, or use any such engine for the purpose of catching oysters or oyster brood, though none be taken; or drag upon the ground of any such fishery with any net or other engine; every such person, except the owner, lessee, or occupier of the said fishery, or person lawfully entitled to catch oysters therein, shall be deemed guilty of a misdemeanor, and may be indicted at the assizes or quarter sessions for the county or division; and every such offender being convicted by verdict before the justices in sessions, or on his own confession, may be punished by fine and imprisonment, or either of them, as the court may think proper; such fine not to exceed 2*l*. or be less than 40*s*.; and such imprisonment not to be for more than three months, nor less than one month. Offenders may be apprehended by warrant of any justice, who may commit them to the common gaol or other prison, until the next assizes or quarter sessions, unless they enter into recognizance with two sureties in 20*l*. each to appear and answer to such indictment, &c. See **OYSTER**.

FISHERY, Pearl. See **PEARL fishery**.

FISHERY, Pilchard. The pilchard is a small salt-water fish, bigger than the anchovy, but less than the herring, which in other respects it resembles. Its head is yellow; its belly white; and its back a sea-green. It is excellent when fresh, or lightly salted. See **PILCHARD**.

There are certain seasons for fishing the pilchard; which, like the herring and anchovy, is a fish of passage from the northern latitudes; and its arrival is indicated by similar signs with those of the herrings. They are prepared and salted much as the anchovy is; with this difference, that the head is cut off the latter: but the pilchard is distinguishable from the anchovy, even though its head were off likewise; the pilchard having a very flat back, and the anchovy a round one.

The chief pilchard fisheries are along the coasts of Dalmatia, to the south of the island Issa; on the coasts of Bretagne, from Belle island as far as Brest; and along the coasts of Cornwall and Devonshire; when they appear about the middle of July, and range between Fowey harbour and

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the Scilly islands about September; some few occasionally returning after Christmas.

It is a saying of the Cornish men, with regard to the pilchard, that it is the least fish in size, most in number, and greatest in gain, of any they take out of the sea. This observation is amply confirmed by Dr. Borlase's account of this fishery; for besides the great number of persons employed by it, the poor are fed with the offals of the captures, the land with the refuse of the fish and salt, the merchant finds the gains of commission and commerce, and the fisherman the gains of the fish. The usual produce of the number of hogheads exported each year, for ten years, from 1747 to 1756 inclusive, from the four ports of Fowey, Falmouth, Penzance, and St. Ives's, amounted to 29,795 hogheads. Every hoghead for ten years last past, together with the bounty allowed for each hoghead exported, and the oil made out of each, has amounted, one year with another, at an average, to the price of *1l.* 13*s.* and 3*d.*; so that the cash paid for pilchards exported has, at a medium, annually amounted to the sum of 49,532*l.* 10*s.* The number taken at one shooting out of the nets is amazingly great. In 1757, there were at one time inclosed in St. Ives's bay 7000 hogheads, each hoghead containing 35,000 o fish; in all 245,000,000*l.*

That on the coasts of Dalmatia is so plentiful, that it not only furnishes all Greece, but a great part of Italy. That on the coasts of Bretagne has employed yearly above three hundred sloops, and most of the seamen of the country.

The fish caught on our own coasts, though bigger, are not so much valued as those on the coasts of France; owing principally to their not being so thoroughly cured.

The season is from June to September.

The pilchards, like the herrings, naturally follow the light, and will gather about a boat that bears a light in the night time; which contributes much to the facility of the fishery.

On the coasts of France they make use of the roes of cod-fish as a bait; which thrown into the sea makes them rise from the bottom, and run into the nets placed for that purpose.

On our coasts there are persons, called in Cornwall *buers*, posted ashore, who, spying by the colour of the water where the shoals are, make signs to the boats, to get among them, to call their nets.

When taken, the fish are brought to a warehouse on shore, where they are laid up in broad piles, supported by backs and sides.

As they pile them, they salt them with bay-salt; in which they lie soaking twenty or thirty days, and discharge a great quantity of blood, with dirty pickle, and bitter; which last draws much of the oil from the fish, to the great loss of the owners. When taken out of the pile, there remains a quantity of salt, blood, scales, &c. at bottom, which, with fresh salt, serves for another pile.

They now proceed to wash them in sea-water to clear off the dirt and blood; and, when dry, they put them up in barrels, and press them hard down to squeeze out the oil, which issues away at a hole in the bottom of the cask; and in this state they are fit for sale or use.

FISHERY, Salmon. The salmon is a northern fish, occupying the European seas, the latitudes lying between France and Greenland, being unknown in the Mediterranean sea, and other warm climates, and, according to some, breeds in the sea: but the opinion of others seems better warranted, that it breeds in the clear sandy parts of rivers, remote from their mouths. They commonly spawn in November; and

when they have found a place fit for the purpose, the male and female unite in forming a proper receptacle for it in the sand or gravel, about the depth of eighteen inches; in this the female deposits her spawn, and the male his milt, which they cover carefully, as it is said, with their tails; for after spawning, they are observed to have no skin on that part. The spawn lies buried till the spring. The milt and spawner, having performed their office, betake themselves to the sea; and if their return be prevented by weirs, or the like, they become sick, lean, and are then called *kipper*, pine away, and die in two years time. If they spawn in the mean time, the produce is a diminutive salmon, called *flagger*, which will never arrive at the natural bulk; it being the sea that makes them grow big, and the rivers fat. The female is distinguished from the male, in that its nose is longer, and more hooked, its scales not so bright, and its body speckled over with dark brown spots, its belly flatter, and its flesh not so red; more dry, and less delicious to the taste. In spawning time, when they repair from the sea up to the rivers, scarce any thing can stop their progress. Many have seen them leap up cataracts and precipices many yards high. They will ascend rivers 500 miles from the sea, and force themselves against the most rapid streams. They are frequently taken in the Rhine as high as Basil in Switzerland; they gain the sources of the Lapland rivers notwithstanding their strong torrents; and surmount the perpendicular fall across the Liffy, at Leixlip, 7 miles above Dublin, though nearly 30 feet in height. As soon as they come to the bottom of the cascade, they seem disappointed on meeting the obstruction, and retire some paces back; they then review the danger that awaits them, survey it without motion, advance, and again retreat; till at last, summoning up all their force, they take a leap from the bottom, with the body quite straight, and with a strong tremulous motion; and they most frequently clear every obstruction. It sometimes happens, however, that they want strength to make the leap, in which case they are entangled in their descent by baskets placed on purpose, from which they cannot escape. The shooting of salmon, in their leap, is sometimes practised for amusement. See SALMON.

When the salmon first enter the fresh water, they have a number of insects, the *lernee salmonæ* of Linnæus, adhering to them, especially above the gills, which are signs that the fish is in high season: these die and drop off soon after the salmon have left the sea. About the latter end of March the spawn begins to exclude the young, which gradually increase to the length of four or five inches, and are then termed smelts or smouts; and about the beginning of May the Tweed, &c. is full of them; but they are soon hurried away to the sea. About the middle of June, the earliest of the fry begin to drop, as it were, into the river again from the sea, being about twelve, fourteen, or sixteen inches, and they gradually increase in number and size till about the end of July (at Berwick the fish in this stage is called gille); when they again lessen in number and increase in size, some being, in August, six, seven, eight, or nine pounds in weight.

The chief salmon fisheries in Europe are along the coasts of England, Scotland, and Ireland. The fishing usually begins about the first of January, and ends by the last of September. It is performed with nets, in the places where the rivers empty themselves into the sea, and along the sea coasts thereabout. The fish are seen to crowd thither frequently in shoals from all parts in search of the fresh water; they also fish for them higher up in the rivers: sometimes with nets, and sometimes with a kind of locks, or weirs, made for the purpose, with iron grates therein, so disposed, as that

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that the fish, in going up the river, open them with their head; but are no sooner entered than the gate claps to. Thus the salmon are inclosed as in a reservoir, where it is easy to take them. In some places they fish for salmon in the night time, by the light of torches, or kindled straw. The fishermen watch when the fish draws towards the light, whereof he is naturally a great lover, and strikes him with a spear or lifter. In some parts of Scotland it is said, they ride a fishing up the rivers, and, when they spy them in the shallow parts, shoot them with firearms.

Salmon form, in several countries, a great article of commerce; being cured in different ways, by salting, pickling, and drying. There are stationary fisheries in Iceland, Norway, and the Baltic; but those at Coleraine in Ireland, at Berwick in Great Britain, and in some of the rivers of Scotland, are the most considerable. The capture in the Tweed near Berwick, about the month of July, is prodigious; a boat load, and sometimes near two, are taken in a tide; and it is common to take from fifty to a hundred fish at one haul. At this time the coopers in Berwick begin to salt both salmon and gillies in pipes, and other large vessels, and then barrel them to send abroad. The salmon barrel holds above forty-two gallons, wine measure. Most of the salmon taken before April is sent fresh to London; and that which they fail to send is boiled, pickled, and kitted. Fresh salmon has also been sent to London in the latter end of September; but then the fish are full of large roes, very thin bellied, and are esteemed neither palatable nor wholesome. In the month of July a stone of fresh salmon, of eighteen pounds ten ounces and a half, has been sold at Berwick for eight-pence; but the more common price is between sixteen-pence and two shillings and six-pence. The season for fishing in the Tweed begins the thirtieth of November, though the fishermen work very little till after Christmas, and ends on Michaelmas day. There are on this river forty-one considerable fisheries, beside others of less value, which formerly rented for near 540*l.* per annum.

Scotland possesses also great numbers of fine fisheries on both sides of that kingdom. The salmon are cured in the same manner as at Berwick; and a great quantity is sent to London in the spring; but after that time the adventurer begins to barrel and export them to foreign countries; though the demand for them is much abated of late years. They have also in Scotland a great deal of salmon, salted in the common way, which, after soaking in brine for a competent time, is well pressed, and then dried in smoke: this is called *kipper*, is chiefly made for home consumption, and, if properly cured and prepared, is reckoned very delicious food. The great fisheries are those of the Tweed, the Forth, the Tay, the Dee, the Don, the Devon, the Spey, the Findhorn, the Ness, the Braulie, and thence northward to Dunglass head, the coast of the Pentland firth, the coast from cape Wrath to the Mull of Cantire, all the Hebride islands, and the coasts of Airshire, Galloway, and the Solway firth, where the rivers, bays, or lakes are open. The season of fishing at Aberdeen is from the 30th of November to the 8th of September; but few fish come into the rivers before the 1st of January, from which time, to the middle of May, the salmon are boiled and killed for the London market, and sent off almost every week, by swift sailing sloops, called *smacks*, retained for the purpose. Those that are caught through the summer are salted for foreign exportation. No salmon is allowed to be barrelled and cured, except by the town's coopers, who are required to put the initial letters of their names on their barrels; nor can they be shipped for exportation till the letters A.

B. D. have been burned on each barrel, by an officer appointed for that purpose. No fish that hath been bit by seals, none under a certain fixed weight, nor any that have been damaged in the carriage from the river, are to be put into a barrel, without having the word *rebate* burned on the end of the cask. The barrels are of a fixed size, containing about 250 pounds of fish, so carefully packed that they do not differ a pound of fish from one another. After they are packed from the vats in which they had been salted, great care is taken to keep them brim full of pickle, till the bungs are fixed down, a day or two before they are shipped. By this attention the Aberdeen salmon hath acquired such a character abroad, that it generally fetches the highest price, and no questions are asked respecting the quality.

The north of Ireland abounds with this fish: the most considerable fishery is at Cranna, about a mile and a half from Coleraine, rented, in 1754, for 620*l.* a year. It is situated on the river Bann, where they fish with nets eighteen score yards long, and are continually drawing night and day through the whole season, which lasts about four months; eight hundred and forty fish have been taken at a single draught. There is also a weir on the river, which takes the fish that escape the nets. In 1760, three hundred and twenty tons were taken in the Cranna fishery. The salmon are cured in this manner: they are first split, and the guts and gills, and many of the bones, are taken out, and then rubbed with fine salt; and after lying in pickle in large tubs for six weeks, are packed up with layers of coarse brown Spanish salt in casks, six of which make a ton. These are exported to Leghorn and Venice, &c. at the price of twelve or thirteen pounds a ton. Pennant's Brit. Zool. v. iii. p. 284. 294. See a further account of this fishery under COLERAINE.

The stat. 4 & 5 Anne, cap. 21. was made for the increase and preservation of salmon in rivers in the counties of Southampton and Wilts, requiring that no salmon be taken between the first of August and the twelfth of November, or under size, &c. And by 1 Geo. I. cap. 18. salmon taken in the rivers Severn, Dee, Wye, Were, Ouse, &c. are to be eighteen inches long, at least; and the nets shall not be less than 2½ inches in the mesh; nor shall any salmon be sent to London out of the said rivers under six pounds weight; or the persons catching them shall forfeit 5*l.* This statute contains several other regulations. And by 30 Geo. II. cap. 21. no salmon is to be caught in the rivers Thames and Medway between the eleventh of November and twenty-fourth of August, or to be of less weight than six pounds.

Salmon is also fished for in rivers, after the manner of trout, with a line and hook. He bites best in the afternoon, about three, in May, June, July, and August; the water being clear, and a little breeze of wind stirring; especially if the wind and stream set contrary ways. The salmon is caught like a trout, with worm, fly, and minnow; and especially the garden-worm, if well secured, and kept twenty days in moss. The salmon never stays long in a place, but is continually shifting to be as near the spring-head as possible, and swimming generally in the deepest and broadest parts of the rivers, near the ground. Put two or three garden-worms well secured on your hook at once, as if you were baiting for trout: and be sure to give him time to gorge his bait, before you strike. Some use a wire-ring on the top of the rod, through which the line may be let run to any length at pleasure, by a reel near the land.

FISHERY, Seal, &c. The fishery for seals is very productive

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ductive and gainful. The skin of the seal is tanned and made into shoes, commonly called dog-skin shoes; it also serves for the bottoms of chairs, and for various other purposes. The oil is used in chambers, and sells at a much higher price than that of the cod-fish, which is burned in street-lamps. The greatest seal fishery is on the coast of Labrador in North America. The boats used in the cod-fishery of Newfoundland are about 50 feet in length, decked at both ends; they have two masts, and a short bowsprit; they are built of fir or spruce, and will fail, as the seamen say, in the wind's eye. In the winter season, when the Newfoundland cod-fishery is finished, these boats, with 30 or 40 men in each, repair to the frozen shores of Labrador, where the winds and tides often drive immense floats of ice into the bays, and on these floats a great number of seals. As the boats belong to different merchants, the float of ice is marked out in equal portions, and each boat's crew are strictly limited to the part assigned them. Having settled these regulations, they attack the seals in their respective departments. The first man of the party advances towards a seal, which he strikes immediately above the nose with a club; then attacks another and kills it; and marches forward to a third, which he also kills. Thus advancing, the whole field of ice becomes a scene of blood, strewed with dead seals. When the first seal is killed, the next person in rank tears off the skin, which he leaves on the spot, and advances to the second, and so on. A third person takes a layer of fat, with which the seal is covered next the skin, which he leaves on the spot, and immediately follows the two others. Thus the killer, the slayer of skin and of fat, with the remaining crew, will sometimes clear to the value of 500*l.* within the interval of 24 hours. When this happens, they return with what they call a full cargo, which abundantly reimburses their employers. The seal-fishing in Scotland is in some respects similar. The Scottish seas are open through the whole year, and the seals, being of the amphibious kind, frequent the caverns and openings of the rocks upon the shore, where they bring up their young. The Hebrides, and the northern shores of the main land, are the principal resort of the seals. On the western coast of North Uist, a part of the Long island, lies the rock Consmil, about a quarter of a mile in circumference, which is still famous for the yearly fishing of seals there the end of October. This rock belongs to the farmers of the adjacent lands; one of whom furnishes a boat, to whom a particular share is due on that account, besides his proportion as a tenant. The minister, steward, and subordinate officers have their shares by virtue of their respective offices. The farmers man their boats with a competent number of persons; and when the crew are landed, a signal is given for a general attack, the passers being surrounded, and they beat down the seals with their staves. The seals on this onset make towards the sea with full speed, and often force their passage over the necks of the stoutest assailants, who always aim at the foreheads of the seals, giving many blows before they are killed; and sometimes the seals lay hold of the staves with their teeth, and carry them away to the sea. Those that are in the boat shoot at them as they run to sea, but few are caught that way. Some of the largest seals lose their lives by endeavouring to save their young, which they tumble before them towards the sea, and in this act they are cruelly knocked on the head with sticks or staves. Three hundred seals, it is said, have been killed at one time in this place. They are attacked in October, because in the beginning of this month they bring forth their young on the west side of these islands; but those on the east side are

of a smaller stature, and bring forth their young in the middle of June.

The seals eat no fish till they first take off the skin; they take hold of the fish between their teeth, and pluck the skin off each side with their sharp-pointed nails. The natives say that the seals are regularly coupled, and resent an encroachment on their mates at an extraordinary rate. It is said that the seals make their mutual addresses by salutations; and the female puts away its young as soon as it is able to provide for itself, in doing which it recurs to many severe blows. In the skin of the females there is a hole, within which the teats are secure from injury, as it creeps along the rocks and stones; and on this account nature has formed the point of the tongue cloven, in order to enable the young to suck. The natives salt the seals with the ashes of burnt sea-ware, and say they are good food. The vulgar eat them commonly in the spring, and use a long pointed stick instead of a fork, to prevent the strong smell which their hands would otherwise retain for several hours afterwards. This four-footed creature is reckoned one of the swiftest in the sea: and it is likewise said, that in cold weather it will leap to the height of a pike above water; that the skin of it is white in summer, and darker in winter; and that its hair stands up with the flood, and falls again at the ebb. The natives cut the skin in long pieces, and use them as ropes to fix the plough to their horses when they till the ground.

The *basking sharks* are supposed to be migratory fishes from the Arctic circle; they frequent the coast of Norway, the Orkney and Hebride isles, the firth of Clyde, the bay of Ballyshannon in Ireland, and the west coast of Wales, particularly Carnarvonshire and Anglesey. They appear in the firth of Clyde, near the isle of Arran, in small shoals of seven or eight, but more generally in pairs, some time in June, and remain till the end of July, when they disappear. Although they are in size from 10 to 20 feet in length, they are so tame and stupid, that they will suffer themselves to be stroaked in the water. They lie on the surface, sometimes on their bellies, and sometimes on their backs, as if they were asleep. When the harpooner strikes his weapon into them, which he does as near the gills as possible, and they perceive themselves wounded, they sling up their tail and plunge headlong into the bottom, coiling the rope round them in their agonies, and attempting to disengage the harpoon by rolling on the ground. As soon as they find that their efforts are ineffectual, they swim away with such rapidity and violence, that a vessel of 70 tons has been towed away by them against a fresh gale. They sometimes run off with 200 fathoms of line, and with two harpoons in the body; and will contend for 24 hours before they are subdued. When they are killed, the liver, which is the only useful part, is taken out and melted in kettles provided for that purpose. A large fish, particularly the female, will yield eight barrels of oil, two of uselefs sediment, and afford a profit of 20*l.* The oil is of the most valuable kind, being pure and sweet, extremely proper for lamps, and much valued by tanners. It is also used by the fishers for curing burns, bruises, and rheumatic complaints.

The catching of *sea-dogs* is a kind of defensive fishery. These animals, though scarcely exceeding the size of a large cod, are equally destructive to nets, and to all the species of fish which they can overcome. They had become so offensive on the coasts of Newfoundland and Labrador, that the enraged fishermen made war upon them as a common enemy, and with such success, that they have almost extirpated the whole species from the American shores. They abound on the coast of Shetland, particularly the Hebrides, where they

are

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are taken in considerable numbers. Being split and dried, they are conveyed by the women through different parts of the country, and sold or exchanged for necessaries; these forming a petty inland commerce.

FISHERY, Sturgeon. The sturgeon is a large sea-fish, which at its season runs up the rivers; having a sharp-pointed snout, a flat belly, and blueish back. Sturgeons, as well as whales, are reckoned among the number of royal fishes.

There are sturgeons of all sizes; and we even read of some twenty feet long; but the middle size are reckoned the best; though some prefer the smaller. See **STURGEON**.

It is of the roe or eggs of this fish that the caviar, or kavia, so much prized by the Italians, &c. is prepared. See **CAVIAR**.

Sturgeon, when fresh, eats deliciously. To make it keep, they salt or pickle it in large pieces, and put them up in cags, from twenty-five to fifty pounds.

The greatest sturgeon fishery in the world is in the mouth of the Volga, in the Caspian sea; where the Muscovites find employment for a great number of men. We have also had a considerable supply of sturgeon from North America, which rivals that of the Baltic.

They are not caught in nets, but in a kind of inclosure, formed by huge flakes, disposed in triangles, representing the letter Z several times repeated. These kinds of fisheries are open on the side towards the sea, and close on the other; by which means the fish, ascending in its season up the river, embarrasses itself in these narrow angular retreats; and not being able to turn itself, to go back again, on account of its bulk, is easily struck, and killed with a sort of harping-iron. They are also taken during summer, in the lakes Frischehoff and Curischehoff, near Pillau, in large nets, made of small cord; the adjacent shores are formed into districts, and farmed out to companies of fishermen; some of which are rented for six thousand guilders, or near 300 *l. per annum*.

The chief object of this fishery is the roe or spawn, which is a commodity as much used in Muscovy as butter in Holland; and there are some sturgeons that furnish each four hundred pounds thereof. It is only the lesser and younger sturgeon that they pickle for eating.

FISHERY, Turbot. The method of taking turbot and other fish by the people of Scarborough is this: when they go out to fish for turbot, each person is provided with three lines; each man's lines are fairly coiled upon a flat oblong piece of wicker-work. The hooks being baited and placed very regularly in the centre of the coil, each line is furnished with 14 score of hooks, at the distance of six feet two inches from each other. The hooks are fastened to the lines upon snoods of twitted horse-hair, 27 inches in length. When fishing, there are always three men in each coble, and consequently nine of these lines are fastened together, and used as one line, extending in length nearly three miles, and furnished with 2520 hooks. An anchor and buoy are fixed at the end of each man's line; in all four anchors, which are commonly perforated stones, and four buoys are made of leather or cork. The lines are always laid across the current, and remain upon the ground about six hours. The coble is 20 feet 6 inches long, and five feet in extreme breadth: it is about one ton burden, rowed with three pair of oars, and admirably constructed for the purpose of encountering a mountainous sea. When the wind suits, they hoist a sail.

FISHERY, Whale, or Greenland FISHERY. This huge fish, we have elsewhere observed, chiefly caught in the

North sea. The largest sort are found about Spitzbergen, some of them being there two hundred feet in length. Those on the coasts of America are about ninety, or a hundred; and those on the coast of Guyenne, and the Mediterranean, are the smallest of all.

The first persons that seem to have been employed in the whale fishery were the Norwegians, probably soon after their discovery of Greenland, about the year 837: for we find that king Alfred received information from Oäther, a Norwegian, in 887 or 890, that the Norwegians were employed in this fishery. He tells the king, that he sailed along the Norway coast, as far north as the whale hunters commonly used to travel; but it seems that all knowledge of this gainful employ was lost, at least in this country, for almost seven centuries. The Biscayners were also concerned in it, for the sake not only of the oil, but also of the whale-bone, before the English; for, though their north-east discoveries in 1553 had pointed out the way to the whale-fishery at Spitzbergen, they were so ignorant of the business in 1575, as to be under a necessity of procuring information and assistance from Biscay for this purpose. The first mention that occurs in the English history of whale-fins, or whale-bone, is in 1593, when eight hundred fins, part of the cargo of some Biscay ships, that had been wrecked three years before, were brought to England from the bay of St. Laurence in America by an English ship; previous to which time, the ladies' stays, as Mr. Anderson observes, must have been made of split or some other tough and pliant wood; the whale fishery being carried on for the sake of the oil long before the discovery of the use of the whale-bone, which was first brought to England, with the blubber or oil, in 1617. The English, having been accustomed to the Northern seas, by their repeated trials for a north-west and north-east passage to China, in 1598 commenced their fishery for whales at or near Spitzbergen, where those animals resort in greater numbers than any where else. But the first English voyage for the purpose of killing whales was undertaken by the Russian company in 1611, who sent two ships thither, with six Biscayners, expert in the business; the ships were lost, though their men and boats, &c. were saved by a ship of Hull, then at Spitzbergen. In 1618, the East India adventurers joined stock with the Russian company for pursuing the whale fishery, and fitted out thirteen ships, but the voyage proved unsuccessful. The manner of managing the whale-fishing, both by the English and Dutch, was then quite different from the present mode: the whales, having never been disturbed, resorted to the bays near the shore, so that their blubber was easily landed at Spitzbergen, where they erected cookeries, *i. e.* coppers, &c. for boiling their oil; and these they left standing from year to year, and only brought home the purified oil and the whale-bone. The English, having been the first in that fishery, kept possession of the best bays; the Hollanders, coming later, were obliged to find bays farther to the north; the Danes, who came later into this trade than the Dutch, got in between the English and Dutch; the Hamburgers came after the Danes, and after them came the French, and also the Biscayners, the most ancient whale-fishers in Europe, except the Norwegians, and pursued the same method. But, since these times, the whales are less frequent in the bays, and are commonly among the openings of the ice farther from the land: so that the blubber is now cut from the whales after they are killed, in the manner described in the sequel of this article, and brought home to be boiled and purified, and the whale-fins are also to be cleaned at home.

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home. This latter method of fishing, being dangerous to shipping, discouraged our English adventurers who traded in a company; so that they soon after, viz. in 1619, relinquished the fishery. Some private adventurers prosecuted the trade with various success in 1621, 1622, and 1623, when they were molested by the Dutch, who were then superior in number of ships, and had the prince of Orange's commission; for in 1622 the Dutch, for preventing of disturbance in their whale fishery, had erected an exclusive company, who, by their own power, might protect it: however, the fishery was laid open, in 1643, to all the inhabitants of the seven provinces. As to the claims which different European nations have alleged in favour of a monopoly of the whale-fishery at Spitzbergen, it has been urged by the English that they were the first discoverers, by sir Hugh Willoughby, in 1553; by the Dutch, who deny his having been so far north as Spitzbergen, and maintain their having first discovered it in 1596; by the Danes, that Spitzbergen is a part of Old Greenland, possessed in early times by them. But all nations have now wisely given up their exclusive pretensions, and that part of the world remains now alike free to all nations for this fishery. In 1616, king Charles I. confirmed by his proclamation the Greenland whale-fishery solely to the Russia company, who soon relinquished it. In 1672 an attempt was made for reviving this fishery, when an act was passed for the encouragement of it; and this act was continued in 1690, but without any great effect. A corporation was established by act of parliament, in 1693, for carrying on this fishery, called the *Greenland Company*.

In 1725, the English South-sea company revived this trade: but, after great losses, were obliged to discontinue it, in 1733. At this time a bounty of 20*s.* per ton was granted by parliament to British ships of two hundred tons and upwards, fitted out for the whale-fishery, which bounty was not only continued, in 1740, but an additional bounty of 10*s.* per ton was granted during the war with Spain, in which we were then engaged; and in 1749 a farther bounty, or allowance of 20*s.*, over and above that of 1733, was granted to all British whale-fishing ships, and extended to ships of the British American colonies; and in 1755 this bounty was extended to ships under two hundred tons burthen; and, as a farther encouragement to this fishery, foreign protestants, serving three years in it, were naturalized on certain conditions. See Hackluyt's *Coll. Voyages*, and *Anderfon's History of Commerce*.

But, notwithstanding the great importance and numerous advantages of this trade to England, and the encouragement which the legislature has given it, the Dutch carried it on with much greater success than the English; and it became one of the principal branches of their flourishing trade. The chief merchants of the several provinces associated themselves into a body for carrying it on, and sent every year a great fleet of vessels to the North seas for that purpose. They attempted to make their first establishments in Greenland; but not succeeding, they have since fixed their fishery about the western coast of Spitzbergen, from the latitude of 76 deg. 40 min. to 80 deg. and from east to west about eighty nine leagues.

To give some idea of the manner and importance of this trade, we shall here subjoin the discipline for a long time observed in the whale-fishery, the method of fishing; the cargo and equipage of a vessel; and the produce thereof.

The discipline is adjusted by a standing regulation, consisting of twelve articles; the principal of which are:

That in case a fishing-vessel be shipwrecked and the cap-

tain and crew saved, the next vessel they meet shall take them in; and the second vessel take half of them from the first; but that no vessel shall be obliged to take any of the loading of a vessel shipwrecked; that as to the effects of a shipwrecked vessel, which are absolutely relinquished, and which another captain shall find, and take up, upon his arrival in Holland, he shall account for one half of them to the proprietors of the shipwrecked vessel, clear of all expences; that if the crew desert a shipwrecked vessel they shall have no claim to any of the effects saved, but the whole shall go to the proprietor; but if they be present when the effects are saved, and assist therein, they shall have one-fourth thereof; that if a person kill a fish on the ice, it shall be reputed his own, so long as he leaves any person with it; but the minute he leaves it, it becomes the due of the first captain that comes that way; but that, if a fish be tied to an anchor, or a rope fastened to the shore, it shall remain to its first proprietor, though he leave it alone; that if any person be wounded or lamed in the service, the commissioners of the fishery undertake to procure him a reasonable satisfaction; to which the whole fleet shall contribute.

Besides this general regulation, to the observance of which all the captains, pilots, and masters of vessels, were obliged to swear, before they put to sea, there was also a particular one for each ship's crew, which they were all sworn to execute, in presence of one of the commissioners, who went aboard every ship, to receive the oath.

This regulation was a kind of charter-party, importing, that they would attend prayers morning and evening, on pain of an amercement, at the discretion of the captain; that they would not get drunk, nor draw their knives, on forfeiture of half of their wages; nor fight, on forfeiture of the whole; that no one should lay wagers on the good or ill success of the fishing, nor buy or sell on these conditions, in case they took one or more fish, on penalty of twenty-five florins; that they would be contented with the provisions allowed them; and that they would never light fire, candle, or match, by night or day, without the captain's leave, on the like penalty.

After the reading of this regulation, the crew were all called to receive the customary gratuity before their setting out, with an assurance of another sum at their return in proportion to the success of the fishing.

The captain, on this occasion, received from an hundred to an hundred and fifty florins; the pilot from forty to sixty; each harpooner from forty to fifty florins; the other officers from twenty-six to thirty-six florins; the elder sailors twenty; and the younger twelve.

The fleets, which consisted mostly of fluyts from two to three hundred tons, and from thirty-six men to forty-two, usually set sail about the beginning of April, and took its course by the isles of Iceland, from 60 to 61 degrees of latitude; after which, leaving them to the west, it steered northward, through 73, 74, and 75 deg. of latitude, where they began to find the ice.

It was among these huge heaps of ice, wherewith the whole quarter is filled, that they first began to spy the whales; and there most of the vessels fixed their abode for the fishing. But as the fish were larger and fatter the farther north they went, some captains would venture as far as 80 or 82 deg. of north lat. Each vessel of three hundred tons had six shalloops; and each shalloop had six harpooners, with five seamen to row it. To every shalloop there were seven lines, of three inches circumference; five of them in the hind part of the vessel, and two before. The hind lines together made six hundred fathoms, and, with the

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addition of the other two, eight hundred and eighty. If the whale dived deeper, or ran farther underneath the ice than this float, the line must be cut, lest the shallop should be drawn after it.

In the English whale-fishery every ship has six or seven boats; each of which has one harpooner, one boat-steerer, one manager of the line, and four seamen to row it. In each boat there are two or three harpoons, several lances, and six lines fastened together, each line being a hundred and twenty fathom long. To each harping iron is fastened a strong stick, about six feet long, and a soft pliable line, about six fathom long, called the fore-gauger, which is fastened to the lines in the boat. When more line is wanted, the lines of a second boat are fastened to those of the first.

The instrument, wherewith the whale is struck, is a harping-iron or javelin, five or six feet long, pointed with steel, in a triangular shape, like the barb of an arrow.

The harpooner, upon sight of the fish, from one end of the shallop where he is placed, flings the harping-iron with all his might against his back; and, if he be so happy as to make it penetrate the skin and fat into the flesh, he lets go a string fastened to the harping-iron, at the end whereof is a dry-gourd, which swimming on the water, discovers whereabouts the whale is; for the minute he is struck he plunges to the bottom, commonly swimming against the wind.

If the whale return to breathe in the air, the harpooner takes occasion to give him a fresh wound, till, fainting by the loss of blood, the men have an opportunity of approaching him, and thrusting a long flecked lance under his gills into his breast, and through the interlines, soon dispatch him; and when the carcass begins to float, they cut holes in the fins and tail; and, tying a rope in these holes, they tow him to the vessel, where he is fastened along the larboard side of the ship, floating upon his back almost level with the sea. They then begin to take the blubber or fat, and the fins, as they are called, or *whale-bone*.

In order to this, several men stand upon the fish, with a kind of iron calkers, or spurs, to prevent their slipping; and cut off the tail, which is hoisted upon deck, and then cut out square pieces of blubber, weighing two or three thousand pounds, which are hoisted on board with the capstan, where each piece is again cut into smaller pieces, each of two or three hundred pounds weight; and these are thrown into the hold, and left to drain for three or four days. When all the blubber is cut from the belly of the fish, it is turned on one side, by means of a piece of blubber left in the middle, called the *cant*, or turning-piece; and then they cut out this side in large pieces, called *hockies*, as before, and also the whale-bones with the gums, which are preserved entire, and hoisted on deck, where the blades are cut and separated, and left till they have time to clean and scrape them. The fish is next turned on its back and the blubber cut out from the back and crown bones; and last of all they cut the blubber from the other side as before. They then cut out the two large jaw-bones, situate in the under-lips, which are hoisted on deck, cleansed and fastened to the shrouds, and tubs are placed under them to receive the oil which they discharge; this oil belongs to the captain, and likewise the tail and fins. The carcass is left to float, and supplies food for Greenland birds, called malleucks, &c. In three or four days they hoist the pieces of blubber out of the hold, chop them, and

put small pieces through the bung-holes into their casks. A whale, the longest blade of whose mouth is nine or ten feet, generally fills thirty butts with blubber; but one of the largest fish will fill seventy butts and more. A good large whale is valued at about 1000*l.* sterling. A full ship of three hundred tons is worth, clear of all expence, at least 5000*l.* There is a premium assigned to every person in the ship for every whale: the captain has three guineas; the mate, one; each harpooner, one; the surgeon, one; carpenter, one; cook and boat sweepers, half a guinea each; a common man, a crown; and each boy, half a crown. The captain and harpooners have no wages; but the captain is allowed twenty-five pounds, and the harpooners, nine guineas each. In a successful voyage they have six shillings for every ton of oil boiled in Greenland-deck; but the rest of the ship's company have monthly wages, besides the fish-money, but no oil-money.

Nothing now remains, but to sail homewards, where the fat is to be boiled, and melted down into train-oil.

The whale-fishery of the Caroline islands is more easy and agreeable than that of all other places, and, beside the great profit, affords a pleasant spectacle to multitudes of people on the shores.

There are ten or twelve of these isles disposed in form of a circle, so that they make a sort of port, in which the sea is perpetually calm and pleasant.

When a whale appears in this gulf, the people all get into their canoes, and rowing toward the sea, keep between the creature and its retreat, and drive him forwards towards the isles at the bottom of the port. They drive him in this manner before them into the shallows, where they plunge into the water themselves, and some get ropes and chains about him, while others dart him with their spears. Their agility and address are wonderful in this. The creature can never get away when they have once got him fastened, but is soon killed, and got to the shore.

FISHERY, *Produce of one Year's Whale.* To state the produce, we make choice of the fishery of 1697, as being one of the greatest and most fortunate that ever was known; to which we shall add that of the year 1725.

In the year 1697, there were a hundred and eighty-nine vessels of divers nations; whereof a hundred and twenty-one were Dutch, forty-seven Hamburgers, two Swedish, four Danish, twelve of Bremen, two of Embden, and one of Lubbeck; who caught in all 1968 fish.

In the year 1725, there were two hundred and twenty-six vessels; whereof one hundred and forty-four were Dutch, twelve English, forty-three Hamburgers, twenty-three of Bremen, two of Berghen, two of Flensburg. Their captures were 349 fish.

The Dutch captures in 1697,	}	41,344	punchcons of
produced			blubber.
The Hamburgers	-	16,414	
The Swedes	-	540	
The Danes	-	1710	
The Bremeners	-	3790	
The Embdeners	-	68	

The English captures in 1725, produced 1000 punchcons of blubber, and 20 tons of whale-bone.

Now, estimating the punchcon of blubber at thirty florins Dutch, or 2*l.* 15*s.* English, the current price in the year 1697, the total produce of the year's fishing amounts to 175,631*l.* 10*s.* sterling. As to fins, or whale-bones, setting them at two thousand weight *per* whale, and an hundred weight at 4*l.* 4*s.* they will yield 165,312*l.* which, added to the former sum, amounts to 340,943*l.* 10*s.*

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Mr. Anderfon, in his *History of Commerce*, vol. ii. p. 350, observes, from an account of the Dutch whale-fishing for forty-six years, ending anno 1721, that in this time they had employed 5886 ships, and caught 32977 whales, which valued one with another at 500*l.* give an amount for the whole value of above 16 millions sterling, gained out of the sea mollly by the labour of the people, deducting the expence of the wear and tear of shipping, the casks, and the provisions.

The whale-fishery begins in May, and continues through the months of June and July; but whether the ships have good or bad success, they must come away and get clear of the ice by the end of August; so that in the month of September at farthest they may be expected home; but the more fortunate ships may return in June or July.

The statute 26 Geo. III. c. 41. prescribes the conditions on which ships going on the Greenland whale-fishery shall obtain licences from the commissioners of the customs. A certificate shall be produced, signed by an officer of the customs, after due examination of each ship, stating that the ship is legally qualified for the voyage, by being navigated by a master and three-fourths British subjects, and having on board a competent number of men, boats, lines, provisions, &c. Every ship of the burden of 200 tons, designed for this fishery, shall have on board 40 fishing lines of 120 fathom each, 40 harpoon irons, 4 boats with 7 men at the least, including a harpooner, a steerfinan, and a line manager, to each boat, besides the master and surgeon, and 6 months provision at the least for such a number of men; and every ship of larger burden, an increase of 6 men, one boat, 10 such lines, and 10 harpoon irons more, for every 50 tons above the said 200 tons, together with provisions in proportion; and every ship shall have apprentices indentured for 3 years, in the proportion of one at the least for every 35 tons burden, and one fresh or green man for every 50 tons burden. On the return of such ship, her condition shall be certified by the proper officer of the customs, together with a variety of particulars relating to her voyage, cargo, &c. &c.; and then the commissioners at the port where such ship shall arrive shall assign a bounty or premium of 30*s.* per ton, according to the admeasurement of such ship duly certified. This bounty shall be restricted to such ship as shall have sailed from the port whence she cleared on or before the 10th of April in each year, and shall have continued in the Greenland seas, Davis's straits, or seas adjacent, endeavouring to catch whales, and not have departed thence before the 10th of August next following, unless such ship, if 300 tons, be laden with 30 tons of oil, or blubber in proportion, and 1½ ton of whale-fins in like proportion to the tonnage, or be forced by accident to depart from these seas. Each ship entitled to the bounty must have kept a log-book. The owners may insure the bounty, in case of the loss of the ship. Whale-fins, oil or blubber of whales, seal oil or seal skins, or any other produce of seals or fish caught in the seas of Greenland, or Davis's straits, or parts adjacent, may be imported duty free. No harpooner, line-manager, or boat-steerer, belonging to any ship in this trade, shall be liable to be impressed from this service. The Greenland seas, Davis's straits, and seas adjacent, shall be deemed and extend to the latitude of 59° 30' N., and no farther. The stat. 29 Geo. III. c. 52. c. 53. contains some additional regulations. This act is continued by 41 Geo. III. c. 97.

Southern Whale Fishery. The statutes 35 Geo. III. c. 92. and 42 Geo. III. c. 18. assign premiums to 16 ships employed in this fishery, under certain prescribed restrictions: 12 of which shall be fitted and cleared out between

January 1st and December 31st, 1802, and between January 1st and December 31st in each of the three succeeding years, shall sail to the southward of the equator, there carry on the fishery, and return to some port of Great Britain before December 1st in the year subsequent to that of their being cleared out; to 4 of these which shall arrive first within the time limited, with the greatest quantity of oil or head-matter, being not less in the whole than 20 tons in each, there shall be allowed 300*l.* each; and 200*l.* to each of the 4 ships which shall next arrive with the next greatest quantity of oil or head-matter; and 100*l.* to each of the 4 vessels which shall next arrive with the greatest quantity of oil, &c. not less than 20 tons. To 4 other such ships, which shall proceed to the westward of 36° of S. latitude, and shall carry on the said fishery, and shall return, before the 31st of December in the second year after their clearing out, to some port of Great Britain, there shall be allowed 400*l.* each, having not less than 20 tons of oil or head-matter, as aforesaid. The stat. 35 Geo. III. c. 92. requires such ships to be navigated by persons, of whom the master and at least three-fourths of the mariners are his majesty's subjects. Or if such ship clear out from any port of Great Britain, such ship may be navigated by persons being protestants, and who, not being subjects of his majesty, have been before employed in carrying on the said fishery, and on clearing out have taken the oath of fidelity and allegiance to his majesty, and another oath that it is their intention to establish themselves and their families in Great Britain, &c. No premium shall be paid to any ship that has not an apprentice indentured for three years for every 50 tons burden; nor unless such ship shall have regularly kept a log-book on board. The commissioners of the customs in England and Scotland are to pay the premiums, which are to be claimed within two months. Ships concerned in this fishery may sail and pass for that purpose to the eastward of the Cape of Good Hope, and to the westward of Cape Horn, or through the straits of Magellan; but such ships shall be obliged to take out a licence for each respective voyage from the East India company, &c. &c. Every ship intending to navigate any sea comprised within the boundaries of the exclusive trade of the South Sea company, described by an act of the 9th of queen Anne, must take a licence for the voyage from the said company. By statute 42 Geo. III. c. 18. any ship fitting and clearing out, and licensed according to the preceding acts, sailing to the eastward of the Cape of Good Hope, and having passed beyond 123° of E. longitude, may pass to the northward as far as 1° of N. latitude, but no further to the northward, until such ship shall have sailed or passed to the eastward of 180° E. longitude from London.

FISHERY, Whitings. These fish frequent the English seas in large shoals, particularly during the spring, keeping at the distance of half a mile to three miles from the shore. They are taken in abundance by the line, and afford excellent diversion. They are the most delicate and wholesome of any of the genus, but do not grow to a large size near the coast, where the usual length is 10 or 12 inches. In the deep water on the edge of the Dogger-bank, they have been found to weigh from four to eight pounds.

FISHERY, Free, in Laxo, or the exclusive right of fishing in a public river, is a royal franchise (see *FRANCHISE*); and is considered as such in all countries where the feudal law has prevailed. (Seld. *Mare Clausum*. l. 24. *Dufresne*. v. 503. *Craig de Jur. Feod.* ii. § 15.) However, the making of such grants, and thus the appropriating of that which it seems unnatural to restrain, the use of running water, was prohibited for the future by king John's great charter;

and the rivers that were fenced in his time were directed to be laid open, as well as the forests to be disafforested. This opening was extended by the second and third charters of Henry III. to those also that were fenced under Richard I.; so that a franchise of free fishery ought now to be at least as old as the reign of Henry II. This differs from a *several* fishery; because he that has a *several* fishery must also be (or at least derive his right from) the owner of the soil, which in a free fishery is not requisite. (M. 17 Edw. IV. 6. P. 18 Edw. IV. 4. T. 10 Hen. VII. 24. 26. Salk. 637.) It differs also from a *common* of piscary, in that the free fishery is an exclusive right, where the common of piscary is not so; and, therefore, in a free fishery, a man has a property in the fish before they are caught; in a common of piscary, not till afterwards. (F. N. B. 88. Salk. 637.) Some, indeed, have considered a free fishery not as a royal franchise, but merely as a private grant of a liberty to fish in the *several* fishery of the grantor. (2 Sid. 8.) But to consider such right as originally a flower of the prerogative, till restrained by *magna carta*, and derived by royal grant (previous to the reign of Richard I.) to such as now claim it by prescription, and to distinguish it (as judge Blackstone does) from a *several* and a *common* of fishery, may remove some difficulties (says the learned Judge) in respect to this matter, with which our books are embarrassed. For it must be acknowledged, that the rights and distinctions of the three species of fishery are very much confounded in our law-books; and that there are not wanting respectable authorities (see Hargrave's Notes on Co. Litt. 122.) which maintain, that a *several* fishery may exist distinct from the property of the soil, and that a *free* fishery implies no exclusive right, but is synonymous with *common* of piscary. Blackst. Com. vol. ii.

FISHERIES, *British Society for Encouragement of*. By stat. 35 Geo. III. c. 100. the governor, deputy-governor, and directors of the British society for extending the fisheries, and improving the sea coasts of this kingdom, incorporated by 26 Geo. III. c. 106. are empowered to give the following premiums and loans to persons at the society's settlements; *viz.* 6*l.* a year, in premiums or rewards, to sober and industrious persons residing at any of these settlements, who are most expert in fishing, curing of fish, preparing of soap or oil from fish, making of nets, &c.; and also to lend at legal interest a sum not exceeding 50*l.* for the purpose of purchasing, building, or equipping boats or other vessels for the fishery; and also such farther sums on loans to such persons as may build houses or tenements at any of the settlements of the society, the sum so lent not exceeding one-third of the value of such buildings, payable by instalments in the course of five years; and also such sums in loans, not exceeding 200*l.* on proper security to be repaid in one year, to such persons as may undertake to provide stores of oatmeal or salt, or other necessaries, at either of the said settlements, the sum not to exceed two-thirds of the value of the commodity; and also such sums of money, not exceeding 200*l.*, in loans to such persons as may establish a manufactory of sail-cloth or cordage, &c. such sum to be repaid in three years, and not to exceed two-thirds of the value of the material provided.

FISHES, aboard a *Ship*, are pieces of timber, convex on one side, and concave on the other, used to strengthen the masts and yards, when they begin to fail, through an extraordinary weight of sail, or after damage in battle, or tempestuous weather. They both nail the fishes on with iron spikes, and also *would* them as they call it, that is, wind ropes hard about them. There is also a tackle called the fish, which hangs at the end of the davit by the strap of

the block, in which is the runner of the fish-hook; by which means the fluke of the anchor is haled up to the ship's bow, or chainwale. (See BLOCKS.) Perhaps this tackle was called a fish, from that which the ancients called a dolphin, which was a pointed and vastly heavy piece of iron, which they used to heave up by a tackle to a good height, and then, when they came near enough to the enemy's ship, let it fall at once, to break or pierce a hole through the bottom of the enemy's vessel, to sink her.

FISH-GIG, an instrument used to strike fish at sea, particularly dolphins. It consists of a staff, three or four barbed prongs, and a line fastened to the end, on which the prongs are fixed; to the other end is fitted a piece of lead, which serves to give additional force to the stroke when the weapon flies, and to turn the points upward after the fish is penetrated.

FISH-GARTH, according to Skinner, signifies an engine to take fish; but it should rather seem to denote the dam or weir in a river, where these engines are laid and used.

FISH GLUE. See ICHTHYOCOLLA and GLUE.

FISHING, the act or art of catching fish.

Right of fishing and the property of fish belong to the lord of the manor, when he hath the soil on both sides of a river; but where a river ebbs and flows, and is an arm of the sea, they are common to all; and he who claims a privilege to himself must prove it. In the Severn, the soil belongs to the owners of the land on each side; and the soil of the River Thames is in the king, &c. but the fishing is common to all. There are several statutes for preventing the destruction of the fry of fish; and persons using nets for that purpose, or taking salmon or trout out of season, or any fish under certain lengths, are liable to forfeit 20*s.*; and justices of peace and lords of leets have power to put the acts in force. See 1 Eliz. cap. 17. 3 Jac. I. cap. 12. 30 Geo. II. cap. 21. See SALMON FISHERY, and Stealing of FISH.

Fishing is distinguished with regard to its instrument into that performed with the net, for fish that go in shoals; and that with the hook, for solitary fish; which latter is properly called *angling*.

Fishing, again, is distinguished with regard to its object into that performed in salt water, and that in fresh. The first practised for whales, herring, cod, salmon, pearls, mackarel, and other sea-fish. The latter practised for pike, trout, carp, tench, perch, dace, eels, &c.

The instruments principally used in angling or fishing with the hook, are the rod, line, hook, and fly.

The points on which the art of fishing chiefly turns are the proper season, place, bait, and manner of application. What relates to each thereof, we shall here give the reader in the several kinds of fishing chiefly practised among us.

In March, April, and September, the warmest days are the best for fishing, and the bait must be deep; for the fish in these cool months lie near the bottom. In fly-fishing, it is always observed, that the fish will rise best after a small shower of rain, that has just beat down the flies upon the water without muddying it. March, April, May, and June, are the best months for fly fishing, and the best hours are about nine in the morning, and three or four in the afternoon; in a still warm evening they will bite as long as the day light lasts, at those seasons when the gaats are seen most plentifully about in the air.

In the extremity of heat, when the earth is parched with drought, there is but little sport to be expected in fishing in any water. In cold weather, when there is a white hoary frost in the morning, the fish will not bite kindly

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all day, except in the evening, if that should prove serene and warm.

Too much wind is never convenient for fishing, though a little is rather advantageous than otherwise. It is bad fishing about sheep-shearing time, in waters where the sheep are washed; for the fish glut themselves in such a manner with what is washed from these creatures, that they will not take any bait till that season is over.

North and east winds are enemies to fishing; and it is not right to fish soon after the time of the fish spawning, for they are then sick, and have no great appetite, so that they do not bite readily. All fish have a natural fore-knowledge of a shower of rain, and when clouds are coming on that will fall in rain, they will not bite; the expert angler, who is used to this, often escapes being wet to the skin by it.

The subterranean or under-ground fishing of the lake Ribelskajamnia has been much talked of by those who have written of the Zirehnitzer sea, of which it is a part; but on the whole it amounts to no more than this. The waters of this lake emptying themselves through subterranean passages into another lake below, the whole body of the water, with the fish in it, is first received into a large opening, which conveys it into a sort of subterranean basin, in the bottom of which there are many holes, and through these the water is let out, but the fish left behind. The people of the place who know this, descend through the large hole into this subterranean basin with torches in their hands, and as the waters run off, they seize upon the fish wherever they can catch them. This sort of fishing is attended with one inconvenience; for the people being obliged to stand up to the middle more or less in the water, the horse-leeches, which are extremely plentiful there, seize upon their legs and other parts, and are only to be got off by some persons making water upon the part; the heat and nauseous taste of the urine always making them let go their hold. Phil. Trans. N^o 91. For a curious method of fishing in China, see CHINA.

FISHING, *White-bait*. See BAIT.

The season for taking white-bait is only from the first of August to the first of October. 30 Geo. II. cap. 21.

FISHING, *Barbel*. See BARBUS.

No barbel is to be taken in the Thames or Medway under twelve inches in size, from the eye to the end of the tail, and only between the twenty-fourth of August and the twenty-first of March. 30 Geo. II. cap. 21.

FISHING, *Carp*. The carp is generally held the queen of fresh-water fish. It is exceeding subtle, and of all others, the eel only excepted, lives longest out of water. Mr. Ray assures us, that in Holland they have a speedy way of fattening them, by hanging them up in a net in a cellar, and feeding them with white bread and milk. The fish is wrapped up in a quantity of wet moss, spread on a piece of net, and then gathered into a purse in such a manner, however, as to allow him room to breathe. The net is then plunged into water, and hung up to the ceiling of a cellar: the dipping must at first be repeated every three or four hours, but afterwards it need only be plunged into water once in about six or seven hours. Bread soaked in milk is first given him in small quantities: in a short time the fish will bear more, and grow fat by this treatment. Many have been kept in this way, breathing nothing but air, for several days successively. (Phil. Trans. vol. lxi. part 1. p. 310.) They breed several times in the year; for which reason we seldom meet with male or female without either milt or spawn. Their natural place is some still water; in running waters they rarely, if ever, breed. To make them fat and

large, it is a good way, when the pond is low, in April, to rake all the sides thereof with an iron rake, and sow hay-seeds thereon. By autumn there will be a crop of grafs, which coming to be overflowed as the pond rises, will be a fine feeding-place for them. See FISH-PONDS.

Great patience is requisite in angling for carp, on account of their incredible policy. They always chuse to lie in the deepest places; they seldom bite in cold weather; and in hot, a man cannot be too early or too late for them. When they do bite, there is no fear of the hold. The tackle must be very strong, and it will be proper to bait the place beforehand, where it is to be fished for, with a coarse paste. It may be also proper to bring the carp to the place intended for angling, by throwing in cow-dung and blood, or bran and blood mixed together, or some chicken guts cut small. The baits are the red-worm, in March; the cadew, in June; and the grafs-hopper, in July, August, and September. Proper pastes may also be prepared for them; as honey and sugar, wrought together with flour, and thrown in pieces into the water some hours before you begin to angle. Honey and white crumbs of bread mixed together also make a good paste. The following paste is much recommended: take common wheat flour and veal, or any other young meat, of each equal quantities; beat them together in a mortar till the meat is thoroughly dissolved or broke to pieces; then add about half the quantity of honey; beat it well together again, and add more flour till the whole is of a proper consistence. This has the advantage of a paste, and of an animal bait, and hangs well upon the hook, so that it seldom fails of success.

The best season for catching such as are intended for sale is autumn.

FISHING, *Chub*. The chevin or chub is a fresh-water fish with a large head. It spawns in March, and is very strong, though inactive, yielding in a very little time after it is struck; and the larger it is the quieter. His bait is any kind of worm or fly, particularly the large yellow moth; also grains, cheese, the pith in the bone of an ox's back, &c. He affects a large bait, and variety of them at the same hook. Early in the morning angle for him with snails; but, in the heat of the day, chuse some other bait; and in the afternoon, fish for him at ground or fly. See CRUB.

No chub is to be taken under nine inches from the eye to the end of the tail, and only between August 24th and March 21st, in the river Thames and waters of Medway. 30 Geo. II. cap. 21.

FISHING, *Dace or Dare*. See DACE.

No dace are to be taken in the Thames or Medway under six inches from the eye to the end of the tail in size, and only between August 24th and March 21st. 30 Geo. II. cap. 21.

FISHING, *Eel*. See EEL.

The silver eel may be caught with divers baits, particularly powdered beef, garden-worms or lobbs, minnows, hens guts, fish, garbage, &c. But as they hide themselves in winter in the mud, without stirring out for six months, and in the summer, they take no delight to be abroad in the day, the most proper time to take them is in the night, by fastening a line to the bank side with a hook in the water; or a line may be thrown at large, with a good store of hooks baited, and plumbd with a float, to discover where the line lies in the morning. A small roach does well here for a bait, the hook being laid in his mouth. For other methods of catching eels, see BOBBING, BULTERS, EEL-SPAR, and SNIFFLING.

No leaps or rods for eels are to be laid in the Thames and Medway.

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Medway but from April 21st to October 30th; but they may be hooked for all the year. 30 Geo. II. cap. 21.

FISHING, Flounder. The flounder is a flat sea or river fish, caught in April, May, June, and July, in any time of the day, in a swift stream, and sometimes also in a still deep. The best bait is red worms, wasps, and gentles.

Flounders may be taken in the rivers Thames and Medway at any time of the year; but their size must not be less than six inches from the eye to the end of the tail. 30 Geo. II. cap. 21.

FISHING, Gudgeon. The gudgeon is a small fish of a very delicious taste. It spawns three or four times in the summer-season, and feeds in streams and on gravel, slighting all kinds of flies; but is easily taken with a small red worm, fishing near the ground; and being a leather-mouthed fish, will not easily get off the hook when struck. The gudgeon may either be fished with a float, the hook being on the ground, or by hand, with a running line on the ground, without cork or float. He will bite well at wasps, gentles, and cadworms; and one may even fish for him with two or three hooks at the same time, which makes good sport. When you angle for gudgeons, stir up the sand or gravel with a long pole, which will make them gather to the place and bite the faster.

The season for gudgeon fishing in the Thames and Medway is from August 24th to March 21st. 30 Geo. II. cap. 21.

FISHING, Perch or Percb. The perch or perch is hook-backed, not unlike a hog, armed with stiff prickles, and his sides with dry thick scales; he is voracious, and will venture on his own kind even with greater courage than the pike. He seldom grows much above a foot long. He spawns in February or March, and bites best when the spring is far spent. The proper baits are the bradling, minnow, and small frog; as also the lob worm, bob, oak-worm, gentle, wasp, and cad-bait. The minnow yields the best sport, which is to be alive, and stuck on the hook through the upper-lip or back-fin, and kept swimming about mid-water. If the frog be used, he is to be fastened to the hook by the skin of his leg. When the fish bites, as he is none of the leather-mouthed kind, he must have time to pouch his bait. The best place to fish for him is in the turning of the water-eddy in a good gravel bottom.

No perch is to be taken in the Thames or Medway under six inches from the eye to the end of the tail, and only between August 24th and March 21st. 30 Geo. II. cap. 21.

FISHING, Pike. The pike is reputed the tyrant of the fresh waters. By the common consent of naturalists, he is the longest-lived of all fishes. The larger he is found, the coarser is his flesh; and so *vice versa*. This fish never swims in shoals, but always single, being very rapacious, and preying even on his own kind. The pike spawns in February and March. The best sort is in rivers; the worst in meres and ponds. His ordinary food is frogs, and what fish he can lay hold on.

There are two ways of fishing for the pike: by the *ledger-bait* and the *walking-bait*. 1. The ledger-bait is that fixed in one certain place, and which the angler may leave behind him. Of this kind the best is some living bait, as a dace, roach, gudgeon, or a living frog. To apply it, if a fish, stick the hook through his upper-lip; then fastening it to a strong line twelve or fourteen yards long, tie the other end of the line to some stake in the ground, or bough of a tree, near the pike's usual haunt, letting the line pass over the fork of a stick placed for the purpose, suspending the hook, and about a yard of line in the wa-

ter, but so as that when the pike bites, the fork may give way, and let him have line enough to go to his hold and paunch. If the bait be a frog, the arming wire is to be put in at his mouth and out at his vent, and one of his legs to be slithe'd or tied over the upper joint of the wire. 2. The walking-bait is that which the fisher calls in, and conducts with a rod, &c. This is perforated by a troll, with a winch for winding it up. At the top of the line is to be placed a ring for the line to be run through. The line, for two yards and a quarter next the hook, to be of silk double, and armed with wire the length of seven inches. On the shank of the hook is to be fastened a smooth piece of lead, so as to sink the fish-bait, which is to be a gudgeon with its head downwards. Thus disposed, the bait is to be cast up and down; and if you feel the fish at the hook, give him length enough to run away with the bait, and paunch it; then strike him with a smart jerk. To fish with a dead bait, use a yellow frog, dace, or roach, anointed in gum of ivy, dissolved in oil of spike, and cast it where the pike frequents. After it has lain a little while at the bottom, draw it to the top, and so up the stream, and you will quickly perceive a pike in earnest pursuit thereof. This fish bites best about three in the afternoon in clear water, with a gentle gale, from the middle of summer to the end of autumn; but in winter all day long; and in the spring he bites best early in the morning, and late at night. Another method of fishing for pike, see under **HUXING**.

No pike or jack is to be taken in the Thames or Medway under twelve inches from the eye to the end of the tail, and only between August 24th and March 21st. 30 Geo. II. cap. 21.

FISHING, Roach. The roach or rochet is no delicate fish. Those in rivers are more valued than those in ponds, though the latter are much the larger. They spawn about the middle of May.

To angle for this fish in April, cads or worms are proper baits; so are small white snails or flies in summer. The bait is always to be under water, for this fish will not bite at top. Others use May-fly in that season with good success. In autumn, a paste must be used, made of the crumb of white bread moulded with a little water, laboured with the hands into a tough paste, and coloured not very deep, with red lead. In winter, gentles are the best bait. Sprouted malt, the young brood of wasps, and bees dipt in blood, and the thick blood of sheep half dried, are not trums in this sort of fishing.

In the neighbourhood of London they have a peculiar method of fishing for roach; they take a strong cord, at the end of which is fastened a three pound weight; and a foot above the lead a packthread of twelve feet is made fast to the cord; and to the packthread, at proper distances, they add twelve strong links of hair with roach hooks at them, baited with a white snail or perriwiakle. Then holding the cord in their hands, the biting of the fish draws the packthread, and this the cord, which gives them notice what to do. By this means they sometimes dray up half a dozen, and very commonly two or three at a draught. By 30 Geo. II. cap. 21. no roach is to be taken in the Thames or Medway under six inches from the eye to the end of the tail, and only between August 24th and March 21st.

FISHING, Smelt. See **SMELT**.

By 30 Geo. II. cap. 21. no smelt is to be taken in the Thames or Medway less than five inches from the eye to the end of the tail, or at any time, except from January

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25th to June 1st; and those that are caught in other waters mult be of the above size. 33 Geo. II.

FISHING, Soal. See SOAL.

FISHING, Tench. The tench is a fine fresh water fish, having very small scales, but large, smooth fins, with a red circle about the eyes, and a little barb hanging at each corner of the mouth. It takes more delight among weeds in ponds than in clear rivers, and covets to feed in foul water. His slime is said to have a healing quality for wounded fish; upon which he is commonly called the *fishes' physician*. When the carp, pike, &c. are hurt, it is said they find relief by rubbing themselves against the tench.

The season for catching this fish is in June, July, and August very early and late, or even all night, in the still part of rivers. His bait is a large red worm, at which he bites very eagerly, especially if first dipped in tar. He also delights in all sorts of pastes made up of strong-scented oils, or with tar; or a paste of brown bread and honey; nor does he refuse the eel-worm, lob-worm, flag-worm, green gentles, cod-bait, or soft boiled bread-grain.

When a number of tench are to be taken out of a muddy pond, the method is to take a large casting net, well leaded, and with the meshes from the crown to a full yard and a half, not too small; for then, if the pond be deep, the fish will strike away before the net gets to the bottom. The place where the net is to be thrown into must be cleared of weeds, &c. with a rake. A bait is next to be prepared for drawing the fish together: for this purpose put a quarter of a peck of wheat into three quarts of water, send it to an oven, and let it be well soaked; then add to it five pints of blood, and as much bran as is necessary to give it the consistence of a paste; mix with it some clay, and add a quart of lob-worms chopped to pieces. Let the whole be wrought up into a stiff paste, and rolled into balls of the size of a hen's egg, and throw these into the pond in the place where the net is to be cast. Let these, and some grains, be occasionally thrown in, and the place be thus baited for several days. When the fish may be supposed to be well acquainted with the place, let a good baiting be given in the morning, and in the close of the evening let the casting-net be carefully thrown in. When the net is sunk, the mud all about it is to be stirred with a long pole with a fork at the end; the net is to be half an hour, and the mud to be thus stirred all the time; by this means the tench will be raised, and will be taken in pulling out the net; but if the net were to be thrown in and taken out in the common way, there would hardly be one fish taken; for the custom of both tench and carp, when they are frightened, is to plunge their heads up to the eyes in the mud, and thus placed with their tails erect, the net must draw over them, without the possibility of entangling them.

FISHING, Trout. The trout is a delicious fresh water fish, speckled with red and yellow, coming in and going out of season with the buck, and spawning in the cold months of October and November, whereas all the other species spawn in hot summer weather. There are divers kinds of this fish, all valuable; but the best are the red and yellow trouts; and of these the female, distinguished by a less head and deeper body, is preferred. They are known to be in season by the bright colour of their spots, and by their large and thick back; which last may serve also as a rule for other fish. Through the whole winter they are sick, lean, and unwholesome, and frequently lousy. As the spring comes on, deserting the still, deep waters, they repair to the gravelly ground, against which they continue to rub till they get rid

of their lice, which are a kind of worms with large heads. From that time they delight to be in the sharp streams, and such as are swift, where they lie in wait for minnows and May-flies. At the latter end of May they are in their prime.

The usual baits whereby the trout is caught are the worm, minnow, and fly, either natural or artificial. The proper worms are the brandling, lob-worm, squirrel-tail worm, which has a streak round the back, a red head, and a broad tail, earth worm, dung-worm, and maggot or gentle, especially the three first; the brandling is commonly found in an old dunghill, or under cow-dung, or else among tanner's bark; the others are found in the earth, and under large stones, or stumps of trees; but whatever worms are used, they are the better for keeping, which is to be done in an earthen pot, with moss, frequently changed. To take the trout with a ground bait, the angler should have a light, taper-rod, with a tender hazel top; and may angle with a single hair of three links, the one tied to the other, for the bottom of the line, and a line of three-haired links for the upper part: with this sort of tackle, if the sportsman has room enough, he will take the largest trout in any river. The angler must always keep out of sight, and the point of the rod must be down the stream. The season for fishing for the trout for the ground bait begins in March, and the mornings and evenings are the best time of the day; but in cloudy weather the sport may be followed all day long. There must be a plummet at ten inches from the hook, which the angler must feel always touching the ground; and this must be heavier as the stream is swifter. When the minnow is used, chuse the whitest, and that of middling size; slip the hook through his mouth, and the point and beard out at the tail, so as it may lie almost straight on the hook. Then try, against the stream, whether it will turn. The tackle in this case may be stronger, for the trout will seize this bait as soon as it comes in sight; the upper part of the line may be of three silk and three hairs, and the lower of two of each; and the hook may be moderately large. In defect of a minnow, a small loach, or a stickle-back, may serve the turn; or, for want of either, an artificial one may be made of cloth by the life, which is found every whit as good a bait as the natural one.

The most agreeable manner of fishing for trout is with the fly: the rod in this case must be light and pliable, and the line long and fine; if one hair be strong enough, as it may be made by proper skill in the angler, there will be more fish caught than when a thicker line is used; and the fly-fisher should have the wind in his back, and the sun before him. See ANGLING.

By 1 Eliz. cap. 21. no trout is to be taken under eight inches in length; and by stat. 24 Anne, cap. 21. sea-trout is not to be taken in particular rivers, creeks, or arms of the sea between June 30th and Nov. 11th. By 30 Geo. II. cap. 21. no trout is to be taken in the Thames or Medway between November 11th and August 24th, or to be of less weight than one pound.

FISHING-baits. See the preceding articles, and ANGLING.

FISHING-fly, a bait used in angling for divers kinds of fish. The fly is either *natural* or *artificial*.

Natural flies are innumerable: the more usual on this occasion are the dun-fly, the stone or May-fly, the red-fly, the moor-fly, the tawny-fly, the vine-fly, the bell-fly, the cloudy and blackish-fly, the flag-fly; also caterpillars, canker-flies, bear-flies, &c. all which appear sooner or later, according to the forwardness or backwardness of the spring. To know the particular fly the fish most covets, when you come in the morning to the river-side, beat the bushes with your rod, and take up what variety you can of

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all sorts of flies; try them all, and you will quickly know which are in most esteem; not but that fish will sometimes change their fly; but it is only when they have sometimes glutted themselves therewith.

There are two ways to fish with natural flies, either on the surface of the water, or a little underneath it.

In angling for chub, roach, or dace, move not your natural fly swiftly, when you see the fish make at it; but rather let it glide freely towards him with the stream; but if it be in a still and slow water, draw the fly slowly sideways by him, which will make him eagerly pursue it.

The artificial fly is most successfully used in blustering weather, when the waters are so troubled by the winds that the natural fly cannot be seen, nor rest upon them.

Of this artificial fly there are reckoned ten principal sorts:

1. The dun-fly, in March, made of dun wool, and the feathers of a partridge wing.
2. A dun-fly, made of black wool, and the feathers of a black drake; the body made of the first, and the wings of the latter.
3. The stone-fly, in April, the body made of black wool, dyed yellow under the wings and tail.
4. The ruddy-fly, in the beginning of May; the body made of red wool, and bound about with black silk, with the feathers of a black capon, which hang dangling on his sides next his tail.
5. The yellow or greenish fly, in June; the body made of black wool, with a yellow list on either side, and the wings taken off the wings of a buzzard, bound with black broken hemp.
6. The moorish-fly; the body made of dusky wool, and the wings with the blackish mail of a drake.
7. Tawny-fly, till the middle of June; the body made of tawny wool, the wings made contrary one against the other, of the whitish mail of a white drake.
8. The wasp-fly, in July; the body made of black wool, cast about with yellow silk, and the wings of drakes' feathers.
9. The steel-fly, in the middle of July; the body made of greenish wool, cast about with the feathers of a peacock's tail, and the wings made of buzzards' wings.
10. The drake-fly, in August; the body made of black wool, cast about with black silk, his wings of the mail of a black drake, with a black head.

The best rules for artificial fly-fishing are,

1. To fish in a river somewhat disturbed with rain, or in a cloudy day, when the waters are moved by a gentle breeze; the fourth wind is best; and if the wind blow high, yet not so but that you may conveniently guide your tackle, the fish will rise in plain deeps; but if the wind be small, the best angling is in swift streams.

2. Keep as far from the water-side as may be; fish down the stream, with the sun on your face, and touch not the water with your line.

3. Angle always in clear rivers with a small fly and slender wings, but in muddy places use larger.

4. When after rain the water becomes brownish, use an orange fly; in a clear day, a light-coloured fly; a dark fly for dark waters, &c.

5. Let the line be twice as long as the rod, unless the river be encumbered with trees.

6. For every sort of fly have several of the same, differing in colour to suit with the different complexions of several waters and weathers.

7. Have a nimble eye and active hand, to strike presently with the rising of the fish, or else he will be apt to throw out the hook.

8. Let the fly fall first into the water, and not the line, which will scare the fish.

9. In slow rivers or still places, cast the fly cross over the

river, and let it sink a little in the water, and draw in gently back with the current.

Salmon flies should be made with their wings standing one behind the other, whether two or four. That fish delights in the gaudiest colours that can be; chiefly in the wings, which must be long, as well as the tail.

Fishing-floats are little appendages to the line, serving to keep the hook and bait suspended at the proper depth, to discover when the fish has hold of them, &c.

Of these there are divers kinds, some made of Muscovy duck quills, which are the best for slow waters; but for strong streams, sound cork, without flaws or holes, bored through with an hot iron, into which is put a quill of a fit proportion, is preferable; pare the cork to a pyramidal form, and grind it smooth.

Fishing-hook, a little engine of steel-wire, of a proper form to catch and retain fish.

The fishing-hook, in general, ought to be long in the shank, somewhat thick in the circumference, the point even and straight; let the bending be in the shank. For setting the hook on, use strong, but small silk, laying the hair on the inside of your hook; for if it be on the outside, the silk will fret and cut it asunder.

There are several sizes of these fishing-hooks, some big, some little; and of these some have peculiar names, as,

1. Single-hooks.
2. Double-hooks, which have two bendings, one contrary to the other.
3. Snappers or gorgers, which are hooks to whip the artificial fly upon, or to bait with the natural fly.
4. Springers or spring-hooks, a kind of double hooks, with a spring which flies open, being struck into any fish, and so keeps its mouth open.

Fishing-line. See *Angling Line*.

Fishing-nets. See *NET*.

Fishing-rod, a long, slender rod or wand, to which the line is fastened for angling.

Of these there are several sorts, as,

1. A troller or trolling rod, which has a ring at the end of the rod for the line to go through when it runs off a reel.
2. A whipper or whipping-rod, a top-rod that is weak in the middle, and top-heavy, but all slender and fine.
3. A dopper, which is a strong rod, and very light.
4. A snapper, or snap-rod, that is, a strong pole, peculiarly used for the pike.
5. A bottom-rod, being the same as the dopper, but somewhat more pliable.
6. A fuiggling or poking-stick, a forked stick, having a short strong line, with a needle, baited with a lob-worm: this is only for eels in their holes.

Fishing-rods are made of different materials and strength, according to the purposes for which they are used: in fishing with more than one hair, and with a silk-worm gut, red deal is reckoned the best, with hickery top, and the length of the whole rod should be about four yards; but for a small fly and single hair, the length of three yards will be sufficient, with the top of yellowish hickery, and about nine inches of whalebone, near as long as the stock, which should be of white deal. The stocks or buts of rods are generally of ground hazle, ash, or willow, about two or three feet long; and every joint should gradually taper to the top. Hazle tops are preferred, though some use the Bamboo cane, and say it exceeds the best hazle. For ground angling, especially in muddy waters, the cane or reed is preferred for a stock; with a hazle top, consisting of one, two, or three pieces, and a final piece of round, smooth, taper whalebone, which is whipped to the hazle with strong silk, rubbed with shoe-maker's wax; the whole length of the rod being five yards or five and a half yards. The best method of piercing hazle and bone is first to whip the end of the hazle with thread, and to bore it with

a square

a square piece of iron of a proper size; and then make the thick end of the bone, first dipped in pitch to go into it; after which let it be scraped, filed, and neatly whipped. However, the neatest rod may be thus made: get a thick white deal or fir-board, free from knots, and seven or eight feet long; let this be divided by a joiner into several breadths, and with his planes let him shoot them round, smooth, and taper. To one of these fasten an hazle rod, six or seven feet long, which may consist of two or three pieces; to the top of which fix a piece of yew, about two feet long, made round, taper, and smooth, and to the yew a piece of small, round, smooth whalebone, five or six inches long. The fir may be coloured by warming it at the fire, and with a feather dipped in aqua-fortis, stroking it over and chafing it into the wood, which will make it of a pure cinnamon colour.

It is found useful to have rings or eyes made of fine wire, and placed upon the rod from one end to the other, in such a manner as that when the eye is laid to one you may see through all the rest: through these rings the line is made to run, which will thus be kept in a due posture; and you must have a winch or wheel affixed to the rod about a foot above the end, by which, whenever it is proper, you may give range to the fish. See ANGLING.

FISHING-vessels, or those used in the several fisheries at sea, or on the coasts, are the buss, coble, cock, dogger, driver, eel-boat, fly-boat, fluyt, hooker, Peter-boat, smack, stand-boat, trawler, trinker, &c.

FISHING Bay, in *Geography*, a bay of America, in Maryland, lying on the east side of Chesapeake bay, partly in Dorchester and Somerset counties, the entrance of which is between Goldsborough and Devil's islands. This bay receives several rivers from each of the above-mentioned counties; the chief of which are Wicomico and Nanticoke, and also Transquaking and Blackwater creeks.—Also, a bay on the south side of lake Ontario, about 37 miles E. of fort Niagara.

FISHING Creek, a township of America, in Pennsylvania, situated on Susquehanna river.—Also, a river of Virginia, which runs into the Ohio. N. lat. $39^{\circ} 35'$. W. long. $80^{\circ} 57'$.—Also, a river of Kentucky, which runs into Cumberland river, N. lat. $36^{\circ} 49'$. W. long. $84^{\circ} 19'$.—Also, a river of Pennsylvania, which runs into the Susquehanna. N. lat. $40^{\circ} 19'$. W. long. $76^{\circ} 56'$.—Also, a river of New Jersey, which runs into Delaware bay. N. lat. $39^{\circ} 5'$. W. long. $74^{\circ} 54'$.

FISHING-town Point, a cape on the east coast of Borneo. S. lat. $1^{\circ} 38'$. E. long. $116^{\circ} 30'$.

FISHKILL, a post town of America, in Dutchess county, New York, five miles E. of Hudson river or Fishkill, containing about 30 houses, a church for episcopahans, and another for Low Dutch. The township is very extensive, and contains six churches, and 6163 inhabitants, of whom 524 are slaves; 66 miles N. of the city of New York. *Fishkill landing* is a part of the above town on the river, where is a post-office.

FISH-KILL, or *Creek*, is the small river on which the above-mentioned town stands, and from which it derives its name. It discharges itself into Hudson river, nearly opposite to New Windsor.—Also, the name of a small stream which runs S.W. into Oneida lake.—Also, a stream which rises from Saratoga lake, and runs six miles easterly to the Hudson. Its mouth is opposite to Batten-kill, two miles above Saratoga town, memorable on account of general Burgoyne's army having laid down their arms as prisoners on its north side, during the contest between Great Britain and America.

FISHLIN, one of the smaller Shetland isles, five miles S. from the island of Yell. N. lat. $60^{\circ} 13'$. W. long. $1^{\circ} 23'$.

FISH-PONDS, reservoirs of water for the breeding, feeding, and preserving of fish.

The quality of the pond, water, &c. proper for this end is scarce determinable by any certain symptom or rule: for some very promising ponds do not prove serviceable that way. One of the best indications of a breeding pond is, when there is good store of rush and grazing about it, with gravelly shoals, such as horse-ponds usually have; and when a water takes thus to breeding, with a few milters and spawners, that is, males and females, two or three of each, a whole country may be stocked in a short time.

Eels and perch are of very good use to keep down the stock of fish; for they prey much upon the spawn and fry of bred fish, and will probably destroy the superfluity of them.

As for pike, perch, tench, roach, &c. they are observed to breed almost in any waters, and very numerous; only eels never breed in standing waters that are without springs; and in such are neither found, nor increase, but by putting in; yet where springs are they are never wanting, though not put in. And, which is most strange of all, many say there is not in an eel the least token of propagation, either by milt or spawn; so that how they are produced is a question very mysterious. See EEL.

For fish-ponds, it is agreed, those grounds are best which are full of springs and apt to be moorish; the one breeds them well, and the other preserves them from being stolen. The situation of the pond is also to be considered, and the nature of the currents that fall into it; likewise, that it be refreshed with a little brook, or with the rain-water that falls from the adjacent hilly ground. Add, that those ponds which receive the stale and dung of horses, and other cattle, breed the largest and fattest fish.

Fish-ponds are not only a thing of convenience to great families, but may be made a very profitable article with the farmer under due management. Watery and boggy land is often fit for no other use, and these are then a great improvement of it. Ponds made in dry grounds in the flat bottoms between hills, will also serve not only to supply the cattle with water, but the profit of the fish that may be bred in them is greater than many are aware of, and comes without any labour or expence.

In making the pond, observe that the head be at the lowest part of the ground; and that the trench or the flood-gate or sluice have a good swift fall, that it may not be long in emptying on occasion.

The best way of making the head is by driving three or four rows of stakes about six feet long, and at about four feet distance from one another, the whole length of the pond head: the first row of these is to be driven in four feet deep, that they may be very firm and secure; and if the bottom be not good, but be of a loose sand, some lime is to be added, which will harden into a sort of stone. The earth dug out of the pond is to be laid between these stakes and rammed hard down. Other rows of stakes must be added behind and over these, and the spaces filled up till the whole is as high and as thick as is necessary. The face of it must be made even and flat, and there must be a walk left to carry off the superfluous water in floods, &c.

If the pond carry six feet of water, it is enough; but it must be made eight feet deep, to receive the fishes and runs that may fall into it.

It would also be advantageous to have facies on the sides for the fish to fish themselves in, and lay their spawn on;

FISH-PONDS.

beside, in other places, certain holes, hollow banks, shelves, roots of trees, islands, &c. to serve as their retiring-places. Consider farther, whether your pond be a breeder; if so, never expect any large carp from thence, the greatness of the number of spawn overstocking the pond.

Carp and tench will live and thrive very well together in the same pond. Where pike are kept, there should be roach, or some other quick breeding fish, to supply them with food.

Some think that pike and tench may be kept in the same pond. They imagine that pike will not feed upon tench; but they are mistaken, for the pike is fonder of this than of almost any other fish. Ponds with clear gravelly and sandy bottoms are usually the best for breeding of fish, and foul water with muddy bottoms is the best for them to fatten in. Carp have been known to grow in one year from five to eighteen inches long in ponds where the water of the common sewers of any town have run into it.

The ordinary growth of a carp is not above two or three inches in that time, so that all the excess is to be attributed to the fatness of the water of the sewers.

The carp, which was first brought into England by Leonard Mascall, about the year 1514, is the most valuable of all kinds of fish for the stocking of ponds, because of its quick growth and great increase. If the breeding and feeding of this fish were more understood and practised, the advantages would be very great, and fish-ponds become as valuable an article as gardens. The gentleman who has land in his own hands may, beside furnishing his own table, and supplying his friends, raise a great deal of money, and very considerably improve his land at the same time, so as to make it yield more this way than by any other employment whatever. The sale of carp makes a part of the revenue of the nobility and gentry in Prussia, Pomerania, Brandenburg, Saxony, Bohemia, Mecklenburg, and Holstein. For this purpose particular attention should be paid to the soil, water, and situation of the carp-pond: the best kinds of ponds are those which are surrounded by the finest pastures and corn-fields of a rich black mould, having soft springs on the spot, or running water that is neither too cold, nor impregnated with acid, calcareous, selenitic, or other mineral particles. The water, indeed, may be softened by exposing it to the air and sun in a reservoir, or by forming an open channel for it at some distance from the pond. They should likewise be sheltered against the easterly and northerly winds, and be fully exposed to the influence of the sun.

It is found by experience most convenient to have three kinds of ponds for carp; *viz.* the spawning pond, the nursing and the main pond. The first sort of pond must be well cleared of all other kinds of fish, especially those of the rapacious kind, such as the pike, perch, eel, and trout, and also of all newts, of lizards, and the water-beetles. It should be supplied with soft water, and be exposed to the sun and air. A pond of one acre requires three or four male carp, and six or eight female ones, and in the same proportion for each additional acre. The best carp for breeding are those of five, six, or seven years old, in good health, with full scales, fine full eyes, and a long body, and without any blemish or wound. The pond should be stocked on a fine calm day, towards the latter end of March or in April. Carp spawn in May, June, or July, according to the warmth of the season; and for this purpose they swim to a steady, warm, sheltered place, where they gently rub their bodies against the sandy ground, grass, or others, and by this pressure the spawn issues out. At the spawning season all kinds of fowl should be kept from the

ponds. The young fry, hatched from the spawn by the genial influence of the sun, are left in this pond through the whole summer, and even the next winter, if the pond is deep enough to prevent their suffocation under the ice in a severe winter; otherwise the breeders and fry are put into separate ponds, more convenient for the wintering.

Ponds of the second kind are the nurseries; the young should be removed into the nursery in March or April, on a fine calm day; a pond of an acre will admit a thousand or twelve hundred of this fry. When they are first put in, they should be well watched and driven from the sides of the pond, lest they become the prey of rapacious birds. In two summers they will grow so much as to weigh four, five, sometimes six pounds, and to be fleshy and well tailed.

The main ponds are the last sort; into these are put carp, that measure a foot, head and tail inclusive. Every square of fifteen feet is sufficient for one carp; their growth depends upon the room, and the quantity of food allowed them. The best seasons for stocking the main ponds are spring and autumn: carp continues to grow for a long time, and to a very considerable size and weight. Mr. Forster mentions one which he had seen in Prussia above a yard long, and of twenty-five pounds weight; and two or three hundred between two and three feet long, and which, as he was told, were of between fifty and sixty years standing. Gesner mentions an instance of one that was 100 years old: these were tame, and came to the shore in order to be fed, and swallowed with ease a piece of white bread of the size of a halfpenny roll. Ponds should be well supplied with water during the winter, and when they are covered with ice, holes should be opened every day for the admission of fresh air, through want of which carp frequently perish. See *Carp Fishing*, and *Breeding of Fish*.

For the general management of fish-ponds reserve some great waters for the head-quarters of the fish, whence you may take, or wherein you may put any quantity thereof; and take care to have flows, and other auxiliary waters, so that you may convey any part of the stock from one to the other, and lose no time in the growth of the fish, but employ the water as you do your land, to the best advantage. View the grounds, and find out some fall between the hills as nearly flat as may be, so as to leave a proper current for the water: if there be any difficulty in judging of such, take an opportunity, after some sudden rain, or the breaking up of a great snow in winter, and you will plainly see which way the ground casts, for the water will take the true-fall, and run accordingly.

The condition of the place must determine the quantity of ground to be covered with water. For example, we may propose in all fifteen acres in three ponds; or eight acres in two, and no less; and these ponds should be placed one above another, so as the point of the lower may almost reach the head or bank of the upper; which contrivance is no less beautiful than advantageous.

The head or bank, which, by stopping the current, is to raise the water, and to make a pond, must be built with the clay and earth taken out of the pan or hollow dug in the lowest ground above the bank: the shape of the pan is to be an half oval, whereof the flat is to come to the bank, and the longer diameter to run square from it.

All fish-ponds should be drawn once in three or four years, and the fish sorted; if it be a breeding-pond, the smaller fish should be taken out to store other ponds with; and in feeding ponds all the fish should be kept as nearly as may be of a size, for the larger and smaller never all thrive well together.

Flounders will both thrive and breed in any pond, especially

cially in a clay pond, and will be much larger than in rivers.

Bitterns, herons, otters, water-rats, and sea-gulls, are all great destroyers of fish, and the ponds should be kept as clear as possible of them; but the greatest of all destruction in fish-ponds is occasioned by frosts.

To remedy this, some propose to break the ice and lay in pipes, straw, and other things, to give air to the fish; but all these fail when the ponds are foul; but when they are clean, the fish seldom suffer any harm, be the frost ever so long, though no holes be broke in the ice. The stench of foul water seems to be the occasion of the death of the fish, in this case of its being locked up by frosts, and not the want of air. The cleaning of ponds frequently is of great use as well on this as on many other occasions; and it is done at no expence, because the mud, serving as manure to the lands, more than pays the expence of taking it out.

When the ground is boggy, and carts cannot come up to take the mud, it is best to cut the ponds long and narrow in form of moats, that it may be thrown out at one tofs by the labourers in clearing them; for if it require two tofses, the difference will be just the double price of labour.

In many situations where fish-ponds can be readily formed, it may not unfrequently be adviseable to have recourse to them in the view of profit from the fish, and their convenience in family use. It is not easy to ascertain what quantity of produce, or profit, might be derived from ponds of this description under different circumstances, as very few experiments have yet been detailed from which conclusions can be drawn. It would lead to much interesting information on the subject, if the annual increase in the weight of different sorts of fish, in different stages of their growth, and under different circumstances of soil and water, were correctly determined.

It has been stated by Mr. Lowden of Berkshire, in the "Annals of Agriculture," that a pond of the extent of three acres and a half, drawn, after three year's stocking with stores of one year old, afforded 195 pounds weight of carp, and 230 pounds weight of tench; which in the whole was 425 pounds, which sold for twenty pounds ten shillings, or nearly 2*l.* 6*s.* 0*d.* the acre per annum. And that the same pond, when stocked with tench only, on being drawn three years afterwards, produced about twenty-six pounds. Therefore, supposing that, in a pond which supports two thousand four hundred fish, half a pound be gained annually, it will be 1200 pounds weight, which, at 6*d.* the pound, will afford thirty pounds, and for fifteen acres, forty shillings the acre; and when at 9*d.* the pound three pounds the acre.

As there is little trouble in this sort of farm management, such profits should not be disregarded or overlooked in particular situations. In the district noticed above, it is stated that the usual price, when sold by the pound, is one shilling for tench, and ten-pence for carp. And that this is the best manner of disposing of them that can be adopted. But when they are sold by the number, as per hundred, &c. they are mostly measured from the eye to the tail, and disposed of in this manner.

Tench.

		£.	s.	d.
Under 12 inches	- -	3	0	0
12 ———	- -	5	10	0
14 ———	- -	7	0	0

Carp.

		£.	s.	d.
Under 12 inches	- - -	5	0	0
14 ———	- - -	6	10	0
16 ———	- - -	8	0	0

In what relates to the proper stocking and managing of ponds for the raising of fish, in the intention of deriving advantage from the sale of them much still remains to be accomplished before the greatest possible profit can be obtained.

In different situations the methods of stocking are extremely different. It is the practice in Berkshire to stock with carp and tench in the proportion of one hundred to the acre, while in Suffex they stock in the quantity of seventy five brace to the acre. Stocking in too large a proportion may be injurious to the profit, as fish require the food to be abundant in most cases.

The sorts of pond-fish most profitable to farming proprietors, are probably those of carp, tench, perch, and occasionally eels. But in thinly stocked ponds, the two last sorts should not be both admitted at the same time, as they devour young fry very largely. Where ponds are large, carp and tench answer well together; but in those of the smaller kind, the former is apt to deprive the latter of its food, in consequence of being so much more powerful. Carp seldom affords much profit in small ponds, but tench succeed well in those of almost any dimensions. Carp, perch, and eels, sometimes answer pretty well together, and likewise tench with eels. Where the ponds are but small, the best practice is perhaps to keep the carp and tench separate.

Carp frequently injure themselves by breeding, but this is not often the case with tench.

The situations in which fish-ponds can be made, in the intention of farm-profit, are principally in the dips, hollows, and other parts of ground where the quality of the land is very bad, but where there is the convenience of plenty of water proper for the purpose.

In a national point of view, ponds of this sort can hardly yet be considered of much importance, but they should not be neglected by those who are engaged in the improvement of landed property.

Though fish-ponds are numerous in many districts of the kingdom, it is perhaps only in the counties of Suffex and Surry that any thing like a system has been established for raising fish with the intention of profit; but in these counties fish-ponds have long been formed for letting to dealers in pond-fish, and stocking in order to the disposal of the produce as an article of farm-stock, like that of any other kind. It is not, however, improbable but that as the nature and management of pond-fish become more perfectly understood, such a practice may be considerably extended.

FISH-TOWN, in *Geography*, a town of Africa, at the mouth of the river Calbari.

FUSKEROE, an isle or peninsula on the Laponic shore, part of which belongs to Russian Lapland.

FISKO, a small island of Sweden, between the islands of Aland and the coast of Finland. N. lat. 65° 28'. E. long. 25° 45'.

FISMES, a town of France, in the department of the Marne, and chief place of a canton in the district of Rheims, situated on the Veille; 15 miles N.W. of Rheims. N. lat. 49° 18'. E. long. 5° 46'. The place contains 2125.

and the canton 11,152 inhabitants, on a territory of 182½ kilometres, and in 23 communes.

FISSATO, a sea-port town of Africa, in the country of Tripoli; 90 miles N.W. of Tripoli. N. lat. 33° 50'. E. long. 12°.

FISSENIA, in *Ancient Geography*, a town of Asia, in Mesopotamia, seated on the Basil or Royal river, towards Babylon.

FISSIDENS, in *Botany*, from *fissus*, cloven, and *dens*, a tooth, an Hedwigian genus of mosses, distinguished by its author, from his own *Dicranum*, only by the male flowers being axillary on the same plant with the female ones; a difference which, though corroborated by the habit in most cases, not in all, we think too difficult to be of any practical use. See DICRANUM.

FISSILIA, from the fissile or easily cloven corolla. Just. 267. Willd. Sp. Pl. v. 1. 194. Lamarck t. 28. An evergreen tree of the *isle de Bourbon*, where it is called *lois de periquet*, because the smaller kinds of parrots are fond of the fruit. The leaves are alternate, on short stalks, elliptic-lanceolate, entire, bluntish, thick and coriaceous, smooth, with one rib and a few slight veins. *Stipulas* none. *Flowers* axillary, somewhat racemose, occasionally solitary, on longish smooth stalks, resembling those of an orange but smaller. *Fruit* a small drupa, encompassed with the enlarged, cup-shaped, entire, permanent calyx.

This is the *Olas fissurorum* of Vahl's Enum. v. 2. 33. "Leaves ovate-oblong or lanceolate, slightly veiny. Branches round." See OLAX, to which genus it is with indubitable propriety referred by Vahl, though they are placed in two very different natural orders by Jussieu, who knew *Olas* but imperfectly. What he terms barren filaments in the flower, Linnæus, less authentically perhaps, takes for nectaries.

FISSUM-FOLIUM, a leaf that is cloven, or divided vertically more or less deeply. See LEAF.

FISSURA, in *Anatomy*, a name given to several openings, particularly in the bones of the head; as the superior orbital fissure of the spheroid bone, the inferior-sphæro-maxillary fissure formed between the sphenoid and superior maxillary bones, &c.

FISSURA Magna Sylvii, a division in the substance of the brain, separating the anterior from the middle lobe; See BRAIN.

FISSURE, a term in *Surgery*. All practitioners and authors have, from the earliest times, understood by the word *fissure*, a solution of continuity in a bone, having the appearance of a hair. Hence the expression *rima capillaris*, *capillary fissure*, which, in short, is nothing more than a very fine, minute crack in a bone.

The old surgeons used to believe, that this sort of fracture took place both in the flat and the long cylindrical bones; and it was M. J. L. Petit, who first brought into doubt the opinion, in as far as it related to bones of the latter class. The subject was noticed by this writer, in his "Traité des Maladies des Os." In this work, he represents fractures, said to occur exactly in the direction of the length of the bones, as only imaginary. His reason for this sentiment is, that there is no force capable of breaking a bone in this way, which would not much more easily occasion a fracture of the transverse kind.

The signs of a fissure, as stated by Fabricius ab Aquapendente, are very equivocal and fallacious: he observes: "quod si os secundum longitudinem fractum sit, primò adest membri crassities ultra naturalem statum, deinde dolor, tum membri inæqualitas." But all these symptoms, when they

make their appearance, ought rather to be ascribed to the effects of the contusion, than to any other circumstance. It is also evident, on reading Fabricius ab Aquapendente, that he meant by a longitudinal fracture, what is now called, an oblique one. Indeed as M. J. L. Petit notices, Fabricius would never have advised extension to be made for a fracture which was exactly in the direction of the length of a bone, since this practice is obviously not applicable to the case, and he would never have recommended making pressure round the broken part, which could not be in a displaced condition, even were the bone actually fractured in a longitudinal manner. Duverney in his "Traité des Maladies des Os," has adduced no solid arguments in favour of the doctrine of longitudinal fractures.

The reader may find the present subject very judiciously investigated at the beginning of M. J. L. Petit's work. It appears from the facts and reasons there brought forward, that, on the bones of the extremities a fissure can only occur, in cases of gunshot-wounds, where the splinters sometimes extend as far as the nearest joint. Such fractures are not easy of detection. They are most frequently attended with symptoms, arising more from the violence and shock always occasioned by gunshot injuries, and the consequent mischief excited in the substance or medullary structure of the bone, than from the particular nature of the fracture itself.

But though authors differ in opinion, in regard to fissures on the long cylindrical bones, they are all of one sentiment in acknowledging the occurrence of such fractures on the bones of the cranium, in consequence of blows upon the head. Here the accident is often termed by Latin writers *scissura*. The crack is either plainly perceptible, or scarcely discoverable; in which latter case, the expression of *capillary fissure* is often used. In both cases, the solution of continuity may take place, either precisely in the place against which violence has been directed, or at some other part of the skull. Encyclopedie Méthodique; Partie Chirurgicale. Art. Fissure.

FISSURE, in *Geology* and *Mining*, generally signifies the same with *Fault*, which see; but Mr. W. Martin, a late, and generally a very correct writer, defines it (Outlines of the Knowledge of Extraneous Fossils, p. 172.) to mean, a partial and superficial rift, rarely extending through more than one stratum; which definition, by the notes in this page, is made to apply nearly to mineral veins; like those in the Limestone district of Derbyshire, and by which two things very different in their nature, and the mode and period of their formation, are confounded together, as we have observed, when treating of Faults.

FISSURE Fossils, in *Mineralogy*, or venous or venigenous minerals, are those found in veins or fissures, and which are generally crystallized in a more or less perfect state; see VENIGENOUS Fossils, RIDERS, VEINS, &c.

FISSURES, in the *History of the Earth*, certain interruptions that horizontally or parallelly divide the several strata of which the body of our terrestrial globe is composed.

FISTELLA, or FEFZA, in *Geography*, a town of Morocco, the inhabitants of which are rich, courteous, and warlike; 150 miles N.E. of Morocco.

FISTER, a town of Norway, in the diocese of Bergen; 16 miles N.E. of Stavanger.

FISTRITS, or BYSTRZIT, *New*, a town of Bohemia in the circle of Bechin; 28 miles E. of Budweis. N. lat. 49° 3'. E. long. 15° 1'.

FISTRITZ, a river of Moravia which runs into the March, near Olmatz.

FISTUCA, in *Antiquity*, an instrument of wood used in driving piles, and fitted with two handles. It was either raised with pulleys fixed at the head of large beams, and then let fall again directly on the piles, or was wrought by the hand only.

FISTULA, *Lat.* a pipe, a flute, a flageolet, a whistle.

FISTULA, in the *Ancient Music*, an instrument of the wind kind, resembling our flute or flageolet.

The principal wind instruments of the ancients were the tibia and fistula; though how these were constituted, or wherein they differed, or how they were played on, does not at present appear. All we know is, that the fistula was at first made of reeds, and afterwards of other matters. Some had holes, some none; some again were single pipes; some a combination of several; witness the *lyringa* of Pan.

FISTULA, *Liturgical*, was the pipe, being generally made of gold or silver, through which during several ages, persons who communicated under both kinds, drank out of the chalice. The use of it was retained in the abbey of St. Dennis, near Paris, as long as it subsisted, as likewise by the kings of France, when they received the sacrament at their coronation.

FISTULA Panis, Pan's pipe. See **SYRINX** and **SIRINGA**.

FISTULA, in *Surgery*, has usually been defined, "sinus angustus, callosus, profundus; acri sanie diffluens;" or, as Dionis translates it, "un ulcère profond, et cavernæux, dont l'entrée est étroite, et le fond plus large; avec issue d'un pus acre et virulent; et accompagné de callosités." In the words of Mr. Pott, a fistula is "a deep, hollow sore, or sinus, all parts of which are so hardened, or so diseased, as to be absolutely incapable of being healed while in that state; and from which a frequent, or daily discharge is made of a thin, discoloured sanie, or fluid."

A fistula generally leads down to some cavity, commonly situated in the cellular substance, between the integuments and muscles, or in the interspaces between the muscles themselves. The cavities with which fistulæ communicate are usually termed *sinuses*. These, in some measure, serve as receptacles for whatever matter is secreted by the parietes of the abscess, and when pressure is made upon such sinuses, a much larger quantity of sanie, or matter, flows out of the external fistulous opening, than appearances would induce one to expect.

The reader will excuse us from devoting much time to criticisms on the ordinary definitions of a fistula; but we cannot refrain from observing that a fistula might be better, and more simply called a narrow track or passage, leading from the seat of an abscess, giving vent to more or less of the matter outward, and having little or no tendency to heal. However, in cases of fistulæ in perineo, and of those of the parotid duct, the foregoing definition will not be altogether accurate, since the fistulous passage leads from parts where urine and saliva exist, instead of pus. In the present state of surgery, so many disorders are termed fistulous, which have no claim to the appellation, (according to the strict sense of the expression,) not being accompanied with any callosities or sanious discharge, that perhaps a surgeon would be less liable to imbibe erroneous notions from the signification which we have suggested, than from the ancient one. We are ready to acknowledge, however, that almost all definitions are difficult, objectionable in some way or another, and exposed to controversy, and we gladly quit the subject ourselves, ever ready to retract our own explanations in favour of better ones.

The sinuses which are formed in cases of ulcers and abscesses are most frequently occasioned by the confinement of purulent matter, which readily makes its way in different directions in the cellular substance, which is the softest and most yielding part of the texture of the body. If a timely opening be made into abscesses, the formation of fistulæ and sinuses is generally avoided. But though a puncture be made by the surgeon at a seasonable period, if the aperture should not be made in a depending situation, so that the mass of pus cannot freely flow out, some of the matter will be continually oozing out in a slow way, prevent the part from healing, and be the cause of a fistula. The cavity of the abscess, in consequence of being kept for a considerable time distended with matter, instead of contracting and granulating, will acquire a diseased state, in which a thin sanious discharge will be emitted, and the parts lose all tendency to get well of themselves.

The foregoing observations are equally applicable to cases, in which an abscess bursts of itself, in a place which is very unfavourable for the escape of the pus.

Another circumstance under which fistulæ are necessarily produced, is when a dead portion of bone, or some extraneous body lodged in the flesh, maintains a continual suppuration around it. In this sort of case, the opening by which the abscess first breaks never closes as long as the secretion of pus within goes on; the matter is every now and then oozing out, and the track through which it passes becomes fistulous.

No term in surgery has been so much misapplied as the word fistula; and since the expression has always conveyed to the practitioner's mind the idea of a disease attended with a great deal of callous induration, this abuse of language has too often led, especially in former days, to methods of treatment equally unnecessary, hurtful, and barbarous. Even at present, so many disorders are called fistulæ without deserving the name, at least, without being accompanied with any callous hardness, that, as we have already said, young surgeons would avoid imbibing many prejudices, by merely considering the phrase "fistula," as implying an outlet for some discharge, which outlet, owing to some particular cause, has not much propensity to heal. The truth of what we have here remarked will be better seen, when the subjects of fistula in ano, and fistula lachrymalis, are presently treated of.

We shall next notice some of the modes of treatment which have been put into practice for the purpose of curing fistulous complaints. Some of the plans alluded to may now be said to be exploded; but there is an advantage in knowing what has been done by our predecessors, and, for this reason, we shall enter into some details, which otherwise would not have been given.

In recent cases of fistulæ, many writers have recommended what they call *vulvarary* injections to be made use of, and when the disease is in a more advanced state, and the sides of the sinus from length of time are in a callous state, escharotic injections and powders are preferred. Such applications, however, have seldom or never produced any real good effects, and the too frequent indiscriminate employment of them has often rendered sinuses hard and callous, which previously were by no means indisposed to heal.

In all cases in which the sides of a sinus are in an indurated callous state, some recommend laying open the cavity from one end to the other, and removing all such parts as have become hardened, so as to convert the whole diseased place into one wound, which is to be treated on common principles.

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The simple division of a fistula throughout its whole extent is, even at this day, the most approved plan of treatment generally speaking; but the additional method of cutting out all the surrounding indurated parts has long been abandoned by all good surgeons. The absurdity and bad effects of such treatment were well explained by Pott, in his treatise on the fistula in ano, and, since his time, the lamest practitioners in this country have not disgraced themselves by the performance of excisions of this nature.

Though there cannot be a doubt, that dividing fistulae throughout their whole extent is generally the most eligible mode of cure, it must be acknowledged that, in certain instances, the greatness of the pain, the disagreeableness of the fear, and the degree of danger, are formidable objections.

For example, the practice of cutting thus extensively is not applicable to cases in which fistulae extend a very considerable way up the rectum; and certainly no prudent surgeon would advise fistulae to be cut open which run to an immoderate depth, and, as very often happens, below large blood-vessels, nerves, and tendons.

In these last-mentioned, and several other kinds of fistulae, the French surgeons are advocates for the employment of a seton. They observe that the object in the treatment of all fistulous diseases, is to make the sides of the sinus adhere together, so that no cavity may remain. They state, that the most effectual plan of fulfilling this indication is first to make an opening in the most depending part of the fistula, in order to give free vent to the matter; and, secondly, by a gentle irritation to excite a certain degree of inflammation over the inner surface of the cavity. It is well known that in the inflammatory state, coagulating lymph is effused, and, becoming vascular, renders the sides of the fistula permanently adherent together.

According to the French writers, the two indications, just now specified, may be best fulfilled, in the majority of cases, by introducing a seton from the orifice of the fistula down to the very bottom of the sinus, where a counter-opening is to be made.

The seton should be made of silk or cotton, and more or less thick, according to the size of the fistula. The skein of silk or thread is to be gradually lessened, as the cure advances, one or two threads being removed every two or three days. At length, when the cavity of the sinus is almost filled up, and the discharge has considerably diminished, the seton may be entirely removed. A moderately tight bandage over the dressings will then serve to complete the cure.

Setons are not generally preferred for the cure of fistulae by English surgeons. Indeed it is obvious, they can only be used when the whole course of the fistula can be traced with a probe, and its termination is so situated that a counter-opening can be made into it. This may be said never to be the case with fistulae in ano.

The simple division of fistulous sinuses is generally the most judicious mode of cure. It is only when a fistula runs under parts, which it would be dangerous or hurtful to cut, that the knife must give place to other means. A director, a crooked bistoury, and a probe, are the instruments which are used in dividing fistulae.

Many fistulae are kept up by the presence of extraneous bodies, dead pieces of bone, &c. In such instances, it is manifest that the accomplishment of a cure cannot be effected, either by injections, setons, or laying open the sinuses; but can only be brought about by the removal of the foreign substance, or diseased portion of bone.

We shall now treat of the fistula in ano, fistula lachrymalis, and fistulae in perinaeo, all which are surgical diseases of the greatest importance.

Fistula in ano.—Clear and precise definitions of diseases, and the application of such names to them, as are expressive of their true and real nature, are (says that celebrated surgeon Mr. Pott) of more consequence than they are generally imagined to be: untrue or imperfect ones occasion false ideas; and false ideas are generally followed by erroneous practice.

The same writer remarks that it would be no difficult matter to produce instances of disorders, whose treatment has, for a great length of time, been accommodated more to the titles imposed upon them, than to their true and real character. Among these, the fistula in ano is mentioned as a most glaring proof.

“The custom of giving the appellation of fistula to every imposthumation, and to every collection of matter formed near to the anus, has, by conveying a false notion of them, been productive of such methods of treating them, as (though perhaps suited to such idea) are diametrically opposite to those which ought to be pursued; such as have often rendered those cases tedious and painful, which might have been cured easily and expeditiously; and, consequently, such as have brought disgrace on our art, and unnecessary trouble on mankind.

“A small orifice or outlet, from a large or deep cavity, discharging a thin gleet or sanies, made a considerable part of the idea which our ancestors had of a fistulous sore, wherever seated. With the term *fistulous*, they always connected a notion of callosity; and, therefore, whenever they found such a kind of opening yielding such sort of discharge, and attended with any degree of induration, they called the complaint a fistula. Imagining this callosity to be a diseased alteration made in the very structure of the parts, they had no conception that it could be cured by any means but by removal with a cutting instrument, or by destruction with escharotics; and therefore they immediately attacked it with knife or caustic, in order to accomplish one of these ends; and very terrible work, by their own accounts, they often made, before they did accomplish it.

“Several of the above mentioned circumstances so frequently attend collections of matter near to the rectum; and therefore, for want of proper attention to the true nature of the case, the custom of calling them all fistulae has generally prevailed, though without any foundation in truth or nature.

“That abscesses, formed near the fundament, do sometimes from bad habits, from extreme neglect, or from gross mis-treatment, become fistulous, is certain; but the majority of them have not, at first, any one character or mark of a true fistula; nor can, without the most supine neglect on the side of the patient, or the most ignorant mismanagement on the part of the surgeon, degenerate, or be converted into one.

“Collections of matter from inflammation, wherever formed, if they be not opened in time, and in a proper manner, do often burst. The hole, through which the matter finds vent, is generally small, and not often situated in the most convenient or most dependent part of the tumour: it therefore is unfit for the discharge of all the contents of the abscesses; and, instead of closing, contracts itself to a smaller size; and, becoming hard at its edges, continues to drain off what is furnished by the undigested sides of the cavity.

“This is often the case in the most muscular or fleshy parts of the body, where the cellular and adipose membrane,
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does not abound ; but is more particularly so in the neighbourhood of the anus, where that membrane is large in quantity, well stocked with fat, and not compressed by the action of any large or strong muscles."

After taking notice of the frequency of abscesses about the anus, and their being attended with considerable induration, which does not subside, particularly when they have been allowed to burst of themselves, Mr. Pott remarks that the smallness of the accidental orifice, the hardness of its edges, its being found to be the outlet from a deep cavity, its discharging every day a thin, gleet, discoloured kind of matter, attended with great induration of the surrounding parts, are all of them circumstances raising and confirming the idea of a true fistula.

"To this idea (says Mr. Pott) the general treatment of these cases has therefore been made to accord: upon this has been built the prevailing doctrine of free excision, or as free destruction, without any regard to the original production of the complaint, its particular seat, its date, or any other attendant circumstances; and without examining whether it would not admit a more easy and a more expeditious method of cure. In short, this notion, that all sinuses near the rectum are necessarily fistulous, has occasioned the prescription of such a manner of treating them, from their very first appearance as they can hardly ever stand in need of at any time; and a more ill founded supposition that the induration of the parts about may be owing to a diseased callosity, is urged as a reason for using them with more severity than even such a state would require."

Mr. Pott next observes, that whoever would obtain a true notion of the disease in question, must consider it under all the forms in which it makes its appearance. These, which are many and various, both with regard to aspect, situation, and symptoms, are what shew the different nature of the complaint in different states, and are the circumstances which ought to regulate a surgeon's conduct in the cure of it.

Sometimes (says Mr. Pott) the attack is made with symptoms of high inflammation; with pain, fever, rigor, &c. the fever subsiding as soon as suppuration is fully established.

"In this case, a part of the buttock, near to the anus, is considerably swollen, and has a large circumscribed hardness. In a short time, the middle of this hardness becomes red and inflamed; and, in the centre of it, matter is formed.

"This, in the language of our ancestors, is called in general a phlegmon; but, when it appears in this particular part, a phyma.

"The pain is sometimes great, the fever high, the tumour large, and exquisitely tender; but however disagreeable the appearances may have been, or however high the symptoms may have risen before suppuration, yet, when that end is fairly and fully accomplished, the patient generally becomes easy and cool, and the matter formed under such circumstances, though it may be plentiful, yet is good.

"On the other hand the external parts, after much pain, attended with fever, sickness, &c. are sometimes attacked with considerable inflammation, but without any of that circumscribed hardness which characterized the preceding tumour; instead of which, the inflammation is extended largely, and the skin wears an erysipelatous kind of an appearance. In this the disease is more superficial, the quantity of matter small, and the cellular membrane sloughy to a considerable extent.

"Sometimes, instead of either of the preceding appearances, there is formed in this part what the French call

une suppuration gangreneuse; in which the cellular and adipose membrane is affected in the same manner as it is in the disease called a carbuncle.

In this case, the skin is of a dusky red, or purple kind of colour, and although harder than when in a natural state, yet it has by no means that degree of tension or resistance which it has either in the phlegmon, or in the erysipelas.

"The patient has generally at first a hard, full, jarring pulse, with great thirst, and very fatiguing restlessness. If the progress of the disease be not stopped, or the patient relieved by medicine, the pulse soon changes into an unequal, low, faltering one; and the strength and the spirits sink in such manner as to imply great and immediately impending mischief. The matter formed under the skin is altered in small in quantity, and bad in quality; and the adipose membrane is gangrenous and sloughy throughout the extent of the discolouration. This generally happens to persons whose habit is either naturally bad, or rendered so by intemperance.

"In each of these different affections, (continues Mr. Pott,) the whole malady is often confined to the skin and cellular membrane underneath it; and no other symptoms attend than the usual general ones, or such as arise from the formation of matter, or sloughs in the part immediately affected. But, it also often happens, that, added to these, the patient is made unhappy by complaints arising from an influence, which such mischief has on parts in the neighbourhood of the disease; such as the urinary bladder, the vagina, the urethra, the hæmorrhoidal vessels, and the rectum; producing retention of urine, strangury, dysury, bearing down, tenesmus, piles, diarrhœa, or obstinate constiveness: which complaints are sometimes so pressing, as to claim all our attention. On the other hand, large quantities of matter and deep sloughs are sometimes formed, and great devastation committed on the parts about the rectum, with little, or no previous pain, tumour, or inflammation.

"Sometimes the disease makes its first appearance in an induration of the skin near to the verge of the anus; but without pain or alteration of colour, which hardness gradually softens and suppurates. The matter, when let out, in this case, is small in quantity, good in quality; and the sore is superficial, clean, and well conditioned. On the contrary, it now and then happens, that, although the pain is but little, and the inflammation apparently slight, yet the matter is large in quantity, bad in quality, extremely offensive, and proceeds from a deep crude hollow, which bears an ill-natured aspect.

"The place, also, where the abscess points, and where the matter, if left alone, would burst its way out, is various and uncertain. Sometimes it is in the buttock, at a distance from the anus; at other times near its verge, or in the perinæum; and this discharge is made sometimes from one orifice only, sometimes from several. In some cases, there is not only an opening through the skin externally, but another through the intestine into its cavity; in others there is only one orifice, and that either external or internal.

"Sometimes the matter is formed at a considerable distance from the rectum, which is not even laid bare by it; at others it is laid bare only, and not perforated; it is also sometimes not only denuded, but pierced; and that in more places than one. The original seat of this mischief is, in some cases, high up in the pelvis, near the lower vertebrae of the loins, and the os sacrum; and the matter comes from parts so distant, and so out of reach, that the case is hopeless from the first."

We shall here avoid inserting a few remarks, which Mr. Pott

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Pott has next added, for they seem to rest on doctrines which are now generally abandoned. The different cases which have been mentioned shew, that there is a great variety of states and circumstances, and that the disease must of course have the treatment varied accordingly. When inflammation attacks the cellular substance surrounding the rectum, suppuration can very seldom be prevented from taking place. In conformity to the advice of Mr. Pott, therefore, the best practitioners seldom have any object of this kind in view; but, when called at an early period of the affection, endeavour to moderate the symptoms, promote suppuration, open the abscess, as soon as the matter is formed, and treat the fore in such manner as shall be likely to produce a speedy and lasting cure.

Mr. Pott remarks: when there are no symptoms which require particular attention, and all that we have to do is to assist the maturation of the tumour, a soft poultice is the best application. When the disease is fairly of the phlegmonoid kind, the thinner the skin is suffered to become, before the abscess is opened, the better; as the induration of the parts about will thereby be more dissolved, and, consequently, there will be the less to do after such opening has been made. This kind of tumour is generally found in people of full, sanguine habits; and who, therefore, if the pain be great and the fever high, will bear evacuation, both by phlebotomy and gentle cathartics; which is not often the case of those who are said to be of bilious constitutions; in whom the inflammation is of larger extent, and in which the skin wears the yellowish tint of the erysipelas: persons of such kind of habit, and in such circumstances, being in general seldom capable of bearing large evacuation.

According to Mr. Pott, the erysipelatous inflammation generally makes its attack with nausea, vomiting, slight rigour, heat, thirst, and restlessness.

“The quickness of the pulse, and heat of the skin (says this distinguished surgical writer) are indications for some degree of evacuation, and, indeed, sometimes render it requisite; but, it is a very prevailing opinion with many practitioners, that these evacuations should be freely made, and frequently repeated: in short, that the cure of this kind of inflammation is safely to be effected by them; which is so far from being true, that the practice has proved fatal to many. If, for instance, blood be drawn off in such quantity, as that the patient's pulse sinks suddenly, or his strength be considerably reduced by purging, it is no very uncommon thing for the inflammation to leave the part first affected; and for such complaints to come on immediately, as soon prove destructive, and afford no opportunity to repair the mischief which the evacuation has produced.

“When the inflammation is of this kind, the quantity of matter formed is small, compared to the size and extent of the tumour; the disease is rather a sloughy, putrid state of the cellular membrane, than an imposthuma; and, therefore, the sooner it is opened, the better. If we wait for the matter to make a point, we shall wait for what will not happen; at least, not till after a considerable length of time, during which, the disease in the membrane will extend itself, and consequently, the cavity of the sinus, or abscess, be thereby greatly increased.

“When, instead of either of the preceding appearances, the skin wears a dusky purplish, red colour; has a doughy, unresisting kind of feel, and is very little sensible; when these circumstances are joined with an unequal, faltering kind of pulse, irregular shiverings, a great failure of strength

and spirits, and inclination to doze, the case is formidable, and the event generally fatal.

“The habit, in these circumstances, (continues Mr. Pott) is always bad; sometimes from nature, but much more frequently from gluttony and intemperance. What assistance art can lend must be administered speedily; every minute is of consequence; and, if the disease be not stopped, the patient will sink. Here is no need for evacuation of any kind; recourse must be immediately had to medical assistance; the part affected should be frequently fomented with hot spirituous fomentations; a large and deep incision should be made into the diseased part; and the applications made to it should be of the warmest, most antiseptic kind.”

Mr. Pott afterwards notices the occasional occurrence of strangury, dysfury, and a total retention of urine, when abscesses form in the neighbourhood of the rectum and bladder, particularly, when they are situated near the neck of the latter part. Such complaints may continue from the first attack of the inflammation till the abscess breaks, or they may only last a few hours.

Mr. Pott observes, that strangury and dysfury in general are easily relieved by bleeding, gum arabic, and nitre. “But (says he) the total retention (of urine) is, while it continues, both fatiguing and alarming. They, who have not often seen this case, generally have immediate recourse to the catheter, and for this they plead the authority of precept; but, the practice is so essentially wrong, and I have seen such terrible consequences from it, that I cannot help entering my protest against it.

“The neck of the bladder, from its vicinity to the parts where the inflammation is seated, and from its being involved in the same common membrane, does certainly participate, in some degree, of the said inflammation. This will, in some measure, account for the complaint; but, whoever considers the extremely irritable state of the parts composing that part of the urethra, (if I may be allowed so to call it,) and will, at the same time, reflect on the amazing and well-known effects of irritation, will be convinced, that the principal part of this complaint arises from that cause; and that the disease is, strictly speaking, spasmodic. The manner in which an attack of this kind is generally made, the very little distension which the bladder often suffers, the small quantity of urine sometimes contained in it, even when the symptoms are most pressing, and the most certain as well as safe method of relieving it, all tend to strengthen such opinion.

“But (proceeds Mr. Pott) whether we attribute the evil to inflammation, or to spasmodic irritation, whatever can, in any degree, contribute to the exasperation of either, must be palpably and manifestly wrong. The violent passage of the catheter through the neck of the bladder, (or violent in such circumstances it must be,) can never be right. I will not say, that it never succeeds; but I will say, that it can hardly ever be proper to make the attempt.

“If the instrument be successfully introduced, it must either be withdrawn as soon as the bladder is emptied, or it must be left in it: if the former be done, the same cause of retention remaining, the same effort returns; the same pain and violence must again be submitted to under (most likely) increased difficulties. On the other hand, if the catheter be left in the bladder, it will often, while its neck is in this state, occasion such disturbance, that the remedy, (as it is called,) will prove an exasperation of the disease, and add to the evil it is designed to alleviate. Nor, is this all; for the resistance which the parts, while in this state, make, is sometimes so great, that if any violence be used, the instrument will make for itself a new rout in the neighbourhood

bouring parts, and lay the foundation of such mischief as frequently baffles all our art—an accident, (says Mr. Pott,) which I have known to happen to those, whose judgment and dexterity have never been doubted.”

Mr. Pott remarks, that the true, safe, and rational method of relieving this complaint is by evacuation and anodyne relaxation: this not only procures immediate ease, but does at the same time serve another very material purpose, which is that of maturing the abscess. Loss of blood is necessary; the quantity to be determined by the strength and state of the patient. The intestines should also be emptied, if there be time for so doing, by a gentle cathartic: but, (says Pott,) the most effectual relief will be from the warm bath or fomentation, the application of bladders with hot water to the pubes and perineum; and, above all other remedies, the injection of clysters, consisting of warm water, oil, and opium.

For the painful tenesmus, which is no uncommon attendant on inflammations about the rectum, Mr. Pott recommends a dose of rhubarb, joined with some warm anodyne; and, in case this plan fails, he prescribes starch clysters with opium.

The bearing down in women may be cured by the same means.

For the obstinate costiveness, and piles, which sometimes accompany abscesses about the rectum, Mr. Pott advises phlebotomy, laxative clysters, and a low cool regimen, a soft poultice being externally applied, which softens the indurated piles, and promotes suppuration.

We shall next follow Mr. Pott in considering this disease, when the first symptoms attending the inflammation are gone off, and matter is either formed and collected, so as to require being let out, or this last step having been neglected, the pus has made its own way out.

Mr. Pott reduces all cases of this class to two general heads:

1. Those instances in which the intestine is not at all interested.

2. Those in which it is either laid bare, or perforated.

When the matter is fairly formed, makes a point, and requires being let out, the opening ought always to be made where such point is situated, where the skin is most thin, and the fluctuation most palpable.

Mr. Pott, after censuring the plan of opening abscesses about the anus, exposes the absurdity of the opinion once prevalent, that an abscess, opened by a knife, must be immediately examined and stuffed with dressings, while that, on which a caustic has been applied, must be let alone, until the eschar is cast off. “Let the one be treated as the other is, (observes this eminent surgeon,) and as they both ought to be, and the event will be found to be alike in each; excepting this material difference in favour of the knife, that it will not necessarily occasion any destruction of parts, loss of substance, nor any deformity, which is at all comparable with what must follow the use of the caustic.

“In making the opening, the knife or lancet should be passed in deep enough to reach the fluid, and, when it is in, the incision should be continued upward and downward, in such a manner as to divide all the skin covering the matter. By these means, the contents of the abscess will be discharged at once; future lodgment of matter will be prevented; convenient room will be made for the application of proper dressings; and there will be no necessity for making the incision in different directions, or for removing any part of the skin composing the verge of the anus.”

Mr. Pott has explained with great ability, that though

all abscesses of this kind are called fistulae, and have been supposed to effect the rectum, yet the place where the matter is formed is at such a distance from the intestine, that the latter part cannot be at all concerned, and none of these cases are, in the first instance, fistulae. It does not follow, as a matter of course, that we have any thing to do with the rectum at all, not more than if it were not near the disease, which should be regarded and treated as a common abscess.

It is accurately observed by the celebrated surgical writer, whose remarks are freely quoted in this article, that wherever matter is formed in consequence of inflammation, it always leaves, upon being let out, a proportional hollow, and some degree of induration. The former of these is of different size, according to the quantity of matter, and the latter depends both on the degree of previous inflammation, and the more or less perfect suppuration of the abscess.

The idea, formerly attached to the two circumstances of hollow and hardness, was, that the first arose entirely from loss of substance; the second, from a diseased alteration of the parts. Hence preceding surgeons, as soon as they had discharged the matter, used to fill and distend the cavity, with a view of obtaining a gradual regeneration of flesh, and the dressings were generally of an escharotic quality, intended for the dissolution of the hardness.

“The practice (says Mr. Pott) is a necessary consequence of the theory. Whoever supposes diseased callosity, and great loss of substance, will necessarily think himself obliged to destroy the former, and prevent the cavity formed by the latter from filling up too hastily. On the other hand, he who considers this matter as it really is, that is, he who regards the cavity of the abscess as being principally the effect of the gradual distraction and suppuration of its sides, with very little loss of substance, compared with the size of the said cavity; and who looks upon the induration round about as nothing more than a circumstance which necessarily accompanies every inflammation in membranaceous parts, especially in those which tend to suppuration, will, upon the smallest reflection, perceive, that the dressings applied to such cavity ought to be so small in quantity, as to permit nature to accomplish that end which she always aims at as soon as the matter is let out (I mean, says Pott, the approach of the sides of the cavity toward each other); and that such small quantity of dressings ought to consist of materials proper only to encourage easy and gradual suppuration.

“The fact is so obvious to common sense, that it must appear to every one, who will coolly and impartially consider it.

“What is the part in which the disease is seated? and what are the alterations which such disease produces? The part is mere cellular membrane; and the alteration is obstruction and inflammation, ending in the formation of matter. But do these create any new body? Do not the sides of the abscess still remain cellular and adipose membrane, only inflamed, thickened, hardened, and rendered purulent? Can such alteration require any thing more towards restoring the parts to a natural state than a free suppuration from the parts so altered? Or, can it make extirpation or destruction necessary? Most certainly it cannot. How then is suppuration to be produced and maintained? Not by thrusting in such applications as by their quantity distend, and by their quality irritate and destroy; but by dressing lightly and easily with such as appease, relax, and soften.”

When an abscess near the anus is opened, the cavity, as Mr. Pott observes, is found proportioned to the quantity of matter. If the hollow be immediately filled with dress-

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ings of any kind, the sides of it will be prevented from approaching toward each other, or may even be farther separated. But, if this cavity be not filled, or have little or no dressings of any kind introduced into it, the sides immediately collapse; and, coming nearer and nearer, do, in a very short time, convert a large hollow into a small sinus. The same thing happens when the collection of matter has burst of itself.

Mr. Pott acknowledges, that the sinus will not always become perfectly closed, particularly in cases of fistula in ano; but, still he contends, that the conduct of nature is not the less evident, nor the hurt, which art ought to borrow from her, the less palpable.

Whenever extensive ulcers or cavities exist, whether in cases of fistula in ano, or other disorders, much will depend upon the patient's constitution, and the care taken of it. When the habit is good, or properly corrected, any dressings which are not offensive in quantity or quality will prove effectual; but if the constitution be out of order, or badly treated, the surgeon may try (as Mr. Pott remarks) the whole sarrago of externals, and only waste his own and his patient's time.

This able writer explains, that all these cases are at first mere abscesses; the consequences of inflammation; and require no other treatment than what would be proper in the same kind of case in all other parts. Some few of them are so circumstanced, with regard to the intestine, that it is quite unnecessary to meddle with it at all; but whether that be the case or not; whether the division of the rectum become a necessary part in the cure or not; they most certainly do not deserve the name of fistulae, nor require that sort of treatment which fistulae are said and thought to stand in need of; though by being, from their very first appearance, supposed to be such, they are frequently, by mismanagement, rendered truly fistulous.

By light, easy treatment, says Mr. Pott, large abscesses, formed in the neighbourhood of the rectum, may sometimes be cured without meddling with this intestine at all. But it much more frequently happens that the intestine, although it may not have been pierced by the matter, has yet been so denuded, that no consolidation of the sinus can be obtained except by laying the cavity of the abscess, and that of the intestine, into one.

Sometimes the practitioner may perceive the necessity for such a division at first: that is, on opening the abscess he may find the intestine so bare, that it is evident no cure can be accomplished without this operation. In other instances reasonable hopes of success may be entertained at first; but they may end in disappointment.

Mr. Pott observes, that when the gut is found to be in such state, that there is no reason to expect a cure without its being divided, that operation had better, on many accounts, be performed at the time the abscess is first opened, than be deferred to a future one. When done, as it always may be done, the pain which the patient must feel when the abscess is opened will be so trivially increased, that the difference will hardly be distinguished, either with regard to time or sensation. If the division be delayed, the patient must either be under the continual apprehension of a second cutting, or suffer one when he does not expect it.

The object of the operation is to divide the rectum from the verge of the anus as high as the top of the hollow in which the matter is formed, so as to lay the two cavities of the gut and abscess into one; and by means of an open, instead of a hollow or sinuous sore, to obtain a firm and lasting cure.

The best instrument for the operation is the curved, probe-pointed knife, which, being introduced into the sinus, while the surgeon's fore-finger is in the intestine, will enable him to divide all that can ever require division; and that with less pain to the patient, with more facility to the operator, as well as with more certainty and expedition, than any other instrument whatever. If there be no opening in the intestine, says Mr. Pott, the smallest degree of force will thrust the point of the knife through, and thereby make one: if there be one already, the same point will find and pass through it. In either case it will be received by the finger in ano; will thereby be prevented from deviating; and, being brought out by the same finger, must necessarily divide all that is between the edge of the knife and the verge of the anus; that is, must by one simple incision, which is made in the smallest space of time imaginable, lay the two cavities of the sinus and of the intestine into one.

With respect to the distinction between those cases in which the intestine is pierced by the matter, and those in which it is not, although it may be useful when the different states of the disease are to be described, yet, in practice, as Mr. Pott observes, when the operation of dividing the intestine becomes necessary, such distinction is of no consequence at all; it makes no alteration in the degree, kind, or quantity of pain, which the patient is to feel; the force required to push the knife through the tender gut is next to none; and, when its point is in the cavity, the cases are exactly similar.

Immediately after the operation, Mr. Pott recommends a soft doil of fine lint to be introduced from the rectum, between the divided lips of the incision, as well to repress any slight hemorrhage, as to prevent the immediate re-union of the said lips; and the rest of the sore should be lightly dressed with the same. This first dressing should be permitted to continue, until a beginning suppuration renders it loose enough to be taken away easily; and all the future ones should be as light, soft, and easy as possible; consisting only of such materials as are likely to promote kindly and gradual suppuration. Mr. Pott remarks, the sides of the abscess are large; the incision must necessarily for a few days be inflamed; and the discharge will for some time be discoloured and gleet. This induration, and this sort of discharge, are often mistaken for signs of diseased callosity and undiscovered sinuses; upon which presumption, escharotics are freely applied, and diligent search is made for new hollows. The former of these, as Mr. Pott relates, most commonly increase both the hardness and the gleet, and, by the latter, new sinuses are sometimes really produced. These occasion a repetition of escharotics, and, perhaps, of incisions; by which means, cases which at first, and in their own nature, were simple and easy of cure, are rendered complex and tedious.

Mr. Pott censures, in strong terms, the former custom of applying to the wound the hydrargyrus nitratus ruber, and other escharotic powders. What, says this writer, would any patron of this method of dressing say to a man, who shall order a large tent, well charged with red precipitate, to be thrust up the undivided, unwounded rectum of a person who, from any cause whatever, had an inflammation of the hemorrhoidal vessel, and inside of the said intestine? Would he not say that such tent would prove a fatiguing inflammatory suppository? And would he not be right in saying so? Is then the rectum rendered less sensible and less irritable by being wounded? or, can that very application, which proves a painful stimulus to a gut not divided, become an easy digestive to one that is? If any man thinks that it will, Mr. Pott would advise him to make the experiment.

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rimment on himself; and an appeal might then be made to the testimony of his own unprejudiced sensations.

“In short,” observes this author, “to quit reasoning, and speak to fact only: in the great number of these cases which must have been in St. Bartholomew’s Hospital within these ten or twelve years, I do aver, that I have not met with one in the circumstances before described, that has not been cured by mere simple division, together with light, easy dressings; and that I have not in all that time used, for this purpose, a single grain of precipitate, or of any other escharotic.”

We have now to consider the fistula in ano in that state in which the matter has made its own way out, without the help of art.

The surgeon having omitted to open the abscess with a lancet, or knife, the matter makes its own way out by bursting the external parts somewhere near to the fundament, or by making a hole through the intestine into its cavity, or sometimes by both. In either case, as Mr. Pott explains, the discharge is made sometimes by one orifice only, and sometimes by more. Those in which the matter has made its escape by one or more openings through the skin only, are called *blind, external fistula*; those in which the discharge has been made into the cavity of the intestine, without any orifice in the skin, are named *blind, internal*; and those which have an opening both through the skin and into the gut, are called *complete fistula*.

Thus, as Mr. Pott remarks, all these cases are deemed fistulous, when hardly any of them ever are so; and none of them necessarily. They are still mere abscesses, which have spontaneously burst, and, if properly treated, will not demand the kind of treatment applicable to a true fistula.

The same excellent writer informs us, that the most frequent cases of all are the *blind external*, and the *complete fistula*. Each of these states may be known by introducing a probe into the sinus through the orifice in the skin, while the fore-finger is within the rectum.

Whether the case be what is called a complete fistula, or not; that is, whether there be an opening in the skin only, or one there and another in the intestine, the appearance to the eye is much the same. Upon discharge of the matter the external swelling subsides, and the inflamed colour of the skin disappears; the orifice, which at first was sloughy and foul, after a day or two are passed, becomes clean, and contracts in size; but the discharge, by fretting the parts about, renders the patient still uneasy.

Mr. Pott next observes, that as this kind of opening seldom proves sufficient for a cure, (though it sometimes does,) the induration, in some degree, remains; and if the orifice happens not to be a depending one, some part of the matter lodges, and is discharged by intervals, or may be pressed out by the fingers of an examiner. The disease in this state is not very painful; but it is troublesome, nasty, and offensive: the continual discharge of a thin kind of fluid from it creates heat, and causes excoriation in the parts about; it daubs the linen of the patient, and is at times very fetid. The orifice also sometimes contracts, so as not to be sufficient for the discharge, and the lodgment of the matter then occasions fresh disturbance.

Surgeons in former times used to adopt three modes of curing fistulae which had burst; *viz.* caustic, the ligature, and incision.

The fear of bleeding and a cutting instrument, and the idea of destroying callosity, were the chief motives for the employment of the two first means. However, as they are now universally abandoned, we shall not waste the reader’s time in shewing the great objections to them.

With regard to the plan of curing fistulae in ano in this state, by incision, the same method should be followed as the one already recommended in the case of a collection of matter formed *juxta anum*.

Notwithstanding the opinions of some former very eminent surgeons, such as Cheselden, De la Faye, and Le Dran, that the mere division of the intestine and sinus would not effect a cure, and, that unless we cut out or extirpated a portion both of the said intestine and the skin of the anus, durable relief would not be obtained, it was ably contended by Mr. Pott, and all experience strongly supports him, that the destruction of any of the parts is not only unnecessary, but injurious. As such practice is now gone completely out of vogue, we need not take up any more time in expressing our disapprobation of it.

When the fistula extends high up the rectum, further than the finger introduced within the anus can reach, it is found to be quite unnecessary to divide the sinus throughout its whole length, even were such proceeding practicable and free from danger. If the surgeon fairly divide that part of the fistula and intestine which he can conveniently reach with his finger, he need not concern himself about the deeper part of the disease, as in general a cure will follow without further trouble, in relation to any operation. The experience of Pott taught him this important fact, and succeeding practitioners have daily opportunities of seeing the same truth confirmed.

Thus far we have followed Mr. Pott in considering the disease either as an abscess from which the matter has been let out by an incision made by a surgeon, or from which the contents have been discharged by one single orifice, formed by the bursting of the skin somewhere about the fundament. We shall now pursue the same writer’s plan, and consider the case, in which, instead of one, there are several openings.

“This state of the case,” observes Mr. Pott, “generally happens when the quantity of matter collected has been large, the inflammation of considerable extent, the adipose membrane very sloughy, and the skin worn very thin before it burst. It is indeed a circumstance of no real consequence at all; but from being misunderstood, or not properly attended to, is made one of additional terror to the patient, and additional alarm to the inexperienced practitioner; for it is taught, and frequently believed, that each of these orifices is an outlet from, or leads to, a distinct sinus or hollow; whereas, in truth, the case is most commonly quite otherwise. All these openings are only so many distinct burblings of the skin covering the matter; and do all, be they few or many, lead and open immediately into the one single cavity of the abscess: they neither indicate, nor lead to, nor are caused by, distinct sinuses; nor would the appearance of twenty of them (if possible) necessarily imply more than one general hollow.

“If this account be a true one, it will follow, that the chirurgic treatment of this kind of case ought to be very little, if at all, different from that of the preceding; and that all that can be necessary to be done, must be to divide each of these orifices in such manner as to make one cavity of the whole. This the probe-knife will easily and expeditiously do; and, when that is done, if the sore, or more properly its edges, should make a very ragged, uneven appearance, the removal of a small portion of such irregular angular parts will answer all the purposes of making room for the application of the dressings, and for producing a smooth, even cicatrix after the sore shall be healed.

“When a considerable quantity of matter has been recently let out, and the internal parts are not only in a crude,

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undigested state, but have not yet had time to collapse, and approach each other, the inside of such cavity will appear large; and if a probe be pushed with any degree of force it will pass, in more than one direction, into the cellular membrane by the side of the rectum. But, (continues Mr. Pott,) let not the unexperienced practitioner be alarmed at this, and immediately fancy that there are so many distinct sinuses; neither let him, if he be of a more hardy disposition, go to work immediately with his director, knife, or scissars; let him enlarge the external wound by making his incision freely; let him lay all the separate orifices open into that cavity; let him divide the intestine lengthwise by means of his finger in ano; let him dress lightly and easily; let him pay proper attention to the habit of the patient; and wait and see what a few days, under such conduct, will produce. By this he will frequently find, that the large cavity of the abscess will become small and clean; that the induration about will gradually lessen; that the probe will not pass in that manner into the cellular membrane; and, consequently, that his fears of a multiplicity of sinuses were groundless. On the contrary, if the sore be crammed, or dressed with irritating or escharotic medicines, all the appearances will be different, the hardness will increase, the lips of the wound will be inverted, the cavity of the sore will remain large, crude, and foul; the discharge will be thin, gleety, and discoloured; the patient will be uneasy and feverish, and if no new cavities are formed by the irritation of parts, and confinement of matter, yet the original one will have no opportunity of contracting itself, and may very possibly become truly fistulous."

Without positively denying that there is ever more than one sinus extending along the same side of the rectum, Mr. Pott maintained, that for one instance in which the case is really so, forty are only supposititious ones. He allows that separate openings in the skin, from the same cavity or sinus, are common; but denies that perfectly distinct sinuses, running along the same side of the rectum, are at all usual.

Sometimes the matter of an abscess, formed in the neighbourhood of the anus, instead of making its way through the skin, externally near the anus, or in the buttock, pierces through the intestine only. This is what is called a *blind internal fistula*. In this instance, when the matter has discharged itself, the swelling subsides, and the patient experiences some degree of relief. If the evacuation of the matter does not terminate in a cure, which sometimes, though very seldom happens, some small degree of induration generally remains in the place where the original tumour was. As Mr. Pott describes, when this hardness is pressed upon, a small discharge of matter is frequently made per anum; and sometimes the expulsion of air from the cavity of the abscess into that of the intestine may very palpably be felt and clearly heard. The stools, particularly if hard, and requiring force to be expelled, are sometimes smeared with matter; and although the patient by the bursting of the abscess is relieved from the acute pain which the collection occasioned, yet he is seldom free from a dull kind of uneasiness, especially if he sits for any considerable length of time in one posture. Mr. Pott remarks, that the real difference between this kind of case, and that in which there is an external opening, with regard to the method of cure, is very immaterial; for an external opening must be made, and then all difference ceases. In this, as in the former, no cure can reasonably be expected, until the cavity of the abscess, and that of the rectum, are made one; and the only difference is, that in one case we have an orifice at or near the verge of the anus, by which we are immediately enabled

to perform that necessary operation: in the other, we must make one.

We have next to treat of that state of the disease which really deserves the epithet of fistulous, according to the common definition. Mr. Pott observes, that various causes may produce such a condition of the parts concerned. These causes are divided by this celebrated surgeon into two classes; *viz.* those which are the effect of neglect, disordered habit, or of bad management, and which may be called, without any great impropriety, local diseases; and those which are the consequence of disorders, whose origin and seat is not in the immediate sinus or fistula, but in parts more or less distant, and which, therefore, are not local complaints.

The former are generally cureable by proper treatment; the latter are frequently irremediable by any means whatever.

In the first description of cases, Mr. Pott ranks all those which were originally mere collections of matter within the coats of the rectum, or in the cellular substance surrounding this intestine, but which, by being long neglected, grossly managed, or by happening in habits which were disordered, and for which disorders no proper remedies were administered, suffer such alteration, and get into such state, as to deserve the appellation of fistulae.

In the second kind of cases, Mr. Pott classes all those in which the disease has its origin and first state in the higher and more distant parts of the pelvis, about the os sacrum, lower vertebrae of the loins, and adjacent parts; and are either stumous, or the consequence of long and much disordered habits; or the effect of, or combined with other distempers, local or general, such as a diseased neck of the bladder, or prostate gland, or urethra; the lues venerea, &c.

Mr. Pott notices, that among the very low people who are brought into hospitals, we frequently meet with cases of the first description; cases which at first were mere simple abscesses, but which, from uncleanness, from intemperance, negligence, and disordered constitutions, become really fistulous.

In these examples the general effects of intemperance, debauchery, and constitutional disease, are to be corrected, or removed, before surgery can afford any material relief.

When these great objects have been attended to, the surgery required consists in laying open and dividing the sinus or sinuses in such manner, that there may be no possible lodgment for matter, and that such cavities may be fairly opened lengthwise into that of the rectum. If the internal parts of these hollows are hard, and do not furnish good matter, Mr. Pott advises us to scarify them with the point of a knife, but not to use escharotic applications. When, either from the multiplicity of external orifices, or from the loose, flabby, hardened, or inverted state of the edges of the wound, near the anus, no hopes of healing the parts in an even way can be entertained, such a portion of them may be cut away as will just serve that purpose. Mr. Pott recommends the dressings to be soft, easy, and light.

When the inside of the sinus is occupied with fungous flesh, a slight touch of the lunar caustic may become necessary.

In the mean while, the remedies for the improvement of the system must be continued, and local measures alone not trusted.

When the bad state of the sore arises from the manner in which it has been crammed, irritated, and eroded, leaving

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off such treatment must of course be the means of bringing the disease into a better condition.

Mr. Pott remarks, that a patient who has been so treated has generally some degree of fever, has a pulse, which is too hard and too quick, is thirstily, and does not get his due quantity of natural rest. A sore which has been so dressed has generally a considerable degree of inflammatory hardness round about; the lips and edges of it are tumid, full, inflamed, and sometimes inverted; the whole verge of the anus is swollen; the hemorrhoidal vessels are loaded; the discharge from the sore is large, thin, and discoloured; and all the lower part of the rectum participates of the inflammatory irritation, producing pain, bearing-down, tenesmus, &c. *Contraria contrariis* (continues this able writer) is never more true than in this instance; the painful uneasy state of the sore, and of the rectum, is the great cause of all the mischief, both general and particular; and the first intention must be to alter that. All escharotics must be thrown out and disused; and in lieu of them a soft digestive should be substituted, in such manner as not to cause any distension, or to give any uneasiness from quantity. Over this a poultice should be applied. These dressings should be renewed twice a day; and the patient should be enjoined absolute rest. At the same time attention should be paid to the general disturbance which the former treatment may have created. Blood should be drawn off from the sanguine; the feverish heat should be calmed by proper medicines; the languid and low should be assisted with the bark and cordials; and ease in the part must at all events be obtained by the injection of anodyne clysters of starch and opium.

If, as Mr. Pott observes, the sinus has not yet been laid open, and the bad state of parts is occasioned by escharotic or astringent applications, no operation of any sort should be attempted, until both the patient and the parts are easy, cool, and quiet. When this desirable change has taken place, the sinus may be successfully divided, and, if requisite, a small portion of the ragged edges be taken away.

Lumbar abscesses sometimes form sinuses, which run down by the side of the rectum, and burst near the fundament. The discharge from these is generally large, fetid, thin, and sharp. Hence, we cannot wonder that the sinuses and orifices become hard and callous; that is, truly fistulous. But it must be obvious to every one (says Mr. Pott) who will consider it, that the surgical treatment of these sores and sinuses can be of very little consequence towards curing the diseases from which they arise, and which are generally out of the reach of our instruments and applications. The proper treatment also of such disorders will be spoken of in another part of the *Cyclopædia*. See *LUMBAR Abscess*.

Cancers and cancerous sores are sometimes formed in the cavity, or the neighbourhood of the rectum and fundament, where they make most terrible havoc. See *RECTUM*.

Fistulous sores, sinuses, and indurations about the anus, which are consequences of diseases of the neck of the bladder and urethra, and are named fistulæ in perinæo, require separate and particular consideration, into which we shall presently enter. Pott's Treatise on the Fistula in Ano.

Fistula Lachrymalis.—Every one who has acquired that degree of anatomical knowledge which is essentially requisite in a good surgeon, is well aware that the tears and sebaceous fluid with which the surface of a healthy eye is naturally kept in a moist state, are conveyed, as soon as they become superfluous, through certain tubes or ducts, down into the nose. We leave it to the anatomist and physiologist to determine, whether it is by some action like that of a syringe, or of a capillary tube, or whether it is by the muscular power of the lachrymal passages themselves, that the tears are made

to descend from the eye into the cavity of the nose. The secretion from the lachrymal gland, membranous lining of the eyelids, and Meibomian glands, constitutes what is commonly called the tears, the use of which is to lubricate the eye in its incessant motions, to keep the surface of the cornea in a moist, clean, bright state, fitted for the transmission of the rays of light, and lastly, to wash away any dust or other hurtful particles, which may accidentally fall upon, and irritate the organ. Mr. Pott, in his excellent account of this subject, has observed, that this fluid (meaning the tears) is derived principally from a large gland, named the lachrymal, situated under the upper edge of the orbit, near the outer corner of the eye, which gland is of the conglomerate kind, and lies in a small depression of the os frontis. Its excretory ducts, or those by which it discharges the secreted fluid, pierce the tunica conjunctiva, just above the cartilaginous border of the upper eye-lid.

When any irritating particles come into contact with the eye, a large quantity of fluid is immediately secreted by the lachrymal gland, and is as quickly diffused, by the motion of the eye-lids, over the surface of the eye; by which means, such particles are washed and wiped off. Sometimes, also, as Mr. Pott remarks, the passions of the mind produce an immediate increase of this secretion, which is then strictly called tears. A constant secretion of too large a quantity causes a disease, called *epiphora* (which see); and a deficiency of it makes the motions of the eye-lids difficult and painful.

Although the fluid, secreted by the lachrymal gland, is considerable in quantity; yet, when it is not suddenly produced by irritation from without, or passion within, it is so constantly and gradually carried off, as to create neither trouble, uneasiness, nor blemish.

The edge or border of each eye-lid, continues Mr. Pott, is formed by a thin cartilage, the figure and consistence of which keep the lids properly expanded. These cartilages are covered by a fine membrane, and are called cilia. Their internal edges do, upon every motion, sweep over every point of the surface of the cornea. This motion, though almost imperceptible, unless attended to, is very frequently performed; and as the secretion of the fluid is also constant, the eye is by this means kept always moist, clean, and bright.

Mr. Pott next relates, that at the extremity of each of these cartilaginous borders of the eye-lids, on the side next the nose, is a small papilla or eminence; and in the middle of each of these is a small hole, which, being situated in the cartilage, is not liable to collapse while the parts are in a sound state, but remains always open. They are called the *puncta lachrymalia*, and their office is to receive the lachrymal fluid, as it runs off the corner, along the edges of the eye-lid, so as to prevent it from trickling down the cheek.

From each of the *puncta lachrymalia* proceeds a small membranous tube. These tubes soon enter, or rather expand into, a little sort of pouch, placed near the inner angle of the eye, under the orbicularis palpebrarum muscle. The bag in question is named the lachrymal sac, and its office is to receive all the lymph transmitted through the *puncta* and ducts. The upper part of the sac lies in an excavation, formed partly by the nasal process of the upper maxillary bone, and partly by the os unguis. The lower part of it is confined in a long channel, and forms a tube or duct, which, descending obliquely backward, communicates with the cavity of the nose, behind the os spongiosum superius, by an opening of rather different sizes in different subjects.

This passage, says Mr. Pott, is called the *ductus nasalis*, and through it whatever is received by the lachrymal sac

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from the puncta does, in a healthy and sound state of these parts, pass into the nose.

The membrane which lines the lachrymal sac and nasal duct secretes a kind of mucus.

In the healthy state, the fluid secreted by the lachrymal gland readily passes off through the puncta, sac, and duct, into the nose; but when they are in a diseased state, the case is otherwise. The membrane lining the sac and duct is subject to inflammation, by which it is often so thickened as to render the passage more or less impervious. Hence, the lachrymal sac becomes filled with its own mucus, and with the secretion transmitted into it from the eye; and when no more of this last fluid can enter the puncta lachrymalia, it falls over the eye-lid, down the cheek. The obstruction continuing, and the mucus and tears still lodging, the sac is dilated, and that tumour in the inner corner of the eye, and that discharge from the puncta lachrymalia, upon pressure, are occasioned, which characterise the fist state of the fistula lachrymalis. See Pott's Observations on the Fistula Lachrymalis.

From what we have already stated, the reader must begin to suspect that the term *fistula lachrymalis* necessarily means no callous, indurated disease, accompanied with an acrid, sanious discharge; but merely a disorder, consisting of an obstruction in some part of those passages through which the tears have to pass into the nose, and attended with different appearances in different persons, and under different circumstances. Here the phrase "fistula" is sometimes, in consequence of ancient established usage, so unreasonably employed, that it is applied to a certain stage of the disease, now treated of, in which there is even no ulcerated opening at all, nor any other circumstance which, according to the dictates of common sense, could bring into the mind the idea of a fistula.

When the obstruction to the passage of the tears into the nose is only such as to occasion a watering of the eye, and a consequent necessity of wiping away the effused fluid, the disorder is commonly named *epiphora*; but when a fluid, somewhat similar to pus in appearance, accumulates in the lachrymal sac, and regurgitates through the puncta lachrymalia, on the sac being compressed, the complaint receives the name of *fistula lachrymalis*.

The eminent Scarpa, impressed with a conviction of the bad effects in practice resulting from the use of terms which convey erroneous notions, has proposed calling that stage of the disease which is attended with a discharge of a viscid, curdly, yellowish matter from the puncta lachrymalia, when the lachrymal sac is compressed, the *puriform discharge of the palpebrae*. The term *fistula lachrymalis* is restricted, by this author, to that state of the complaint in which the lachrymal sac is not only greatly distended, but ulcerated, and in a fungous state on its internal surface; and in which there is also an external opening, occasionally attended with a caries of the os unguis.

The varieties of the disease commonly called fistula lachrymalis are referred, by Mr. Pott, to five principal circumstances, *viz.*

1. The degree of obstruction in the nasal duct.
2. The state of the cellular membrane covering the sac.
3. The state of the sac itself.
4. That of the bone underneath.
5. The general state and habit of the patient.

Sometimes the lining of the sac and duct is so thickened, that the fluid cannot pass through them into the nose; and this forms the whole of the complaint. The cellular membrane on the outside not being diseased, there is no appearance of inflammation. In this case, as Mr. Pott describes,

the duct is stopped, and the sacculus dilated, but without any alteration in the colour of the skin. A fulness appears in the corner of the eye next the nose; and upon the application of a finger to this tumour, a clear, viscid mucus is discharged through the puncta lachrymalia. The patient feels no pain, nor finds any inconvenience, except what is produced by the discharge of this mucus, and by the trickling of the tears down the cheek.

The same writer next notices, that, in some cases, the mucus is not perfectly and always clear, but is sometimes cloudy, and looks as if it had a mixture of milk or cream in it. At first waking, some of it is generally found in the corner of the eye; and the eye-lashes, being smeared over with it during sleep, most commonly adhere together in the morning.

Mr. Pott remarks that this is the most simple state of the disease, and what the French have called the *bernia*, or *by-drops sacculi lachrymalis*. It is frequently met with in children who have been ricketty, or are subject to glandular obstructions; and, in this state, it sometimes remains for some years, subject to little alterations, as the health or habit shall happen to vary; the sac being sometimes more, sometimes less, full and troublesome. The mucus which is pressed out is sometimes more, sometimes less, cloudy; and, now and then, it is attended with a slight ophthalmia, or an inflammation of the eye-lids, but which, by common care, is easily removed.

When the sac is not much dilated, the discharge small, and produced only by pressure, the chief inconveniences are the weeping eye, and the gumming together of the eye-lids after sleeping; but these, by being attended to, may be kept from being very troublesome; and, if the disease makes no farther progress, may be so regulated as to render any more painful process totally unnecessary.

When the dilatation is considerable, says Pott, the swelling is more visible, and the quantity of mucus is larger. It is also in this state more frequently mixed and cloudy, and more troublesome, from the more frequent necessity of emptying the bag. But if the patient be adult, it may, even in this more dilated state of it, be kept from being very inconvenient.

If an inflammation comes on, the tumour is thereby considerably increased, the discharge is larger, as well during sleep as upon pressure; the skin covering it loses its natural whiteness and softness, becomes hard, and acquires an inflamed redness; and with the mucus a mixture of something, which in colour resembles matter, is discharged, especially if the pressure be made with any force, or continued for any time. This circumstance, added to the painful sensation and inflamed appearance of the parts, has been productive of a supposition, that there is either an ulcer or an abscess within the sac or duct; an opinion which Mr. Pott has taken great pains to refute.

We shall here introduce Scarpa's sentiments concerning the manner in which the fluid which distends the sac is formed. The viscid, curdly, yellowish fluid, mixed with tears, which regurgitates from the puncta lachrymalia, is not altogether secreted by the sac itself, as some have conjectured. The greatest part of it passes into the sac from the eye-lids, through the puncta lachrymalia, from which it regurgitates on pressure being made on the sac. This puriform fluid is chiefly secreted by the lining of the eye-lids, especially by the lower eye-lid along the tarsus, and by the glands of Meibomius. The sebaceous matter, which is furnished by these glands, is not only secreted more abundantly, but assumes an irritating quality. Besides the sebaceous fluid from the glands just now specified, a thin mucus

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is effused from the lining of the eye-lids; which mucus greatly increases the quantity of viscid matter which is spread over the eye and eye-lids.

It becomes manifest that the puriform fluid, which comes out of the lachrymal sac, is derived from the sources which have been pointed out, by turning the eye-lids, particularly the lower one, outward, and comparing their appearance with that of the sound ones of the opposite side of the face. The lining of the former always seems redder than natural, and exhibits a villous appearance, particularly along the tarsus. The margin of the eye-lid is swollen, and marked with a great number of little varicose vessels. The glands of Meibomius are more turgid and prominent than natural, and, when looked at with a magnifying glass, frequently seem to be somewhat ulcerated.

The villous texture, which the inside of the eye-lids acquires in these cases, is converted into an organ which secretes an unusual quantity of a fluid like viscid lymph, which, being blended with the sebaceous secretion from the glands of Meibomius, makes the tenacious matter which is smeared over the eye-lids, and which, passing through the puncta lachrymalia, sometimes distends the lachrymal sac in a very extraordinary degree.

If the lachrymal sac be emptied of this matter by means of pressure, and the eye and inside of the eye-lids be carefully washed, so that none of the glutinous secretion which issues from the sac may remain upon them, and the inside of the eye-lids be turned out half an hour afterwards, their inner surface, especially that of the lower one, will be observed to be covered with a new effusion of mucus, mixed with a sebaceous secretion; which fluids have manifestly not regurgitated from the lachrymal sac to the eye, but have been formed between the eye and eye-lids by the villous inside of the last-named parts, and the glands of Meibomius.

As a further proof, that the lachrymal sac has no other concern in this disease than that of receiving the tears and puriform fluid which are transmitted from the eye-lids, Scarpa mentions, that if the morbid secretion from the eye-lids be retarded or stopped, either by accident or the effect of applications, little or none of the viscid, curdly fluid accumulates in the lachrymal sac, or can be pressed out of the puncta lachrymalia.

The membrane which lines the lachrymal sac is one that has no sebaceous glands, and is only calculated for the secretion of a thin mucus. A small addition of this latter may be made to the puriform fluid and tears which are collected in the sac, but the quantity cannot be considerable.

We shall now resume the account of the different states of the disorder, as delivered by Mr. Pott. The inflammation of the integuments covering the sac is a circumstance which makes a considerable difference, both in the appearance of the disease and its requisite treatment. In some cases, it is confined merely to the surface of the tumour; in others, it spreads still farther, affecting the eye-lids, cheek, and side of the nose.

When the parts are in this state, continues Mr. Pott, the mucus within the bag has generally the appearance of being matter, that is, it wears a deep yellow colour, and is of a more thin consistence. If the puncta lachrymalia are naturally large and open, and the inflammation confined to the surface of the sac, its contents will pass off pretty freely, and the skin will remain entire. This is what the ancients called the *simple* or *imperfect* *achylops*.

But, says Mr. Pott, when the skin covering the lachrymal bag has been for some time inflamed, or subject to frequently returning inflammations, it most commonly happens

that the puncta lachrymalia are affected by it; and the fluid, not having an opportunity of passing off through them, distends the inflamed skin, so that at last it becomes sloughy, and bursts externally. This was named the *perfect* *achylops* or *achylops*. The discharge which used to be made through the puncta lachrymalia, while the skin was entire, is now made through the new opening, and by excoriating the eye-lids and cheek, increases the inflammation, and gives the disease a much more disagreeable appearance. In some, the matter bursts through a small hole, and, after it has discharged itself, the tumour subsides, the neighbouring parts become cool, and, though the skin covering the surface of the sac is sloughy and foul, yet there is no reason to believe that the sac itself is much diseased below. In others, the breach is large, the skin remains hard and inflamed, and, from the appearance of the sore, there is reason to suppose the whole inside of the bag to be in a diseased state; and, in some cases which have been much neglected, or irritated by ill treatment, the cavity of the sac seems to be filled with a loose, ill-natured fungus, which gleans largely, and produces inflammation and excoriation of all the parts about.

Mr. Pott observes, that there is another circumstance which is sometimes found to attend this disorder, *viz.* a carious state of the bones. The practitioners, in ancient times, used to suppose this complication was a very frequent one; and hence they so freely had recourse to the caustic, cautery, and scalpra, in the treatment. But caries is now ascertained to attend the complaint but seldom.

When the fistula lachrymalis is a symptom of the lues venerea, as it sometimes is, the bones are indeed often carious; but then the fistula is not the original complaint, but produced secondarily, and is a consequence of the diseased state of the os ethmoides and ossa spongiosa of the nose, and is not curable by any local means or applications, but depends entirely on the cure of the disease of which it is a symptom.

A very material difference, as Mr. Pott accurately explains, will be occasioned both in the appearance of the disorder, in the prognostic, and in the proper method of treatment, by the combination of other diseases, either of the constitution, the parts themselves, or adjoining ones. The patient, for example, is sometimes subject to an habitual ophthalmia or lippitudo, which will increase the deformity, and give a good deal of additional trouble during the cure. Mr. Pott also observes, that an ozæna, or some other disease of the membrane and cells of the ethmoid bone, or a polypus within the nose, may be combined with a fistula lachrymalis. Strumous complaints are other frequent attendants; and, if we may believe Mr. Pott, it sometimes becomes cancerous.

We shall now proceed to speak of the treatment of the disease; and, for the sake of rendering this subject as easily intelligible as possible, we shall imitate the above-mentioned writer, by dividing the disorder into four states.

The first consists of a simple dilatation of the sac, and an obstruction of the nasal duct, discharging, upon pressure, a mucus either quite clear or a little cloudy.

In the second, the tumour is somewhat larger; the skin which covers it is in an inflamed state, but entire; and the discharge made through the puncta lachrymalia is of a pale yellow or purulent colour.

In the third, the skin covering the sac is become sloughy, and burst, by which means the swelling is in some measure lessened; but the mucus which, while the skin was entire, used to be pressed out through the puncta lachrymalia, now discharges itself through the new aperture. The nasal duct,
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both in this and the preceding state, is not otherwise diseased than by the thickening of its lining.

In the fourth, the passage from the lachrymal sac into the nose is totally obliterated; the inside of the former being either ulcerated or filled up with a fungus, and attended sometimes with a caries of the bone underneath.

In the first or most simple state of the disease, *viz.* that of mere obstruction, without inflammation, various plans have been devised with a view of restoring the parts to their natural state and use, without making any wound at all. The chief of these methods have been the introduction of a probe, the injection of a fluid, and a constant compression, made on the outside of the sac, in the corner of the eye.

A French surgeon, named Anel, invented a probe of so small a size as to be capable of passing through one of the puncta lachrymalia, down into the nose. As the instrument was thus pushed through the lachrymal sac and nasal duct, M. Anel conceived that it would be able to break any small obstruction which might be met with.

The same gentleman also invented a syringe, furnished with a very minute pipe, which admits of being introduced into one of the puncta lachrymalia; and in this manner any fluid may be injected into the sac and duct, in order to clear away any thickened mucus or matter, which may be the cause of the tears not finding their way, as they ought to do, down into the nose.

With regard to the introduction of a small probe through one of the puncta lachrymalia, Mr. Pott observes that the plan has a very plausible appearance, but is unequal to the task assigned: the very small size of the probe, its flexibility, and the little resistance which it is capable of making, are manifest deficiencies in the instrument. He allows that such a probe may be passed through one of the puncta down into the nose; but he contends, that the pain which it gives, and the inflammation which it often excites, are much greater than any benefit which does or can arise from it. As for the idea, that this probe may be of use in removing any obstruction in the puncta lachrymalia, it is an unfounded one; for such an obstruction is seldom met with at all, and never can exist in this state of the fistula lachrymalis, one principal symptom of which is a discharge into the inner corner of the eye, when pressure is made on the sac. This discharge is made from the sac, through the puncta, and proves that the latter are open. The obstruction really forming the disease is one that hinders any thing from passing from the sac into the nose, and not from the eye into the sac.

On the subject of the screw, which Fabricius of Aquapendente invented, for making pressure on the lachrymal sac, we need only say, now that it has gone into perpetual disuse, that though it answered the purpose of compressing the sac very well, it did not operate in any way whatever on the obstruction in the nasal duct, the primary cause of the disease.

M. Anel's syringe is entitled to a much higher share of recommendation than has been given to his probe. Indeed, the plan of injecting fluids through one of the puncta lachrymalia into the lachrymal sac, for the purpose of removing any slight, recent obstruction in the nasal duct, is what receives the sanction of all the best surgeons and oculists of the present day. It is evident, however, that it is a method which can only be adopted while there is no ulcerated opening in the sac, and only then, with much hope of success, as long as the stoppage in the nasal duct is slight, and such as would be occasioned by the lodgment of thickened mucus.

Before entering upon the description of the manner in

which the eminent Mr. Ware employs Anel's syringe for the cure of the epiphora, or first stage of the fistula lachrymalis, it is proper to acquaint the reader that, in the year 1780, sir William Blizard made the proposal of injecting quicksilver instead of water into the lachrymal sac, by means of a pipe small enough to be introduced through one of the puncta lachrymalia, and fixed on the end of a long glass tube. In short, the instrument is exactly like what anatomists commonly use for injecting the lymphatics. The glass tube being filled with the mercury, as high as the practitioner may deem necessary, and the little pipe introduced into one of the puncta lachrymalia, the quicksilver descends by its specific gravity into the lachrymal sac, as soon as a little screw is turned, and, by reason of its weight, is, in sir W. Blizard's opinion, more calculated than water propelled from a syringe for removing the obstruction in the nasal duct. The force with which the mercury acts depending entirely on its weight, it must be manifest that the higher the column of the metal is made, the greater must be the power with which it operates.

There cannot be a doubt that sir William Blizard's method is an exceedingly good one; but perhaps it has no real advantage over the use of the syringe, since the fluid injected by this instrument is one which is always ready at hand, and operates with as much power as mercury, when the practitioner chooses to propel it with force into the lachrymal sac.

Mr. Ware made a trial of sir William Blizard's method, but at length preferred the employment of Anel's syringe. With this he usually injects warm water through the lower punctum lachrymale into the lachrymal sac, while a finger is put over the lower punctum, in order to prevent the fluid from making its way outward. The lachrymal should also be now and then compressed, for the purpose of promoting the descent of the water down into the nose. In particular instances, Mr. Ware has used the injection three times a day; but, in general, much less frequently. This gentleman relates, that his practice has been attended with considerable success.

Mr. Ware commonly commences his method of treatment by injecting some water through the inferior punctum lachrymale, and he repeats the operation four or five days in succession. If, in this space of time, none of the water should pass through the duct into the nose, and the watering of the eye be as troublesome as it was before the injection was employed, he commonly orders the angular vein to be opened, or a leech to be applied near the lachrymal sac. However, Mr. Ware is careful in forbidding the leech to be put on either of the eye-lids, lest it should occasion an extravasation of blood in the adjacent cellular membrane.

About the time when blood is taken away from the vicinity of the eye, Mr. Ware is in the habit of changing the injection, and trying the effects of a weak, vitriolic, or anodyne lotion. In some instances also, when, after several attempts, he has not been able to inject any part of the liquid through the duct, he has introduced a golden probe, about as large as a bristle, through the superior punctum lachrymale, and, attending to the direction of the duct, he has insinuated the end of the instrument through the obstruction, and conveyed it fully into the nose. Immediately after doing this, Mr. Ware has found, that a liquid, injected through the inferior punctum, has passed without any difficulty into the nose; and, by repeating these operations a few successive days, the pervious state of the passage has been re-established, and a cure accomplished.

On some other occasions, Mr. Ware has advised a strongly stimulating sternutatory to be snuffed up the nose, about

an hour before bed-time. Thus a large discharge has been excited from the Schneiderian membrane, which discharge, according to Mr. Ware's account, has had the effect of materially contributing to remove the stoppage in the nasal duct.

Very few cases present themselves which are not remediable by some of the above means. In certain examples which have been attended with a fetid discharge, Mr. Ware has corrected this bad quality, by injecting a vitriolic lotion into the lachrymal sac.

The celebrated Scarpa of Pavia, who has lately published some excellent observations on the diseases of the eyes, has set forth the doctrine, that the primary and principal cause of the fistula lachrymalis does not exist either in the lachrymal sac or the nasal duct, as surgeons have hitherto supposed, but in the morbid state of the eye-lids. Hence the same writer contends, that every method of treatment which is merely calculated to heal the ulceration of the sac, or remove the obstruction in the nasal duct, cannot accomplish a permanent cure of the disease, without the employment of such other remedies as are proper for correcting the diseased secretion from the eye-lids.

In the first stage of the fistula lachrymalis, called by Scarpa "*il flusso palpebrale puriforme*," this surgeon's practice consists in fulfilling two indications; *viz.* first, that of checking the secretion from the lining of the eye-lids, and the glands of Meibomius, from which diseased fluid he thinks that the fistula lachrymalis originates; secondly, that of diligently washing out the lachrymal passages throughout their whole extent.

For the first object, Scarpa recommends the use of Janin's ophthalmic ointment, which is composed of half an ounce of hog's lard, two drams of prepared tatty, the same quantity of Armenian bole, and one dram of the calx hydrargyri alba. The lard, after being washed three times with rose water, is to be well mixed with the other ingredients, after they have been made into a fine powder.

When this ointment is first used, it is to be rendered weaker by the addition of a larger proportion of lard than what is above-mentioned. A bit of the ointment, about the size of a barley-corn, is to be put on the end of a blunt probe, and applied between the eye-lids and eye-ball, near the external angle, every morning and evening, and all the edges of the palpebræ are also to be smeared with the same application. The patient is then to shut his eye, and gently rub his eye-lids, in order to diffuse the ointment all over their internal surface. A compress and bandage are next to be applied. At the end of two hours the eye may be uncovered, and washed with cold water. A collyrium of zincum vitriolatum, and mucilage of quince seeds, is also to be used three or four times a day.

When there are small excoriations upon the edges of the eye-lids, Scarpa recommends the unguentum hydrargyri nitrati to be applied at bed-time to the little fores. When this remedy fails, he says the argentum nitratum must be gently rubbed along the margin of the eye-lids, and the eye immediately afterwards washed with new milk.

Just before every time of making these applications to the eye-lids, Scarpa, in order to fulfil the second indication above specified, advises some plantain-water, containing a little spirit of wine, to be injected into one of the puncta lachrymalia, by means of Anel's syringe.

With regard to the truth of the theory advanced by Scarpa, concerning the primary cause of the fistula lachrymalis, we cannot help having our doubts; but of the practice which we have been describing we have to express our entire approbation. If the origin of the

disease always depended on the morbid secretion from the lining of the eye-lids and the glands of Meibomius, why do we not have a fistula lachrymalis as an attendant on numerous ophthalmies in which we know and see that such secretion is in a diseased state? Besides, in the practice of surgery, we have most positive evidence that the ductus nasalis very frequently becomes obstructed by the pressure of polypi and other tumours in its vicinity; and although this cause cannot be assigned as the ordinary one of the disorder, yet it proves that a fistula lachrymalis may sometimes originate without the secretion of the eye-lids being concerned in its production. Experience also shews that colds which inflame and thicken the Schneiderian membrane, sometimes bring on obstructions in the nasal duct. Nor is the statement of Scarpa altogether correct, when he observes that the disease can never be permanently cured by remedies which only operate in clearing away the obstruction in the duct, without acting upon the diseased inner surface of the eye-lids. We have daily proofs that the epiphora, the incipient state of the fistula lachrymalis, or, as Scarpa terms it, the palpebral puriform discharge, can be cured by merely injecting warm water, with Anel's syringe, through the lower punctum lachrymale.

The ample experience of Mr. Ware is a confirmation of what we have just now remarked.

Much, however, as we have differed from Scarpa in relation to the primary causes of the fistula lachrymalis, we entertain the most favourable opinion of that part of his practice which arises out of his theory. We allude to the plan of applying some such ointment as Janin's, or the unguentum hydrargyri nitrati, to the edges and inside of the eye-lids. Scarpa's description of the diseased state in which the inner surface of these parts is found, is perfectly accurate, and whether such state be regarded with him as a cause, or with us only as an effect, there can be no doubt that something should be done to rectify it.

We have now to speak of the treatment of the second and third stages of the fistula lachrymalis, or of those in which the skin covering the lachrymal sac is either inflamed or burst.

This part of surgery has only attained its present improved state within the few last years; and Mr. Pott, who wrote so well on every surgical subject which attracted his notice, has recommended in his works a mode of treating these states of the fistula lachrymalis much less simple and efficacious than what modern surgeons now universally prefer. For instance, when the sac is burst, he directs the opening, if necessary, to be enlarged with a knife, and, in other cases, an incision to be made through the skin into that cavity. He then advises us to dislend the wound moderately with dry lint, or prepared sponge, so as to be able, in two or three days, to ascertain the state of the inside of the sac, and of the ductus nasalis. When the former is not sloughy nor diseased, and the obstruction in the latter slight, a cure will sometimes ensue, according to Mr. Pott, on a free discharge taking place, and superficial dressings being applied to the fore.

When this method is not attended with success, Pott advises us to render the nasal duct pervious, by introducing a probe, a piece of catgut, or a bougie, from the wound down into the nose. When one of these instruments will not pass all the way down at once, it is to be gently introduced again and again until a passage is obtained.

About the year 1780, Mr. Wathen tried the effect of introducing a canula into the nasal duct. His object was not only to form a communication between the eye and the nose, but, by letting the wound heal over the instrument, to hinder the obstruction from returning afterwards. In

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this way many cures were effected; but, after a time, the method was found to be subject to difficulties. The tubes, as Mr. Ware relates, frequently changed their position in the duct; sometimes they rose too high; at other times they sunk too low; and, in consequence of these accidents, the tears often became obstructed again, and all the old symptoms returned.

A French oculist, M. Pellier, invented some cannulae, which had two projecting edges; one at the top forming a kind of brim, and another about the middle of the instrument. The intention of these was to keep the tube from ascending or descending, after granulations had occupied the space between the two projecting brims.

Notwithstanding the favourable accounts which have been given of cannulae for the cure of the fistula lachrymalis, Mr. Ware has experienced much disappointment from their use; and, among the objections to them, mentions the difficulty which sometimes attends the attempt to withdraw them from the duct, in which they have become fixed.

For the second and third stages of the fistula lachrymalis, the treatment which now obtains universal preference is that which Mr. Ware introduced into practice. Whenever a patient applies to this gentleman for relief, on account of an obstruction in the nasal duct, he always thinks it right to endeavour to free the canal from any thickened mucus which may be lodged there, by injecting some warm water through the lower punctum lachrymale. At the same time he tries, when necessary, the effect of other remedies, mentioned in his writings on the epiphora. But if no benefit be perceptible after employing these means about a week or ten days; or if, from the long continuance of the obstruction, such treatment cannot be expected to succeed; he recommends the operation which we are about to describe. However, with respect to children, Mr. Ware advises it to be deferred till they are eight or nine years old.

If the disease has not occasioned any external opening in the lachrymal sac, or if there is an opening which is not situated in a right line with the longitudinal direction of the nasal duct, Mr. Ware advises a puncture to be made into the sac, at a small distance from the internal commissure of the eye-lids, and nearly in a line drawn horizontally from this commissure towards the nose. This opening is to be made with a very narrow spear-pointed lancet. The blunt end of a silver probe, which must be rather smaller than the probes commonly used by surgeons, ought next to be introduced into the wound, and be gently, but steadily, pushed on in the direction of the nasal duct, with a force sufficient to overcome the obstruction in this canal, and until there is reason to believe that it has freely entered into the cavity of the nose. Mr. Ware remarks that the position of the probe, when thus introduced, will be nearly perpendicular; its side will touch the upper edge of the orbit; and the space between its bulbous end in the nose and the wound in the skin will usually be found in a full grown person to be about an inch and a quarter, or an inch and three-eighths. The probe is then to be withdrawn, and a silver style, of a size nearly similar to that of the probe, but rather smaller, about an inch and three-eighths in length, with a flat head, like that of a nail, but placed obliquely, in order that it may be close on the skin, is to be introduced through the duct in place of the probe, and to be left, for a continuance, in this situation. For the first day or two after the style has been introduced, Mr. Ware informs us that it is sometimes advisable to wash the eye with a weak saturnine lotion, for the purpose of obviating any tendency to inflammation, which may have been excited by the operation. However, the same gentleman observes that this inflammation is in general

so slight, that he has seldom found it necessary to use any application for its removal. The style should be withdrawn once every day for about a week, and afterwards every second or third day. Each time some warm water should be injected through the duct into the nose, and the instrument be then replaced in the same manner as before. Mr. Ware next blackens the head of the style with sealing wax.

On the first trials of this method, Mr. Ware entertained no expectation that any relief would be obtained till the use of the style was left off. He had the gratification of finding, however, that the watering of the eye ceased as soon as the style was introduced, and the sight became proportionally better and stronger.

In cases in which there is no external opening in the lachrymal sac, or no opening which will answer the purpose, Mr. Ware only makes a puncture of just sufficient size to admit the end of the probe or style. This aperture soon changes into a fistulous orifice, through which the style may be passed without the least pain. In short, says Mr. Ware, in about a week or ten days, the treatment becomes so easy, that the patient, or any friend, is fully competent to do what is necessary. It merely consists in withdrawing the style two or three times a week, occasionally injecting some warm water, and then replacing the instrument in the same position which it held before.

With respect to the time which the style should be worn, no determinate rule can be laid down. Mr. Ware acquaints us that some persons, who find no inconvenience from the style, and are afraid to leave it off, wear it for years. Many others leave it off in about a month or six weeks, and continue quite well.

The sores which are frequently met with over the lachrymal sac generally heal as soon as the tears begin to find a passage down into the nose. Two examples, however, are related by Mr. Ware, in which the ulcerations did not heal until the patient had taken a weak solution of the hydrargyrus muriatus and bark.

The fourth and last stage into which the fistula lachrymalis is divided, is that in which the natural passage from the sac into the nose is so diseased as to be quite obliterated, or in which bones are carious.

In either of these circumstances the object to be attempted is to form an artificial passage for the descent of the tears into the nose.

Mr. Pott has explained, in a very clear manner, that the upper and hinder part of the lachrymal sac is firmly attached to the os unguis, a small and very thin bone just within the orbit of the eye. This bone is so situated, that if it be by any means broken through or removed, the two cavities of the nose and of the orbit communicate with each other; consequently, the os unguis forms the partition between the hinder part of the lachrymal bag, and the upper part of the cavity of the nose. It is, says Mr. Pott, by making a breach in this partition, that we attempt the formation of an artificial passage for the lachrymal fluid.

For making a perforation in the os unguis Mr. Pott always employed a curved trocar, the point of which was turned obliquely downward from the angle of the eye towards the inside of the nose. Some make the breach in the bone with a knife; others with some such instrument as a gimblet. As soon as the communication between the sac and inside of the nose is made, the circumstance will be indicated by a discharge of blood from the nostril, and air from the wound, upon blowing the nose.

Without lengthening this article by detailing how the ancients

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ancients used to make the breach in the os unguis with the actual cautery, which the celebrated Scarpa even now prefers, or by explaining how practitioners a very few years back were wont to maintain the breach open by cramming in tents, prepared sponge, a piece of bougie, &c. we shall proceed at once to describe what is generally regarded as the best plan of keeping the artificial opening pervious.

Here we have to make the reader acquainted with an improved mode of treatment, for which the public and the profession are indebted to the ingenuity of Mr. Ware. After the perforating instrument is withdrawn, this gentleman advises us to introduce a nail-headed style, about an inch in length, through the new aperture, in the same manner in which such an instrument is passed through the nasal duct, in cases in which the obstruction is not so great as to prevent its passing in this direction. The style may also be left in the opening made in the os unguis, with as much safety as in the natural ductus nasalis, and this for as long a time as may be deemed requisite for removing all chance of the new passage becoming closed again. Pott on the *Fistula Lachrymalis*. Ware on the *Epiphora and Fistula Lachrymalis*. Scarpa *sulle Principali Malattie degli Occhi*. Venezia, 1802.

Fistula in Perinæo.—Very often, in consequence of various irritations affecting the urethra, inflammations and abscesses are occasioned around this canal. These collections of matter may burst inwardly into the urethra, or externally, or in both ways, in which latter case more or less of the urine flows out of the opening, whenever the patient has need of discharging this fluid. Sometimes the artificial passage through which the urine is evacuated heals up, after the irritation in the urethra is lessened. In other instances, the cause of the preternatural opening remains unremoved, and the urine passing into the abscess by the inner orifice, and, making its escape by the external one, keeps up a constant irritation in the fore, prevents the sides of the passage from uniting, and converts them into a hard callous substance, the inner surface of which, as Mr. Hunter has remarked, loses the disposition to union, and assumes the nature of an outlet. Every opening which is thus caused, which partakes of this nature, and is situated in the perinæum, or even in the scrotum, is, with the general consent of surgeons, denominated a *fistula in perinæo*.

The kind of irritation in the urethra most frequently occasioning fistula in perinæo, is that which attends the obstruction produced by strictures in this canal. When this latter disease is very bad, and the urethra considerably obstructed, nature frequently endeavours to procure relief by ulceration on the inside of that part of the urethra which is between the bladder and the stricture. The urine then passes into the loose cellular membrane of the scrotum and penis, and the irritating quality of this fluid becomes a cause of suppuration wherever it is extravasated, and even of mortification, first, of all the cellular substance, and then, of several portions of the skin. If the patient continues to live, all these sloughs are detached, and the fores contract, till nothing but the fistulous aperture remains, through which the urine makes its escape. In some examples the urine infiltrates itself into the corpus spongiosum urethre, is diffused all over this substance, even into the glans penis, and produces a sloughing of all the parts in which it is lodged.

In irritable constitutions, in old persons, and in subjects whose systems have long been under the influence of the East or West India climate, fistula in perinæo seem to be more easily excited. We have often seen, in such patients, abscesses and openings, through which the urine flowed, occasioned by gonorrhœas, which could not be regarded as

severe ones, and by strictures which had not made sufficient obstruction in the passage even to render the persons themselves conscious of having any stoppage of this kind at all.

Mr. Hunter advises us to treat inflammations which occur in the vicinity of the urethra in the same manner as inflammations in other parts. Resolution is very desirable, though hardly to be expected, when a stricture is the cause, in which case suppuration almost inevitably ensues. When matter is formed, the sooner an external opening is made into the abscess the better, as by this means we may sometimes, though not often, prevent it from bursting inwardly into the urethra. Mr. Hunter recommends the external opening to be made large.

In certain instances it happens, when the collection of matter bursts internally, that the stricture is removed by the ulceration, and is thus fortunately cured. But when the stricture continues, as it almost always does, an attempt must be made to destroy it by some of the methods which will be described in a subsequent part of the *Cyclopædia*. (See STRICTURE.) While the urine passes through the artificial passage no cure can be hoped for.

From what has been already delivered, it must be obvious, that in every instance in which a stricture is known or suspected to have occasioned the abscess and fistula in perinæo, it is proper to examine the urethra with a bougie. If the obstruction has been more or less destroyed by ulceration, so that this instrument, of a certain size, can be passed, its employment should be almost incessantly continued, and its size regularly increased as fast as circumstances will allow, in order to procure a free passage onward to the bladder. Some practitioners, in the same kind of case, would prefer the use of bougies armed with caustic; but this subject more properly belongs to the article in which strictures will be considered.

Some practitioners recommend hollow bougies to be worn after the stricture is in part removed, with a view of preventing the urine from passing into the artificial opening. Mr. Hunter remarks, that this instrument allows the urine to dribble away continually; but that its orifice may be stopped up, and the urine only allowed to flow when the patient has an inclination to make the evacuation. The hollow bougie, according to the same great surgeon, becomes, under certain circumstances, the worst instrument possible; for if its canal is not of a size sufficient to let the water pass as freely as the contraction of the bladder requires, the fluid will easily pass by the side of the bougie, and not being able to get more forward than the remaining part of the stricture, will of course run into the abscess in the perinæum. In order to avoid this disagreeable occurrence as much as possible, the hollow bougies should be as large as the strictured part will allow, and their sides should be as thin as possible, so that their cavity may be the wider. On this account the elastic gum catheters ought to be preferred to common hollow bougies, made with spiral wire, covered with waxed cloth.

Mr. Hunter himself entertained doubts whether the abscess in the perinæum was really prevented from healing by the passage of the urine through it, and consequently held a very high opinion of the use of hollow bougies. He observed, that after lithotomy the parts healed very readily, when they were free from disease. Hence he suspected that in abscesses, and fores in the perinæum, the want of disposition to heal arose from the stricture, not being sufficiently subdued, or the deeper parts not being in a healthy state.

When suppurations in the perinæum are neglected, and no attempt is made to cure the stricture, the latter sometimes closes entirely, no bougie can be passed through it, and all

the urine passes through the artificial passage. For such instances caustic bougies are such as ought to be employed.

In cases in which suppuration takes place in the perinæum, in consequence of strictures in the urethra, the surgeon should not limit his attention to the removal of the latter affection only; he should also make use of every means which is proper for diminishing the local inflammation. Bleeding, and exposing the parts to the steam of hot water, are measures fraught with peculiar efficacy. All practitioners likewise acknowledge the great benefit which is derived from the use of opium, administered both by the mouth and in glysters. Irritation and spasm will be most effectually relieved by conjoining with the foregoing treatment the employment of the warm bath.

In some examples matter forms in the perinæum, and bursts both internally and externally, so that a passage is made, through which the urine escapes; but in consequence of the abscess being circumscribed by the adhesive inflammation, which shuts up the cavities of the cellular substance, the urine does not become diffused.

The avoidance of such an extravasation, however, is frequently not in the power of the surgeon; an unfortunate truth, because sloughing and abscesses generally arise in every place into which the irritating fluid insinuates itself.

As the mischief continues to increase as long as the urine cannot find a free vent outward, and is, consequently, injected more and more into the cellular membrane, the practitioner must not be guilty of delay. It very often happens that all the methods related above prove insufficient, or unproductive of the prompt relief which is urgently demanded. In this circumstance the surgeon must try by other means to unload the bladder, and prevent the increasing extravasation in the cellular membrane of the perinæum, scrotum, and adjacent parts. These two great desirable objects may be effected by making an opening into the urethra, somewhere beyond the stricture; though the nearer to it the better.

With this view, Mr. Hunter advises a director or staff to be introduced into the urethra, as far as the stricture, and an incision made down upon the end of the instrument. The cut is then to be lengthened a little towards the anus, so as to open the urethra just beyond the obstruction.

In cases in which the stricture happens to be situated opposite the scrotum, we are recommended by Mr. Hunter to make an opening into the urethra in the perinæum. It is obvious that in such instances we cannot have the staff to guide us, and we must be directed by our knowledge of anatomy. A cannula is then to be passed from the wound to the stricture, and another cannula from the glans penis also to the obstruction, so as to meet the other tube. A perforating instrument is then to be pushed from one cannula into the other, by which means the stricture will be penetrated. The next step is to withdraw the two tubes, and introduce a gum-catheter, which is to be worn till the wound is healed.

These proceedings, however, are only to be considered as proper in certain very urgent cases. In others, the increasing diffusion of urine may be stopped by merely making an opening into the urethra, somewhere between the stricture and bladder; and, indeed, in the generality of instances, a diligent use of bougies, and making depending apertures for the discharge of the urine, which becomes extravasated, will remove all occasion for more severe measures.

Nor should the important considerations which we have just been speaking of monopolize all the practitioner's attention. Other matters also require his care. That inflammation, which is constantly excited wherever the urine is

extravasated, should be diminished as much as possible. Fomentations and poultices should be applied, and the same scarifications and incisions which serve to let out the urine, and prevent its spreading further in the cellular substance, will also serve to give vent to whatever pus may be collected. When there are sloughs, which is too frequently the case, the incisions should of course rather be made in the insensible dead parts than in the living ones. However, the advantage of having a depending opening ought even to be paramount in the surgeon's mind, to the falsely humane motive of not subjecting the patient to pain. By submitting to requisite operations, it is true the latter suffers for a time, but it is equally obvious that he would certainly suffer much more, and perhaps ultimately die, were such operations neglected. It is frequently the case in surgery, that those proceedings which to an unthinking person seem bold, bloody, and cruel, are in reality, with regard to what the patients must feel, the most tender and humane, and, with regard to his safety, the most discreet. Were the surgeon's knife not used when diseases require it, the patient certainly would not feel the sharp edge of the instrument; but he could not in this way elude pain, which would be tenfold greater, when resulting from the increasing ravages of the disease, than when inflicted by the surgeon, with this material difference, that in one instance it is suffering for the chance of a recovery; in the other, it is suffering in all probability to die.

In cases of old fistulæ in perinæo, in which the dangers arising from an extravasation of urine are over, either common or armed bougies are to be used for the purpose of making the urethra as free from obstruction as possible. When the strictures give way, and the urine can flow freely forward, the fistulous openings in the perinæum often spontaneously heal.

When the urethra is completely free from strictures, and yet the fistulæ in perinæo do not heal, the sinuses are to be laid open like all others which have no disposition to get well. One great object in performing such operations is to cut as little as possible of the sound urethra. On this account, Mr. Hunter advises us to find the inner orifice of the fistulæ, if possible, by introducing a staff, which is to meet the end of a probe passed through the fistulæ into the urethra. Surgeons ought to understand, that though fistulæ in perinæo often have several external openings, they seldom or never have more than one internally, with which they communicate with the urethra. A director is the most convenient instrument when the straight course of the fistula will allow it to be introduced. When the fistulous passage is tortuous, a probe is best, because it can be bent into any shape.

The probe or director being introduced so as to meet the staff, the surgeon is carefully to lay open the sinus, through which it passes, and he is to do this till he has cut as far as the staff.

When no probe nor director can be made to enter so far as to touch the staff, the surgeon must lay open as much of the sinus, as what the instrument enters, and then endeavour to find the continuation of the fistula.

As soon as the fistulous sinuses are all laid open down to their termination in the urethra, a gum catheter should be introduced, and worn at first almost without intermission. However Mr. Hunter recommends the catheter to be disused, as soon as the fores become stationary, as it sometimes has the effect of preventing them from healing.

The same eminent surgeon also advises us to dress the wounds at first down to the bottom. If this prudent method were neglected, the superficial parts might close, while the deeper

deeper ones remained unhealed, and fresh abscesses and fistulæ be the consequence.

FISTULA, Salivary. See SALIVARY *Fistula*.

FISTULA Pulmonis, in *Anatomy*, a term used by some writers for the *aspera arteria*.

FISTULA Sacra, is that part of the back-bone which is perforated.

FISTULA Urinaria, the same with the urethra.

FISTULAR, or FISTULOUS, is applied by the surgeons to wounds and ulcers which degenerate into fistulas.

FISTULAR is also applied to the leaves of plants which are round and hollow within; as the leaves of leeks, &c.

FISTULAR Flowers, among *Herbalists*, are those made up of many small, long, hollow flowers, like pipes.

FISTULARIA, in *Ichthyology*, a genus of abdominal fishes, the snout of which is cylindrical; jaws distant from the eyes; gill-membrane with seven rays; body round, and gradually tapering from the jaws to the tail.

Species.

TABACARIA. Tail bifid, and ending in a setaceous process. Linn. *Petimbubaba*, Marcg. *Tobacco-pipe fish*, Will.

A very singular species, found in the seas of America and Japan. The usual length of this fish appears to be from twelve to eighteen inches, exclusive of the bristle-form process which proceeds from the extremity of the body between the two lobes of the caudal fin, and in general measures rather more than one-fourth the length of the body. Some writers, however, assure us that the tobacco-pipe fish grows to the length even of three or four feet.

The shape is that of an eel, the skin smooth, of a livid brown colour above, and silvery beneath; the back and sides are marked with longitudinal series of blue spots, disposed on each side the middle of the back in two distinct lines; the lateral line is straight, and the fins pale red. In some examples of this fish the tail exhibits two of the above-mentioned filiform appendages instead of one; whether this ought to be considered as an accidental circumstance, or as a criterion of sexual difference is uncertain; Dr. Bloch observes that the snout of those with two appendages to the tail is serrated. According to the remarks of Count de Cépède the spine of this fish is very peculiar in structure, the first vertebra being of immoderate length, the three next much shorter, and the rest gradually decreasing as they approach the tail. The species subsists on smaller fishes, marine insects or worms, &c. which the structure of its snout enables it to obtain, by introducing that part into the cavities of the rocks.

CHINENSIS. Tail rounded, and without the long appendage. Linn. *Chinese trumpet fish*.

A native of the Indian seas, and possessing the same habits as the former. Its general shape resembles that of the common eel. The head is elongated, somewhat bony, and compressed at the sides; the snout tubular and rather broad; mouth small; eyes rather large; and the body covered with scales of moderate size. The prevailing colour is reddish-brown, of a pale hue, with three or four whitish stripes extending from the gills to the tail; the upper part of the body variegated with dusky spots, and the fins pale yellow.

PARADOXA. Body reticulate with prominent lines; tail lanceolate. Gmel. Pallas. *Paradoxical fistularia*.

A species apparently described in the first instance by Seba, and since with yet greater accuracy by Pallas. This fish is of the smaller kind, being only from two or three inches in length, or four inches at the utmost. The body

is whitish-ash, with obsolete brown rivulets; the first dorsal fin and tail blackish; compressed, and spinous at the intersections of the lines. The back is triangular, and the belly towards the ventral fins nearly of the same figure; behind them narrower, and equally six-sided; tail compressed, and seven-sided. The head is rather small; eyes large, at the base of the snout, and with a triangular spine on each side before the orbit. The snout is remarkably long, straight, horny, and terminated in a mouth of small dimensions. The nape is armed with three spines; the gill-openings are shallow, small, and radiated with a few prominent lines. The first dorsal fin is long, reclined, and banded with black; the pectoral fins are very broad; the ventral remarkably large, with the rays deeply cleft and divided, and connected by means of a lax membrane in the form of a longitudinal pouch.

FISTULATOR, Lat. a piper.

FISTULOUS ULCER. See **FISTULA**.

FIT, in *Medicine*, an access, exacerbation, or paroxysm of disease. The term is applied particularly to intermittent or periodical diseases; as we say an ague-fit, the cold or hot fit of the same complaint; and also to all sudden or violent disturbances of the system, as to the attack of apoplexy, epilepsy, hysteria, &c. The word fits, when used without any epithet, applies principally to hysterical attacks in women, to the convulsions of children, and, among the vulgar, to epilepsy. See **CONVULSIONS**, **EPILEPSY**, and **HYSTERIA**; also **COLD Fit**.

FITS of easy reflection and easy transmission. See **LIGHT**.

FITS of the mother. See **HYSTERIC affection**.

FITAQUE, or FILOQUI, in *Geography*, a town of Japan; 30 miles E. of Jeddo.

FITCHBURG, a post-town of America, in Worcester county, Massachusetts; 25 miles N. of Worcester. It contains 1390 inhabitants.

FITCHEE, or FICHEE, in *Heraldry*, is when the lower part of any cross is sharpened into a point fit to fix into the ground. Thus, he bears azure, a cross-potent fitchee.

The origin hereof M'Kenzie ascribes to the primitive Christians, who used to carry their crosses with them wherever they went: and when they stopped at any place in a journey, fixed them in the ground.

FITCHES, in *Agriculture*, a common name often applied by farmers to vetches. Crops of this sort are grown in the field both as a green food for live-stock, and their produce in seed. They are mostly sown broadcast over the land, and harrowed in by a light harrow; but occasionally in drills at narrow distances.

The seasons for putting the crops into the ground are either the autumn or spring, according as they are wanted.

They are occasionally likewise cultivated as a green crop, for being turned into the soil as a manure. This is usually done just before they come into blossom, when they are in their most luxuriant state. See **MANURE**.

When used green for feeding cattle, they are an excellent food; and when given in the pod extremely fattening. See **TARES** and **VETCHES**.

FITCHET, a name used in some places for the weasel; called also the *fitchel* and the *jeanmart*. See **VIVERRA Putorius**.

FITSIL HEAD, in *Geography*, a cape of Scotland, on the W. coast and S. extremity of Mainland, one of the Shetland islands. N. lat. 59° 50'. W. long. 1° 44'.

FITTING-OUT, in *Naval Language*, the act of providing a ship with a sufficient number of men, to navigate

and arm her for attack or defence; as also of furnishing her with proper masts, sails, yards, ammunition, artillery, cordage, anchors, and other naval furniture, together with sufficient provisions for the ship's company. See CREW.

FITTRE', or **FIDDRI**, in *Geography*, a country of Africa, otherwise called **Lussi**, and **Couga** or **Cougu**, situated on the borders of a large lake to the south of **Begarmee**. It is governed by a sultan, and his dominions have been much diminished by the encroachments of the sultans of **Begarmee** and **Wadey**. The inhabitants live in small tents, and are said to be in a low degree of civilization. They have no salt, except what they procure from the ashes of **gossab**. The lake is situated 210 miles S. of **Bornou**. N. lat. 15° 50'. E. long. 22° 30'.

FITZ, a French term, literally denoting *son*; sometimes given by way of addition to the natural sons of the kings of England; as **James Fitz-Roy**, duke of Grafton, &c.

FITZHERBERT, **Sir ANTHONY**, in *Biography*, a learned lawyer and judge, who flourished in the reign of **Henry VIII.** was the younger son of **Ralph Fitzherbert**, esq. of **Norbury**, in the county of **Derby**. He was educated at **Oxford**, and pursued his studies, as preparatory to the practice at the bar, in one of the laws of court in the metropolis. He attained the degree of sergeant at law in 1511, and received the honour of knighthood about the same time. In 1523 he was appointed one of the justices of the court of **Common Pleas**, in which office he passed the remainder of his life, and was distinguished by many valuable legal works, as well as by such an honourable discharge of the duties of his office, as made him esteemed an oracle of the law. In the discharge of his duty he feared no man, and opposed the arbitrary proceedings of **Wolsey** in the height of his power. On his death-bed he is said to have exacted a promise from his children that they would neither accept grants, nor make purchases of lands of the dissolved religious foundations, to which they constantly adhered. He died in the year 1538, leaving a numerous posterity. His principal writings are, "The grand Abridgment," a collection of cases abridged: "The office and authority of Justices of Peace;" "The office of Sheriffs, Bailiffs of Liberties, Constables, &c." and "The new Natura Brevium." He is supposed to have been the author of a work entitled "Of the surveying of Lands;" and also of "The book of Husbandry." *Biog. Brit.*

FITZHERBERT, **THOMAS**, grandson of **Sir Anthony**, was born in the county of **Stafford** in the year 1552, where he received the early parts of his education, after which he went to **Oxford** to pursue his studies. On account of his rigid adherence to the catholic principles, in which he had been brought up, he exposed himself to occasional reproaches from his superiors, and at length became an object of persecution, and was committed to prison in the year 1572. Harsh measures rarely make a man less tenacious of his principles; and, upon his liberation, he became more active in promulgating the doctrines of popery than he had ever been, till at length he was obliged to seek safety in concealment. In the year 1580 he connected himself closely with some Jesuits sent into England as missionaries, assisting them as far as he was able with money and advice. By this conduct he incurred the penalties of "præmunire," and, alarmed at the risks he was every day running, he went to France. This was in the year 1582; he interested himself very much in behalf of **Mary queen of Scots**; and when the death of that unfortunate princess rendered his exertions no longer of any avail, he went to **Madrid** to implore the pro-

tection of **Philip II.** in behalf of the catholics, and their religion in England. From **Madrid** he went to **Rome**, took a lodging near the English college, and observed the same devotions as the inmates of that house, and spent the remainder of his time in writing books in defence of the catholic religion. In 1614 he became a member of the society of **Jesus**, was admitted to priest's orders, and almost immediately afterwards removed to **Flanders**, to preside over the English mission there. Here he displayed great learning and talent, and acquired so much esteem by his behavior and conciliating manners, that he was invited to accept the rectorship of the English college at **Rome**, the duties of which he discharged with high reputation for twenty-two years. He died at **Rome** in the year 1640, at the very advanced age of eighty-eight. As an author his works are numerous, but being chiefly on controverted points of religion, they have little claim to notice. *Biog. Brit.*

FITZHERBERT Island, in *Geography*, a small island in the Florida stream, at the entrance of the gulf of Mexico. N. lat. 24° 40'. W. long. 81° 50'.

FITZHUGH'S SOUND, a narrow channel of the N. Pacific ocean, between **Calvert's island**, and the W. coast of **North America**.

FITZJAMES, **JAMES**, in *Biography*, duke of **Berwick**, natural son of king **James II.** by **Arabella**, sister to the great duke of **Marlborough**, was born in 1671 at **Moullins**, in **France**, where his mother was, in her return from the baths of **Bourbon**. He was educated for the military profession, and distinguished himself at an early age at the siege of **Buda** and battle of **Mohatz** in 1686 and 1687. On his return his father conferred upon him the title of duke of **Berwick**, &c. with the order of the garter. At the revolution he accompanied the abdicated king to France, and afterwards went over to **Ireland** to command in the absence of lord **Tyreconnel**. He sustained important commands at the siege of **Londonderry** and the battle of the **Boyne**, and when all was lost in that country he returned, and served in the armies of France. In the service of **Louis XIV.** he distinguished himself in a very high degree, and in 1703 he was appointed commander-in-chief of the troops sent into **Spain** to the assistance of **Philip V.** and intent solely upon his duty as a general, he in a single campaign reduced a number of important places. As a reward for his great prowess, and for the many victories which he had obtained, he was made marshal of France in 1706. In the same year he returned to the command in **Spain**, and signaled his military skill by a campaign, in which, without fighting a battle, he obliged the enemy to evacuate **Castile**, "conducting them," says his biographer, "from post to post as a shepherd leads his flock." In 1707 he obtained a signal victory over the English and their allies, for which he received the highest honours in rank and titles that the crown of **Spain** could confer. He was afterwards entrusted with the army on the **Rhine**, opposed to that of the empire, and in 1710 he commanded in **Dauphiné**, where with great skill he foiled all the attempts of the duke of **Savoy** with a superior army to break into France. He was now created a duke and peer of France by the title of **Fitz-James**. Notwithstanding his attachment and obligation to France, in the year 1719 he obeyed the orders of **Louis**, in taking the command of an army destined to invade that country, and soon made himself master of **Fontarabia**. He was afterwards commander-in-chief of the troops in the south-western provinces of France; and in the year 1730 was made governor of **Strasbourg**. War being renewed between the empire and France, he was appointed general of the French army

army in Germany, and, in 1734, undertook the siege of Philipburgh, during which he was killed by a cannon-shot on June 12th, at the age of sixty-three. He was naturally of a cold, reserved, and austere temper, but he was a man of principle, sincere, upright, and disinterested. He made few promises and professions of friendship, but no man performed more services to his friends. He avoided all intrigues, and never spoke ill of any man. As a general his great talent was in defensive war, and he desired nothing so much as to have a good fortification to defend. He estimated his own merit with modesty, but such was the public and general opinion of him, that his death was regarded by the French, in whose cause he died, as a great national calamity. Moreri.

FITZROY ISLAND, in *Geography*, a small island near the N.E. coast of New Holland; 5 miles N.E. of Cape Grafton.

FITZSTEPHEN, WILLIAM, in *Biography*, who flourished in the 12th century, was descended from a noble Norman family, and born in London. When he had made a considerable progress in literature at home, he went to France to complete his studies. Upon his return he entered into the monastic state at Canterbury, and by his learning and talents obtained the notice and patronage of the archbishop, Thomas Becket. To this prelate he became attached by habits of intimacy and strict friendship, adhering most zealously to him and his cause in the different reverses of his fortune. After the murder of Becket he exhibited his attachment by drawing up a life of that prelate in the Latin language. The life of the archbishop is introduced by a description of the city of London, and a detail of the manners and customs of the inhabitants in that period. This is said to be the earliest account extant of London, and is to be seen in Stowe's Survey. Fitzstephen died in the year 1191.

FITZWILLIAM, in *Geography*, a township of America, in Cheshire county, New Hampshire, about 16 miles E. of Connecticut river, and separated from Royalton in Massachusetts by the state line; incorporated in 1773, and containing 1240 inhabitants.

FIVE BONNETS, a cluster of small islands in the Mergui Archipelago. N. lat. 10° 29'.

FIVE BROTHERS, a cluster of small islands in lake Huron. N. lat. 44° 55'. W. long. 83° 28'.

FIVE FATHOM BANK, a shoal in the East Indian sea. S. lat. 5° 53'. E. long. 119° 2'.

FIVE FINGERS' POINT, a cape on the S.W. coast of New Zealand, forming the north cape of the fourth entrance into Dusky bay; the rocks of which bear some resemblance to the five fingers of the hand, whence its name. The land of this point is a narrow peninsula stretching off from Resolution island, of a moderate and equal height, and wholly covered with wood.

FIVE ISLAND HARBOUR, a bay on the W. coast of the island of Antigua. N. lat. 17° 13'. W. long. 61° 35'.

FIVE NATIONS of North America, so called by English writers, are the Iroquois of the French, being the Mohawks, Oneydoes, Onondagas, Cayugas, and Sennekas, forming five clans joined in an old confederacy of offence and defence.

FIVE-LEAVED GRASS, Cinquefoil, in *Heraldry*, is used by such as would introduce a blazon by herbs and flowers instead of metals and colours, to signify *vert*, or *green*.

FIVEL, in *Geography*, a river of Holland, which runs into the Ems, near Delfzyl, and gives name to a small country on its banks between Groningen and the mouth of the river; it contains several small towns and villages.

FIUMARA DI MURO, a town of Naples, in Calabria Ultra; 8 miles N. of Reggio.

FIUMARELLA, LA, a river of Naples, which runs into the gulf of Squillace, 2 miles S. of Cantazaro.

FIUME. See *ST. VEIT*.

FIUME FREDDO, a town of Naples, in Calabria Citra; 11 miles W.S.W. of Cosenza.

FIUMICINO, a sea-port in the dominions of the Pope, at the mouth of the Tiber, with a custom-house, where vessels pay for their goods on board; 2 miles S.W. of Porto.

FIXATION, the act of fixing, or of rendering a thing firm and fixed.

FIXATION is applied in the general to any process that fixes and binds together what, of its own nature, is volatile; and enables it to sustain the loss of fire for some considerable time.

Geber defines fixation an operation whereby a volatile thing, *i. e.* a thing that cannot endure the fire, is rendered capable of enduring it. In the general, fixation is the changing of a volatile body into a fixed one.

FIXATION, among *Alchemists*, denotes a peculiar preparation of mercury, whereby it is to be put in a condition to bear the fire without evaporating, or the hammer without flying or separating.

The alchemists hold, that if they had the true secret of fixing mercury, without the addition of any foreign, less heavy and solid ingredient, they could make gold, or at least silver.

M. Homberg had a long process of many months to prepare an oil from the fecal matter of human excrements; which he imagined would have fixed mercury into silver; but it failed.

FIXED AIR. See *AIR*, *CARBONIC Acid*, and *GAS*.

FIXED BODIES, in the general, are those which neither the fire nor any corrosive has such effect on, as to reduce or resolve them into their component elements; *i. e.* absolutely to destroy them.

Chauvin holds it not sufficient to denominate a body fixed that it can withstand the fire or any one agent, but it should withstand all. He contends, that fixity should not be restrained, as it usually is, to an exemption from evaporation, but from destruction, or resolution into primary elements: in this sense, gold, precious stones, and glass, and even sulphur, and mercury itself, are properly fixed bodies; for mercury and sulphur retain their nature notwithstanding all their evaporation.

The chemists divide all natural bodies into fixed and volatile; *i. e.* such as bear the utmost force of the fire without dissipating or spending themselves in fume, and such as do not.

Of fixed bodies, the principal are platinum, gold, silver, precious stones, particularly the diamond; salts, &c.

Of all metals, gold and silver alone are fixed; *i. e.* on remaining a long time exposed to the most intense flame, they alone lose nothing of their weight.

Whence this property should arise is difficult to say. If the reader is not contented with the causes enumerated under *FIXITY*, he may add the following one from Boerhaave, *viz.* the homogeneity and equality of the parts. The parts, *e. gr.* of gold being all homogeneous and equal, will equally sustain each other, and leave equal pores between them; through which pores, when fused, the fire taking an easy equal passage, goes off, without carrying any thing of the metal with it: or rather the particles of gold being of all others the most solid and heavy (as appears from the weight of that metal) and of all others the most strongly united or

bound

bound together (as appears from the immense ductility of that metal), the force of the fire is not sufficient to overcome so powerful a resistance; the solidity of the particles, and their freedom from air, prevents their being rarefied, or set further apart, which might lessen their specific gravity, and diminish their *vis cohesionis*; so that what has the chief effect in the raising of fumes and vapours, *viz.* the rarefaction or expansion of the body being here precluded, the metal maintains its natural weight and tendency to the centre.

Mr. Boyle, the Prince of Mirandola, M. Homberg, and others, have made numerous experiments on gold, silver, &c. to see how far their fixity extended; in these pure gold, kept in an intense heat for two months, lost nothing sensible of its weight: silver, under the like circumstances, and the like time, lost one-twelfth part of its weight; but Mr. Boyle attributes this to the metal's not being fine and pure.

Indeed, by the great burning glasses of Messrs. Tschirhausen and Vilette, the most fixed bodies, as gold itself, are rendered volatile, and lose of their weight; so that there is no body in all nature absolutely fixed.

FIXED Ecliptic, a certain imaginary plane, which never changes its position in the heavens from the action of any of the parts of the solar system on each other; but, like a centre of inertia, remains immoveably fixed. The existence of such a plane is demonstrated by Laplace, who has shewn the method of determining it from the situations, velocities, &c. masses of the planets, and other bodies of the solar system. The rule for determining it is as follows.

If at any instant of time whatever, and upon any plane passing through the centre of the sun, we draw straight lines to the ascending nodes of the planetary orbits referred to this plane; and if we take on these lines, reckoning from the centre of the sun lines equal to the tangents of the inclinations of these orbits to this plane; and if, at the extremities of these lines, we suppose masses equal to the masses of the planets, multiplied respectively into the square roots of the parameters of their orbits, and by the cosines of their inclinations; and lastly, if we determine the centre of gravity of this new system of bodies, then the straight line, drawn from the centre of the sun to this point, will be the tangent of the inclination of the invariable plane to the assumed plane; and continuing this line to the heavens, will there mark its ascending node.

Whatever changes the succession of ages may produce in the planetary orbits, and whatever be the plane to which they are referred, the plane determined by this rule will always be the same. It is true, its position depends on the masses of the planets; but those which have satellites have the greatest influence on its position, and the masses of the others will soon be sufficiently known to determine it with exactness. In adopting the values and the elements of their orbits, as given under **ELEMENT**, we find that the longitude of the ascending node of the invariable plane was $102^{\circ} 56' 56''$.1 at the commencement of 1750, and at the same time its inclination to the ecliptic was $1^{\circ} 35' 40''$.9. In this computation we have neglected the comets, which, nevertheless, ought to enter into the determination of the invariable plane, since they make part of the solar system. It would be easy to include them in the preceding rule, if their masses, and the elements of their orbits, were known. But in our present ignorance of the nature of these objects, we suppose their masses too small to influence the planetary system, and this is the more probable, since the theory of the mutual attraction of the planets suffices to explain all the inequalities observed in their motions. But if the

action of the comets should become sensible in length of time, it should principally affect the position of the plane which we suppose invariable, and in this point of view, the consideration of this plane will still be useful, if its variations could be recognized, which would be attended with great difficulties.

The situation of this fixed ecliptic is at present nearly half way between the orbits of Jupiter and Saturn, and it is inclined in a small angle to the plane of the earth's orbit or true ecliptic.

The property by which it is determined is that the sum of the areas described by the *radii vectores* of the bodies of the system multiplied respectively by the masses of these bodies, is a *maximum*.

FIXED Line of defence, a line drawn along the face of the bastion, and terminating in the curtain. See **DEFENCE**.

FIXED Nitre, a preparation of saltpetre, made by fusing it in a crucible, and then inflaming it, with throwing in a few coals; and thus again and again, till no more flame or detonation arise; then letting it cool, they pulverize and dissolve it in water, and afterwards evaporate it into a fine white salt, which serves to draw the tinctures out of vegetables. This salt, *per deliquium*, yields what they call the *liquor of fixed nitre*.

FIXED Salts, are those extracted or gained from bodies by calcination and lotion. See **SALTS**.

They are called fixed, because the fire was not able to sublime or raise them; as those carried off in the course of calcination by the vehemence of fire are called *volatile*.

The ashes of all plants yield fixed salts. See **LIXIVUM**.

FIXED Signs of the Zodiac, according to some, are the signs Taurus, Leo, Scorpio, and Aquarius.

They are so called because the sun passes them respectively in the middle of each quarter, when that season is more settled and fixed than under the sign which begins and ends it.

FIXED Stars are such as constantly retain the same position and distance with respect to each other.

By which they are contra-distinguished from erratic or wandering stars, which are continually shifting their situation and distance.

The fixed stars are what we properly and absolutely call stars; the rest have their peculiar denomination of planet and comet.

FIXEN, among *Sportsmen*. See **VIXEN**.

FIXES is a name given by the workmen in gold and silver to a solution in silver, from its use in carrying down and fixing the heterogeneous acids mingled with aquafortis.

FIXITY, or **FIXEDNESS**, in *Philosophy*, the quality of a body which denominates and renders it fixed; or a property which enables it to endure the fire and other violent agents.

According to Chauvin, fixity consists in this; that the component principles of the body are so closely united or cohere so strongly, and are mixed in such proportion, that they cannot easily be divided either by fire or any other corrosive menstruum, or their integral parts separated and carried off in vapour: for a body may be said to be fixed in two respects.

First, when, on being exposed to the fire, or a corrosive menstruum, its particles are indeed separated, and the body rendered fluid, but without being resolved into its first elements. The second, when the body sustains the active force of the fire or menstruums, whilst its integral parts are not carried off in fumes. Each kind of fixity is the result

ult of a strong or intimate cohesion between the particles mixed.

FIXITY, or *Fixedness*, in *Chemistry*, is, in a peculiar manner, used for the affection opposite to volatility; *i. e.* the property whereby bodies bear the action of the fire, without being dissipated in fumes.

The principal causes of fixity, or the qualifications that contribute most to the rendering a body fixed, according to Mr. Boyle, are, 1. That its corpuscles be singly of a certain proportionable bulk, too big and unwieldy to be carried by heat, or buoyed up in the air. 2. That they have also a proper degree of weight or solidity. 3. That their figure be such as unites them for evaporation or flying off; some being branched, others hooked, &c. so that being entangled with one another, they cannot easily be extricated, loosened and separated. To these may be added a fourth circumstance, *viz.* the nearness of the particles, and their being contiguous in a great many points, or large extent of surface, which produces a stronger force of attraction and cohesion.

FIXLMILLNER, **PLACIDUS**, in *Biography*, was born at a village near Lintz, in Austria, in May, 1720. He was educated by his uncle, Alexander, who was abbot of Kremsmünster, to whom that institution was indebted for the establishment of a school and observatory. At a very early period he used to take much delight in delineating mathematical figures. At a proper time he went to Salzburg, where he went through a course of philosophy, and attended the mathematical lectures of professor Stuart, who had this peculiarity in his mode of teaching, that he never made use of figures, and yet gave so clear an idea of the different propositions as rendered the comprehension of them easy. In the year 1737, he took the vows of a monastic life, and applied himself diligently to the study of philosophy and mathematics. Nor was he less assiduous in laying a solid foundation in the modern and oriental languages, history, and antiquities. He obtained the degree of doctor in theology, and in 1745 took priest's orders at his monastery. He also undertook the professorship of ecclesiastical law at the school belonging to the monastery, which was frequented by the young nobility from Austria; an office which he discharged for forty years. He was about the same time made dean of the higher schools, and regent of the young nobility. His general knowledge of the law rendered him a fit person to be consulted in regard to law-suits; and, on a similar account, he was appointed "Notarius Apostolicus in Curia Romana." As his high reputation brought many students to Kremsmünster, he did not confine himself to the public hours of teaching, but repeated his lectures privately, and was always ready to assist his hearers, and to give them every explanation in his power. Notwithstanding his diligence and zeal in the way of education, it was not on this that his fame was built; but his attachment to astronomy rendered him most conspicuous, and known in foreign countries. His uncle, Alexander, resolved, in the year 1747, to found an establishment in his monastery, for the purpose of disseminating mathematical knowledge. With this view, he fitted up an apartment to contain the necessary instruments, and for making experiments of every kind. He also caused an observatory to be built in his garden, and in the course of time Fixlmillner was appointed astronomer, retaining at the same time his office as professor of the ecclesiastical law. His application to the study of this science was so intense, that he made the most rapid progress in it, and published several works, in a few years, of great merit. His service, however, to practical astronomy consists chiefly in his having made and col-

lected, at the desire of Lalande, a great many observations on Mercury, and thereby enabled the French astronomer to construct his tables of that planet. This service Lalande publicly acknowledged, and likewise inserted his observations in the supplemental volume to his astronomy. Fixlmillner was also one of the first astronomers who calculated the orbit of the Herschel planet, and constructed the tables which were adapted to it. He was the person who proved the truth of professor Bode's conjecture, that the thirty-fourth star of Taurus, observed by Flamsteed in the year 1690, was the new planet; and by applying Flamsteed's observations to calculation, he produced a theory which fully agreed with the phenomena of it. It would take us much beyond the limits allowed for the article, were we to attempt recording all that this active astronomer did for his favourite science. He had also an uncommon genius for mechanics, and invented many practical helps to observation; such as a new micrometer, and a machine for grinding concentric circles on glasses with great accuracy. His indefatigable industry injured his health; and he died in August, 1791, in the 71st year of his age. He was simple, uniform, and constant, like the laws of nature which he studied and illustrated: his character displayed that mildness and integrity, which never fail to inspire esteem and love. He lived in great harmony with his monastic brethren; and it was a day of general joy to the whole establishment, when, in the year 1788, he celebrated the fiftieth anniversary of his residence in it. *Gen. Biog.*

FIXTELA, in *Geography*, a town of Morocco, 4 miles from Tefla.

FIZES, **ANTHONY**, in *Biography*, an eminent physician of Montpellier, was the son of Nicholas Fizes, professor of mathematics in that university, and was born in the year 1690. He received his early education entirely from his father, who destined him his successor in the mathematical chair. But in the course of his attendance in the classes of the college, he acquired a great disposition to the study of medicine, which he pursued with so much ardour and advantage, that his father was induced to yield to his solicitations; and, notwithstanding the mediocrity of his income, sent Anthony to complete his medical education at Paris, under the tuition of Du Verney, Lemery, and the two Messrs. De Jussieu. On his return to Montpellier, he employed himself in observing diseases in the hospital de la Charité, and in public teaching. On the death of his father, he was appointed joint professor of mathematics with M. De Clapiers, and soon became his sole successor. He held the mathematical chair until the labours of his medical course, and the extension of his practice, compelled him to resign it. In 1732, the medical professorship in the university became vacant by the resignation of M. Didier, and Fizes was elected his successor. He fulfilled the duties of this chair with great propriety, but with little éclat. It was in the practice of his profession that his superiority was particularly conspicuous, for he possessed an extraordinary talent for observation. Being endowed likewise with a sound judgment, and an uncommon memory, he appreciated at once the character of the most complicated disease; and was above all admired for the accuracy of his prognostics. These qualifications placed him at the head of his profession at Montpellier: his fame extended to the metropolis, and he was invited to the office of physician to the duke of Orleans. His age was now, however, advanced; and the fear of the jealousy which this high appointment might produce among his brethren, led him to make some efforts to be permitted to decline this honour. He removed to Paris, nevertheless; but, united to the intrigues, and rail-

eries, and cabals of a court, he was unhappy in his situation: his health began to fail, and he was induced to request permission to resign his office, and returned to Montpellier, after residing fourteen months at Paris, honoured with the protection of the prince, and the friendship of M. Senac, Allrac, Bordeu, &c. He was accused of a little misanthropy on this occasion; but he was an enemy to adulation and selfishness, and seemed to revolt from every species of artificial politeness. He resumed the functions of his professorship at Montpellier, but for a short period; for he was carried off by a malignant fever in the course of three days, and died on the 14th of August, 1765, aged about 75 years. His works were principally essays on different points of theory and practice: 1. "De Hominis Liene sano," Montpellier, 1716; 2. "De naturali Secretione Bilis in Jecore," *ibid.* 1719; 3. "Specimen de Suppuratione in Partibus mollibus," *ibid.* 1722; 4. "Partium Corporis humani Solidarum Conspectus Anatomico-Mechanicus," *ibid.* 1729; 5. "De Cataracta;" 6. "Universæ Physiologiæ Conspectus," *ibid.* 1737; 7. "De Tumoribus in Genere," *ibid.* 1738; 8. "Tractatus de Febribus," *ibid.* 1749. The greater part of the writings of Fizes were collected in one quarto volume, and were published at Montpellier in 1742. Eloy.

FLABELLUM, in *Ecclesiastical History*, the flapper or fan which was heretofore used in the Latin, as it is still in the Greek church, to keep off flies from the priest and the altar, during divine service. At present it is only used in the Latin church, in the solemn processions of the pope, when two attendants carry enormous large flabella or fans, made of peacock's feathers, and fixed on poles, one on each side of the chair in which the pope is carried, to drive away flies, and to keep off the rays of the sun.—This was also one of the names of the vane or weather-cock, on the top of a church, as we learn from the following passage in the *Annales Wintonienses*: "Anno 1248. cecidit flabellum de turri S. Swithuni, quando classicum vespertinum pulsabatur, et fere contrivit Joannem Monachum."

FLACCIDITY, in *Medicine*, &c. a disorder of the fibres or solid parts of the body, opposite to rigidity.

FLACCOURT, F. DE, in *Biography*, director-general of the French East India company, commanded, in 1648, an expedition to the island of Madagascar, where he continued several years; and, during his residence there, he drew up a particular history of the country, which he printed in one volume quarto, with plates designed by himself, and dedicated to the superintendent Fouquet. *Nov. Diet. Hist.* See FLACOURTIA.

FLACCUS, C. VALERIUS, a Roman poet, who flourished in the reign of Vespasian, and died at an early age, in the time of Domitian. From an epigram in Martial, it should seem that he was in no affluent condition; for he advised him as a friend to quit the muses for the more gainful pursuits of the forum. The work on which his fame rests as a poet is entitled "Argonauticon," in eight books. It is in imitation of the Greek poem of Apollonius Rhodius on the same subject, and may rank among the most respectable of the Latin epics after the *Æneid*, the manner and style of which he aims at copying. The best edition of it is that of Burmann, 1724, in 4to. It contains sublime and splendid passages, and is free from the bombast and extravagance of most of the second race of Latin poets; but it is in general deficient in poetical spirit, and is likewise wanting in plan and contrivance. *Rom. Hist.*

FLACCUS, a Roman musician, who set the comedies of Terence to music.

FLACHSTADT, in *Geography*, a small island in the

North sea, about 40 miles from the coast of Norway. *N. lat.* 68°.

FLACIUS, or FRANCOVITZ, MATTHIAS, in *Biography*, was born at Albona in Istria, in the year 1520. His father, who was a literary man, undertook the education of his son; but dying while the youth was quite young, he fell into hands who were either incapable of affording him assistance, or negligent of the charge committed to their care. But by his own application, and some occasional assistance which he received from a learned Italian, he made considerable progress in classical literature and the belles lettres. He went to Venice, and studied under Baptista Egnatius; and when he was but 17 years of age, he felt a strong inclination for theological pursuits, and, from his straightened circumstances, was desirous of entering a monastery; but he was dissuaded from the plan, and went to Basil, where he studied some months, and embraced the opinions of the reformers. From Basil he proceeded to Tubingen, where he received the instructions of the celebrated Camerarius; and in 1541, he became the disciple of Luther and Melancthon, the latter of whom gave him very substantial proofs of his regard and liberality. After he had taken his degree, he married, and was appointed public professor of Wittenberg. During the war between the confederate protestants and the emperor Charles V., the scholars were dispersed from the Saxon seminaries, and Flacius went to Brunswick, where he obtained a high reputation by his lectures; and upon the termination of hostilities in 1547, he returned to Wittenberg, to resume his former situation in that university. In the year 1548, a controversy took place among the followers of Luther, in which Flacius sustained a leading part, and displayed much bigotry and intolerance. It originated in the debates among the Saxons divines concerning the expediency of submitting to the famous edict of Charles V., called the *int. rim.* Melancthon and others concurred in the opinion, that in matters of an indifferent nature compliance was due to the imperial edicts; and in this class they placed many things which had appeared of the highest importance to Luther, among which were the doctrine of justification by faith alone, the necessity of good works to salvation, the number of the sacraments, extreme unction, and certain rites and ceremonies relative to church discipline. On the other hand, the defenders of the primitive doctrines of Lutheranism, with Flacius at their head, attacked with much bitterness and fury these accommodating divines, and accused them of apostacy from the true religion. Among other absurd notions which Flacius, in the heat of argument, avowed, was this, that original sin was not an *accident*, but the very *substance* of human nature. The odium which he excited by embracing this strange notion, rendered it necessary that he should relinquish a professorship at Jena, which he had held five years: he accordingly withdrew to Ratibon, where he continued to publish many books. In the year 1567, he was invited, with some other Lutheran ministers, to Brabant, to model some churches in that country on the principles of the Augsburg confession; but they were soon dispersed by the bloody persecution under the duke of Alva, when he removed to Straßbourg, and afterwards to Frankfort on the Main. The number of his adherents had greatly declined in Germany; and he died in 1575, when he had completed the 55th year of his age. He was a man of excellent talents, great learning, and overbearing zeal against popery; but his turbulent, factious, and quarrelsome temper rendered his good qualities of little avail. He was author of many works, which are enumerated at large by Moreri: the principal are, "Clavis Sacre Scripture,"

Scripturæ," in 2 vols.; and "Centuriæ Ecclesiasticæ Historiæ Magdeburgenses," in 3 vols. folio. Moreri. Bayle.

FLACOURTIA, in *Botany*, so named by L'Heritier, in memory of Stephen de Flacourt, a native of Orleans, superintendent of a colony for some time established by the French in Madagascar, and author of an account of that island, published in quarto at Paris in 1658, and at Troyes in 1661. He was the first who gave a history of the rich natural productions of that country, and though, as Haller observes, not a deep naturalist, he was certainly not destitute of observation. He describes many new and rare plants, especially such as are useful for food, giving figures of the leaves only. L'Herit. Stirp. Nov. 59. Schreb. 702. Mart. Mill. Dict. v. 2. Ait. H. Kew. v. 3. 413. Juss. 291. Class and order, *Diœcia Polyandria, Dryander. D. Icojandria*, L'Herit. Nat. Ord. *Tilacæ*, Juss.

Gen. Ch. Male, *Cal.* Perianth of one leaf, in five or more deep, roundish, obtuse, nearly equal, ascending segments. *Cor.* none. *Stam.* Filaments numerous, from 50 to 100, rather longer than the calyx, capillary, spreading, equal, inserted into a central hemispherical receptacle; anthers roundish, of two cells. *Pist.* wanting, though sometimes the abortive rudiments of one are discernible.

Female, *Cal.* Perianth inferior, of five or more roundish, erect, closed leaves, downy on their inside. *Cor.* none. *Stam.* none. *Pist.* Germen superior, ovate, sessile, rather longer than the calyx; style none; stigma stellated, of from five to nine spreading, oblong, obtuse, furrowed rays. *Peric.* Berry globular, becoming angular by drying, umbilicated, of many cells. *Seeds* two in each cell, one over the other, obovate, compressed, with a furrow on the upper edge.

Eff. Ch. Male, Calyx in five deep segments. Corolla none. Stamens very numerous.

Female, Calyx of several leaves. Corolla none. Stigma radiated. Berry superior, of many cells. Seeds in pairs.

F. Ramontehi is the only known species. L'Herit. Stirp. Nov. 59. t. 30. Lamarek t. 826. Native of Madagascar, where, according to Flacourt, it is called *Alamoton*, and according to Poivre *Ramontehi*. This is a shrub eight or ten feet high. *Branches* spreading, alternate, round, smooth, leafy, dotted, armed with straight lateral spines. *Leaves* alternate, on short downy stalks, spreading, ovate, acute, smooth, veiny, with many shallow serratures, often purplish at the edges. *Stipulas* none. *Flowers* small, few, in terminal clusters; the male ones chiefly conspicuous by their yellow anthers; the female appearing before the fresh leaves come out. *Fruit* like a small plum, at first green, then of a fine red, and finally of a deep violet, sweet and eatable, but leaving a slight acrimony in the mouth. *Seeds* bitterish, like the kernel of a cherry. An island on the coast of Madagascar, to leagues to the south of Foul point, was named by the French *isle aux prunes*, plum island, because they found it covered with bushes of *Ramontehi*.

Propagation and Culture.—This shrub flowers in our sives in June and July, but has not yet produced any fruit. L'Heritier says both sexes blossomed at Paris, where the plant was kept in the green-house, but he had never happened to see them both in one summer. It is propagated by cuttings or layers, but has little beauty or utility to recommend it to our care in this country.

FLADABUNA, in *Geography*, a small island near the N.W. coast of Scotland; 7 miles N. from the isle of Skye. N. lat. 57° 42'. W. long. 6° 19'.

FLADDA, a small island of Scotland, near the N.E.

coast of the island of Skye. N. lat. 57° 37'. W. long. 6° 8'. —Also, a small island of Scotland, one of the Freshwater islands, west of that of Muil. N. lat. 56° 32'. W. long. 6° 24'.

FLADDA Isles, three small islands among the western islands of Scotland, about 1 mile W. from the island of Sandera. N. lat. 56° 52'. W. long. 7° 32'.

FLADHUNA, an inconsiderable island of Scotland, to the north of Hunifa, not far from Skye, and at some distance from the coast, which was formerly inhabited. In its vicinity are six or seven rocks, one of which is about 300 paces in circuit, and flat on the summit, with a deep well in it.

FLADSTRAND, a sea-port town of Denmark, in North Jutland, and diocese of Aalborg, on the east coast, with a harbour defended by three forts. The chief employment of the inhabitants is fishing; 30 miles N.N.E. of Aalborg. N. lat. 57° 27'. E. long. 10° 32'.

FLADUNGEN, a town of Germany, in the bishopric of Warzburg; 40 miles N. of Warzburg. N. lat. 50° 35'. E. long. 10° 20'.

FLAG, a general name, including colours, standards, ancients, banners, ensigns, &c. which authors frequently confound with each other.

The fashion of bearing the flags pointed or triangular, which now obtains, Roderic Toletanus assures us, came from the Mahometan Arabs or Saracens, upon their seizing of Spain, before which time all the ensigns of war were square, stretched, or extended, on cross pieces of wood, like church-banners; on which account they were called in Latin *vesilla*, q. d. *velilla*, à *veli diminutione*, as is remarked by Isidore.

The pirates of Algiers, and those throughout the coast of Barbary, are the only people who bear an hexagonal flag. It is gules, charged with a Moresk head, coifed with its turban, &c. though this be expressly contrary to their law, which prohibits the making any image or representation of a man, founded on an opinion, that they who make them shall be obliged at the day of judgment to find souls for them, and that in defect hereof they shall be damned. But this portrait which they carry is that of Hali, Mahomet's son-in-law, to whose party the Africans all retain, who ordered that his effigy should be expressed on their flags and standards, believing himself so formidable to the Christians, that the bare sight of his image would carry undoubted victory over them. Leunclavius.

FLAGS, in the *Military Art*, are small banners of distinction stuck in the baggage-waggons of the army, to distinguish the baggage of one brigade from another, and of one battalion from another, that they may be marshalled by the wagon-master-general, according to the rank of their brigades, to avoid the confusion that otherwise might arise. See COLOURS and STANDARDS.

FLAG is more particularly used in *Sea-Language*, for the colours, ancient, standards, &c. born on the top of the masts of vessels, to signify the quality of the person who commands the ship, of what nation it is, and whether it be equipped for war or trade.

In the British navy flags are either red, white, or blue, and are displayed from the top of the main-mast, fore-mast, or mizen-mast, according to the rank of the admiral. The first flag in Great Britain is the royal standard, which is only to be hoisted when the king or queen are aboard the vessel. The second is that of the anchor of gold, which characterizes the British admiral, or lords command-in-chief of the admiralty; and the third is the unicorn flag, in which

minic Loricatus), that in six days he could discharge an entire century, by a whipping of three hundred thousand stripes. His example was followed by many penitents of both sexes; and as a vicarious sacrifice was accepted, a sturdy disciplinarian might expiate on his own back the sins of his benefactors. These compensations of the purse and the person, introduced, in the 11th century, a more honourable mode of satisfaction, the merit of military service, which was followed by the crusade. See **CROISADES**, **DISCIPLINE**, **INDULGENCE**, and **PENANCE**.

The parliament of Paris prohibited all public flagellations by an arret of 1601. See **FLAGELLANTES**.

FLAGELLATION is a term more peculiarly appropriated to the sufferings of Jesus Christ, when whipped and scourged by the Jews; from the Latin, *flagellum*, a scourge, or whip.

We say, a painting of the flagellation; or simply, a flagellation, to denote a picture or print representing this torment inflicted on the favour of the world.

In this sense we say the flagellation of such a painter, &c.

FLAGELLATION, *Veast of*. See **DIAMASTIGOSIS**.

FLAGELLIFORMIS CAULIS, in *Botany*, a long and pliant stem as in *Peviploca græca*, and many other plants. See **CAULIS**, where this term is accidentally omitted. The common jasmine is a good example of it.

FLAGEOLET, a **FLAJOLET**, a kind of little flute; or a musical instrument of the flute kind, used chiefly by shepherds and country people.

It is usually made of box, or some other hard wood, sometimes of ivory. It has six holes or stops, besides that at bottom, the mouth-piece, and that behind the neck.

The ambit of the flageolet, according to the scale exhibited by Merseanus, is two octaves from *g sol re ut* upwards.

FLAHERTI, **RODERIC**, in *Biography*, an Irish antiquarian and historian, who published at London, A. D. 1685, a book under the singular and mystic title of "Ogygia, or Rerum Hibernicarum Chronologia," containing chronological memoirs upon the antiquities of the kingdom of Ireland; compiled, as he observes, "ex pervetustis monumentis fideliter inter se collatis eruta, atque e sacris et profanis litteris primarum orbis gentium, tam genealogicis, quam chronologicis suffulta præfidis." This work, a quarto volume containing about 600 pages, he dedicated to the then duke of York, afterwards king James II. of England. The author commences his history from the deluge, continues it to the year of Christ 428, and has divided it into three parts. The first describes the island, its various names, inhabitants, extent, kings, the manner of their annual election, &c. The second is a kind of chronological parallel of the Irish affairs with the events that happened during the same period in other countries. The third is a more ample detail of particular transactions, in the same kingdom. To this is added a professedly exact chronological table of all the Christian kings who have ruled over Ireland, from A. D. 482 till A. D. 1022; and a brief relation of the most prominent historic features of the island, till the time of Charles II. in 1685. To this succeeds a chronological poem, which forms a summary of Irish history to the same period. At the end is a very curious catalogue of the Scottish kings, Irish, who have reigned in the British isles. In his genealogical remarks on the regal house of the Stewarts, the author attempts to prove they were originally an Irish family. It is surprising, that neither the author nor his work has been noticed by Macpherfon or Whittaker in their contro-

versy respecting the peopling of Hibernia, and the origin of the Caledonians; although he is particularly noticed by O'Hallaran in his History of Ireland. See *Moreri*, *Grand Dict. Hist.*

FLAIL, in *Rural Economy*, a well known implement or tool made use of in threshing different sorts of corn. It consists of a hand-staff, and a short beating part, which are attached to each other by a strong thong of leather, passing through loops or staples fixed on the ends of the different pieces. Since the introduction of machines for threshing, the flail method has been much less had recourse to, except upon farms of small extent, as being more laborious and troublesome, and less expeditious in the execution of the work. See **THRESHING Machine**.

FLAIR, in *Sea Language*. The seamen say that the work doth *flair-over*, when a ship being housed in near the water, so that the works hang over a little too much, and thus is let out broader aloft than the due proportion will allow.

FLAIRS, in *Ichthyology*, a name given by some to the skate, a species of raja.

The ancient Greeks called this *batos*, when they spoke of the male, and of the female, *latis*.

FLAKE, in the *Cod-fishery*, a sort of scaffold or platform, made of hurdles, and supported by stanchions, and used for drying cod-fish in Newfoundland. These flakes are usually placed near the shores of fishing-harbours. See **FISHERY**.

FLAKE, in *Gardening*, a name given by florists to those flowers of the carnation kind which have only two colours, and very large stripes, all of which go quite through the leaves.

FLAKE, *White*, in *Painting*, is lead corroded by means of the pressing of grapes, or a ceruse prepared by the acid of grapes. It is brought here from Italy, and far surpasses, both with regard to the purity of its whiteness and the certainty of its standing, all the ceruse or white lead made with us in common. It is used in oil and varnish painting, for all purposes where a very clean white is required. The white flake should be procured in lumps as it is brought over, and levigated by those who use it, because that which the colourmen sell in a prepared state is levigated and mixed up with starch, and often with white lead, and worse sophistications.

FLAMANT, or **FLAMINGO**, in *Ornithology*. See **PHOENICOPTERUS ruber**.

FLAMANVILLE, in *Geography*, a sea-port town of France, in the department of the Channel, with a good harbour, 10 miles S.W. of Cherbourg.

FLAMBEAU, or **FLAMBOY**, a luminary made of several thick wicks, covered over with wax, serving to burn at night in the streets; as also at funeral processions, illuminations, &c.

Flambeaux differ from links, torches, and tapers. See **TORCH**.

They are made square, sometimes of white wax, and sometimes of yellow; they usually consist of four wicks or branches near an inch thick, and about three feet long, made of a sort of coarse hempen yarn, half twisted. They are made with the ladle, much as torches or tapers are, *viz.* by first pouring the melted wax on the top of the several suspended wicks, and letting it run down to the bottom; this they repeat twice. After each wick has thus got its proper cover of wax, they lay them to dry; then roll them on the table, and so join four of them together by means of a red-hot iron.

When joined, they pour on more wax till the flambeau

is brought to the size required, which is usually from a pound and a half to three pounds.

The last thing is to finish their form or outside, which they do with a kind of polishing instrument of wood, by running it along all the angles formed by the union of the branches.

The flambeaux of the ancients were different from ours. They were made of woods, dried in furnaces, or otherwise. They used divers kinds of woods for this purpose; the wood most usual was pine. Pliny says, that in his time they frequently also burnt oak, elm, and hazle. In the seventh book of the *Æneid*, mention is made of a flambeau of pine; and Servius, on that passage, remarks, that they also made them of the cornel tree.

FLAMBO, in *Natural History*, a name given by some to a long anguilliform fish, called *cavayiro*. See *CEPOLA tenia*.

FLAMBOROUGH, in *Geography*, a township of England, in the West Riding of Yorkshire, on the coast of the German sea, containing about 730 inhabitants; 3 miles N. of Burlington.

FLAMBOROUGH Head, a lofty cape or promontory of England, on the E. coast of the county of York. N. lat. $54^{\circ} 8'$. W. long. $0^{\circ} 2'$.

This promontory is formed of lime-stone of a snowy whiteness, and stupendous height, visible far off at sea. A light-house has been lately erected on this head, in which is exhibited a triangular revolving light, distinguished from the revolving lights of Timmouth and Cromer by shewing a face every two minutes, one of them being coloured red.

FLAMBOROUGH, a factory of the Hudson bay company, on the south-western side of Hudson bay.

FLAMBOROUGH, a township in Upper Canada, distinguished by E. and W. Flamborough, in the West Riding of the county of York, and lying W. of the Missisaga lands, and fronting Dundas street.

FLAME, (*flamma*, Latin,) is the actual burning, attended with heat and light, of a volatile combustible substance; and this substance may be either a comminuted solid, (*viz.* a powder,) or a vapour, or a gas.

The powder of rosin, and of other brittle resinous bodies, the farina of several plants, and some other powdered combustibles, when projected through the flame of a candle, or of a piece of burning paper, instantly take fire, and the flame spreads through the whole powdery cloud. Powders of this sort are used at the play-houses for representing a flash of lightning or other sudden light. Powdered rosin, and the powder of lycopodium, have been found to produce this effect equally well; yet the latter, when it may be procured, is by far preferable to the former, and that on account of its being an unadhesive light powder, easily brushed off from any thing, whereas the powdered rosin sticks to, and soils every thing that it happens to fall upon.

The vapour of certain inflammable fluids, such as spirit of wine, ether, spirit of turpentine, &c. are instantly inflamed by the contact of a candle, or other flaming body, or by a spark of electricity, and continue to burn as long as there is a sufficient supply of it.

The inflammable gases, when they are extricated either by the action of heat, or otherwise, from substances that contain them, may also be inflamed, and will burn in a similar manner. Thus, if iron filings and diluted sulphuric acid be placed in a bottle, an effervescence takes place, together with a copious production of hydrogen gas, which comes out in a stream from the aperture of the bottle, and it may

be inflamed either by a lighted candle, paper, wood, &c. or by passing an electric spark through it. Thus also, when coals are lighted in a common fire, the heat softens their bituminous parts, and expels the inflammable gases, which burn and constitute the flame. as every body must daily experience. But besides the inflammable gases, heat expels from coals an aqueous vapour, a thick fluid like tar, and some gases that are not of a combustible nature, and those products are neither equal nor constant, that is, sometimes some of them predominate, and sometimes the other. The consequence of which is, that the flame of coals is continually wavering both in shape and interity of colour. It frequently shifts from one place to another, and what gave a beautiful white light a few seconds before, has become a stream of dense and dark smoke. It may be hardly worth observing that the changeable inclination of the flame is owing to the motion of the air, which runs towards the fire in various directions.

The like thing takes place in the combustion of wood, and vegetable matter in general. The heat extricates the volatile and inflammable materials which take fire, and produce the flame.

In the combustion of charcoal, and of coak, (*viz.* charred mineral coal,) the flame and the smoke are very trifling, because the operation of charring has previously expelled from those materials a great portion of their volatile ingredients.

With respect to the process of the combustion, the same requisites are necessary with the combustion of volatile substances, which produce the flame, as with the combustion of solids; *viz.* the combustible must be heated to a certain degree, a fire must be communicated, and the combustion can only take place in contact with oxygen gas, or with substances which contain oxygen. See *COMBUSTION*.

Thus, we have given a general sketch of the nature of flame; but there are several remarkable particulars belonging to every part of the above mentioned process, which are highly deserving of notice, and which, of course, we shall now endeavour to point out successively.

The purposes for which mankind employs fires, or combustion in general, are either for the use of the heat, or for the use of the light. The heat is subservient to the numerous and important purposes of cooking victuals, of warming apartments, and thus rendering inhabitable such climates, as otherwise the human species could not live in; of giving existence to all metallurgic operations, to the making of glass, of lime for building, &c. &c. The light is subservient to purposes equally important. In short, it enables human beings to follow their operations, during the absence of the day-light nearly, if not full as well, as in the day-time. The flame of a single candle animates a family; every one follows his occupations, and no dread is felt of the darkness of night. Were it not for artificial light, how great a portion of the advantages of industry, and of real comfort, would the human species be deprived of.

When heat is wanted, then rough solid combustibles are used, which give it in abundance, and at a cheap rate: but when light is wanted, then the purest and the most uniform combustibles must be used, otherwise an inadequate effect is produced, and a considerable quantity of materials is expended. In some uncivilized countries, slender faggots of some kind of resinous wood are used by way of candles. When lighted at one end they burn gradually, and afford a good deal of light, but it is unsteady, and encumbered with a good deal of smoke. Besides, these faggots are readily burnt out, and must be quickly replaced by new ones.

At present, in all civilized countries, the principal combustibles

combustibles that are used for the production of a bright and luminous flame, are wax, the fat of animals, under the general name of tallow, oil, either of fish or of vegetables, and the inflammable gas of coals, which has but lately been introduced, at least in this country. The extensive consumption of these materials, and the successive increase of their price, has obliged the industrious to devise the best means of producing the greatest effect with the least possible quantity of materials.

Wax, tallow, and oils must be rendered volatile before they will produce a flame, but for this purpose it is sufficient to volatilize a small quantity of any of them, successively; for this small quantity will suffice to give a useful flame, and hence we must admire the simple, yet wonderful contrivance of a common candle or lamp. This contrivance contains a considerable quantity of the combustible substance, sufficient to last several hours; it has likewise, in a particular place, a slender piece of spongy vegetable substance, called the *wick*, which in fact is the fire place, or laboratory where the whole operation is conducted. The wick which, in the formation of the candle, or preparation of the lamp, has been partly or entirely soaked in the wax, or tallow, or oil, is set fire to by the approach of some other substance actually burning; this heat renders volatile and inflames that part of the wax, oil, &c. which is in the wick, and at the same time softens that which is next to it; the first portion of the wax, &c. being thus consumed, the wick is, in consequence of its capillary attraction, enabled to imbibe more materials for the maintenance of the flame, and so on in succession until the whole is exhausted.

There is a circumstance frequently attending the first lighting of a candle, which demands a short explanation in this place. It is, that at first the candle sometimes burns dimly, and looks as if it would go out. The method of reviving the flame in such cases is to lift up the candle perpendicularly with a quick motion, three or four times successively, which immediately revives the light. The reason of the first dimness is that the wax or tallow, by being too cold or too hard, is not melted by the combustion of that small portion which is in the wick, and of course cannot supply the waste of the wick; but by the lifting up of the candle, the air beats down the flame upon the wax or tallow adjoining to the wick, which melts it, and enables it to run up into the pores of the wick, where it is rendered volatile, and is inflamed, &c.

That part of the combustible which is successively rendered volatile by the heat of the flame is not all burnt, but part of it escapes in the form of smoke through the middle of the flame, because that part cannot come in contact with the oxygen of the surrounding atmosphere; hence it follows, that with a large wick and a large flame, this waste of combustible matter is proportionately much greater than with a small wick and a small flame. In fact, when the wick is not greater than a single thread of cotton, the flame, though very small, is, however, peculiarly bright, and free from smoke; whereas in lamps with a very large wick, such as are often suspended before butcher's shops, or with those of the lamp lighters, the smoke is very offensive, and in great measure eclipses the light of the flame.

In order to avoid this inconvenience, the ingenious Mr. Argand made that famous contrivance of a lamp, which now justly goes by his name. He made the burner or wick thin and circular, with a free passage for the air through the middle. In this construction a very thin and circular flame comes in contact with a vast quantity of air both within and without the circle, in consequence of which none of the volatilized oil escapes without burning, and the flame

is very brilliant and active. This shews the reason of what is commonly said of this lamp, namely, that it consumes its own smoke. With respect to the original construction, and the successive improvements of this admirable lamp, we must refer the reader to the article LAMP.

Instead of a circular form, the wick has also been made thin and oblong; but though this construction has some advantage over the common lamp, yet it is far inferior to Argand's. A circular or an oblong wick has likewise been tried in wax or tallow candles, but the attempts have not been attended with any remarkable advantage.

Another consequence of the want of oxygen in the middle of the large flame of a lamp or candle, is the formation of a coaly concretion at the extremity of the wick. This arises from the coaly or grosser particles of the combustible which are too heavy to become volatile, and at the same time do not come in contact with the oxygen which is necessary for their combustion; hence they accumulate and spread out somewhat like a fungus. If the wick be inclined a little, so that the end of it may just project out of the flame, which always goes straight upwards; then no coaly concretion is formed. In the lamps which illuminate the streets of London, the wick lies nearly horizontal, in consequence of which they seldom contract any coaly concretion.

Of the three principal materials for producing a useful bright flame, *viz.* wax, tallow and oil, the first and second are mostly used within doors in this country; but the fish oil, the combustion of which is attended with an unpleasant smell, is mostly used for street lamps and other out of doors purposes; excepting indeed when Argand's lamps are used, for in these the oil gives no bad smell. Oil of olives burns without any offensive smell; therefore much use is made of it for lamps in private houses in those countries where it may be had at a cheap rate, as in Italy, the south of France, &c.

Besides the above, a new material has of late been attempted to be introduced in this country, for the purpose of lighting houses, streets, manufactories, &c. the material is the inflammable gas of coals. Every body must know, that when coals are burning in a common fire place, a flame more or less luminous (according as it is more or less encumbered with incombustible smoke and vapour) issues from them; and they frequently emit some very beautiful streams of a flame remarkably bright. All this, as we have already mentioned, arises from the gases which are extricated from the coals by the heat. It was natural to imagine that such gas might be received in proper reservoirs, and might afterwards be forced out of small apertures, which being lighted might serve, as the flames of candles, to illuminate a room or other place. The trial was easily made, and it was attended with the desired effect. The principle of the apparatus and of the operation is as follows: The coal is placed in large iron vessels, called retorts, to the apertures of which iron pipes are adapted, which terminate in a vessel, or vessels, called gafometers, or reservoirs, which are inverted in water. The retorts thus charged are placed upon the fire, the action of which extricates the gas from the coals that are within the retorts, together with an aqueous vapour, a thickish fluid, or tar, &c. These products are conveyed through the above-mentioned pipes under the gafometers where the gas is washed, and remains ready for use. There are then other smaller pipes from the gafometer, which branch out into smaller ramifications, until they terminate into the places where the lights are wanted. The extremities of the pipes have small apertures, out of which the gas issues, and the streams being lighted at those apertures, will burn with a clear and constant flame as long as the supply of gas continues. All the pipes which come from the gafometer

gasometer are furnished with stop-cocks, in order both to prevent the useless waste of gas, and to regulate the sizes of the flames.

The method of producing the gas being thus contrived, the next step was to determine how far such lights might be employed, consistently with expence, safety, &c. A few shops in London were lighted with it, but the use was soon discontinued, as it was said, principally on account of the unpleasant smell. A proposal, and some attempts were made for lighting some of the streets of London by means of this coal gas; but either the mysterious nature of the proposals, or the expence attending the operation, or some other cause of obstruction, has not as yet allowed the adoption of the plan. Other attempts of the like nature have been made elsewhere, but of their successes we have no authentic account; excepting however of one, which was laid before the Royal Society by the operator, Mr. Murdock, and is published in the Philosophical Transactions for the year 1808. The precision with which the particulars are stated in Mr. Murdock's account, and the essential use of which such statements may be to a vast number of persons, who are now engaged in similar examinations in this new branch of civil economy, induce us to transcribe the most essential part of the account in the present article; reserving to add what future improvements may come to our notice to the article *Gas Lights*.

These facts and results, Mr. Murdock says, were made, during the present winter, at the cotton manufactory of Messrs. Philips and Lee, at Manchester, where the light obtained by the combustion of the gas from coal is used upon a very large scale; the apparatus for its production and application having been prepared by me at the works of Messrs. Boulton, Watt, and Co. at Soho.

The whole of the rooms of this cotton mill, which is, I believe, the most extensive in the united kingdom, as well as its counting-houses and store-rooms, and the adjacent dwelling house of Mr. Lee, are lighted with the gas from coal. The total quantity of light used during the hours of burning has been ascertained, by a comparison of shadows, to be about equal to the light which 2500 mould candles, of six in the pound, would give; each of the candles with which the comparison was made consuming at the rate of 4.10ths of an ounce (175 grains) of tallow per hour.

The burners are of two kinds: the one is upon the principle of the Argand lamp, and resembles it in appearance; the other is a small curved tube with a conical end, having three circular apertures or perforations, of about a thirtieth of an inch in diameter, one at the point of the cone, and two lateral ones, through which the gas issues, forming three divergent jets of flame, somewhat like a fleur-de-lis. The shape and general appearance of this tube has procured it, among the workmen, the name of the cockspur burner.

The number of burners employed in all the buildings amounts to 271 Argands, and 633 cockspurs; each of the former giving a light equal to that of four candles of the description above-mentioned; and each of the latter a light equal to two and a quarter of the same candles; making therefore the total of the gas light a little more than equal to that of 2500 candles. When thus regulated, the whole of the above burners require an hourly supply of 1250 cubic feet of the gas produced from cannel coal; the superior quality and quantity of the gas produced from that material having given it a decided preference in this situation over every other coal, notwithstanding its higher price.

The time during which the gas light is used may, upon an average of the whole year, be stated at least at two hours

per day of 24 hours. In some mills, where there is over work, it will be three hours; and in the few where night work is still continued nearly twelve hours. But taking two hours per day as the common average throughout the year, the consumption in Messrs. Philips' and Lee's mill will be $1250 \times 2 = 2500$ cubic feet of gas per day; to produce which 700 weight of cannel coal is required in the retort. The price of the best Wigan cannel (the sort used) is $13\frac{1}{2}d.$ per cwt. (*22s. 6d.* per ton) delivered at the mill, or say about eight shillings for the seven hundred weight. Multiplying by the number of working days in the year (313), the annual consumption of cannel will be 110 tons, and its cost 125*l.*

About one-third of the above quantity, or say forty tons of good common coal, value ten shillings per ton, is required for fuel to heat the retorts, the annual amount of which is 2*0l.*

The 110 tons of cannel coal, when distilled, produce about 70 tons of good coak, which is sold upon the spot at *1s. 4d.* per cwt. and will therefore amount annually to the sum of 93*l.*

The quantity of tar produced from each ton of cannel coal is from 11 to 12 ale gallons, making a total annual produce of about 1250 ale gallons, which not having been yet sold, I cannot determine its value.

The interest of the capital expended in the necessary apparatus and buildings, together with what is considered as an ample allowance for wear and tear, is stated by Mr. Lee at about 550*l.* per annum, in which some allowance is made for this apparatus being made upon a scale adequate to the supply of a still greater quantity of light, than he has occasion to make use of.

He is of opinion that the cost of attendance upon candles would be as much, if not more, than upon the gas apparatus; so that, in forming the comparison, nothing need be stated upon that score, on either side.

The economical statement for one year, then, stands thus:

Cost of 110 tons of cannel coal	- - -	£ 125
Ditto of 40 tons of common ditto	- - -	20
		<hr/>
		145
Deduct the value of 70 tons of coak	- - -	93
The annual expenditure in coal, after deducting the value of the coak, and without allowing any thing for the tar, is therefore	- - -	52
And the interest of capital, and wear and tear of apparatus	- - -	550
Making the total expence of the gas apparatus per annum, about	- - -	600

That of candles, to give the same light, would be about 2000*l.* For each candle, consuming at the rate of 4.10ths of an ounce of tallow per hour, the 2500 candles burning, upon an average of the year, two hours per day, would, at one shilling per pound, the present price, amount to nearly the sum of money above-mentioned.

If the comparison were made upon an average of three hours per day, the advantage would be still more in favour of the gas light.

At first, some inconvenience was experienced from the smell of the unconsumed, or imperfectly purified gas, which may in a great measure be attributed to the introduction of successive improvements in the construction of the apparatus, as the work proceeded. But since its completion, and since the persons to whose care it is confided have be-

some familiar with its management, this inconvenience has been obviated, not only in the mill, but also in Mr. Lee's house, which is most brilliantly illuminated with it, to the exclusion of every other species of artificial light.

"The peculiar softness and clearness of this light, with its almost unvarying intensity, have brought it into great favour with the work-people. And its being free from the inconvenience and danger resulting from the sparks and frequent snuffing of candles, is a circumstance of material importance, as tending to diminish the hazard of fire, to which cotton mills are known to be much exposed."

In the burning of candles or oil lamps, the heat of the flame softens and attenuates the materials, and converts them partly into an elastic fluid which takes fire successively and maintains the flame. In the burning of coals, wood, turf, &c. various gases, as well as vapours, are extricated from them, but these products are not all combustible; therefore those which are not combustible tend to check the activity of the flame which arises from the combustion of the others. The gases which are principally extricated from the above-mentioned materials are hydrogen gas, azotic gas, and carbonic acid gas; the first of which only is highly inflammable in all its combinations; and it is hardly ever yielded pure by any of the above-mentioned materials. Its usual combinations are either with sulphur, or with carbon, or with phosphorus; hence it derives the denominations of sulphurated, carburated, or phosphorated, hydrogen gas.

The flames of different combustibles are not all attended with an equal production of heat and light. Sulphur burns with a weak flame; phosphorus with a very dense one. Spirit of wine burns with a very slight flame in point of light, but a very powerful one with respect to heat; so that if an Argand lamp be charged with oil, and another similar lamp be charged with spirit of wine, the flame of the latter will not have a quarter of the light of the other, but it gives more than twice as much heat as the other. The flame of spirit of wine is not accompanied with any smoke. The flame of ether is denser, but produces smoke. The flame of spirit of turpentine is attended with a very dense smoke. The flame of pure hydrogen is very faint. This flame of hydrogen produces a remarkable phenomenon, which deserves to be mentioned in this place.

If a phial, containing the materials proper for the production of hydrogen gas, (*viz.* iron filings and diluted sulphuric acid,) be furnished with a tube having a small aperture for the exit of a stream of the gas, and if this stream be lighted, a flame will continue to burn at that aperture as long as the materials continue to give out the gas. Now, if a glass tube of about an inch in diameter, and about a foot long, be held straight up, with its aperture just over the above-mentioned flame, a sound will be heard, somewhat like a delicate sound of an organ pipe. This sound varies according to the size of the tube. No very satisfactory explanation has, as yet, been given of this singular phenomenon.

The flames of volatile combustibles that are more compound in their nature, vary considerably with respect to the intensities of their heat and light. A curious phenomenon takes place in uniting the flames of two candles, *viz.* the light is considerably increased. Let a person hold two candles before his face, at first separate, and then with their flames joined. Upon the junction of the two flames, his face will appear much more illuminated than it was before. "It is conjectured," Dr. Priestley says, "that the union of the two flames produces a greater degree of heat, and that this causes a farther attenuation of the vapour, and a more copious emission of the particles of which light consists."

The effects which we have just been enumerating are such as take place in common atmospheric air.

The various colours of the flames of simple and compound bodies are likewise highly deserving the attention of philosophers. Certain combustibles, even of the purest kind, burn with flames having peculiar tints; but much stronger colours may be communicated to their flames by the admixture of various substances, especially of salts that are of an earthy or metallic nature.

The flame of a common candle is far from being of an uniform colour. The lowest part of the flame is always blue; and when the flame is sufficiently elongated, so as to be just ready to smother, the tip is always red.

As for the colours of flames that arise from coals, wood, and other usual combustibles, their variety, which hardly amounts to a few shades of red, or purple, intermixed with the bright white light, seems principally to arise from the greater or less admixture of aqueous vapour, dense smoke, or, in short, of other incombustible products.

Spirit of wine burns with a bluish flame. The flame of sulphur has nearly the same tinge. The flame of zinc is of a bright white. The flame of most of the preparations of copper, or of the substances with which they are mixed, is greenish-blue. Spirit of wine, mixed with common salt, burns with a very unpleasant effect, as may be experienced by looking at the spectators who are illuminated by such light. If a spoonful of spirit of wine and a little boracic acid be stirred together in a cup, and then be inflamed, the flame will be beautifully green. If the spirit of wine be mixed with a little strontian earth in powder, or with any of its saline preparations, it will afterwards, on being inflamed, burn with a red, or rather purple flame. If the spirit of wine be mixed with barytes, its flame will have a beautiful yellow appearance. Such are the principal means of colouring flames, the admixture of various other substances will also impart some shades of colour to flaming bodies, but not nearly so strong as the above.

Some years ago an elegant and curious exhibition, under the title of "Philosophical Fire-works," was shewn in London by an industrious foreigner, named Diller. The exhibition consisted of the flames of certain gases or vapours which issued out of a variety of small apertures at the ends of short tubes, which were disposed in the forms of wheels, pyramids, spirals, tridents, &c. Out of these apertures the flames were gradually made to increase and decrease alternately; so that sometimes the room looked as bright as if it were illuminated by the sun, and at other times the flames would be barely discerned. But the most pleasing effect arose from the colours of these flames, as there were beautiful greens, yellows, reds, purples, &c. Mr. Diller died, and it seems that he did not leave the secret of the preparations behind him; for no one has since been able to exhibit any thing equal to those philosophical fire-works. The smell of ether, which predominated in the exhibition room, seemed to shew that Mr. Diller made great use of that liquid.

The combustible vapours and gases are not all inflamed with equal readiness. Hydrogen gas may be inflamed not only by the contact of another flaming body, but even by a very small electric spark. An electric spark a little more powerful will fire spirit of wine and ether, especially when those fluids are a little warm. Spirit of turpentine, and some essential oils may be inflamed, not only by the above-mentioned means, but even by the action of cold acids. Put about a spoonful of oil of turpentine in a cup, and pour over it about half that quantity of strong nitrous acid previously mixed with a few drops of sulphuric acid. The oil

of turpentine will immediately burst out into a flame merely in consequence of the action of the acid.

The thick fat oils must be heated to a considerable degree, and in that state a flaming body must be brought in contact with their vapour, before they will be inflamed. Even when raised to a very high temperature, they seldom will of themselves burst out in a flame. If a vessel containing oil be set upon a fire, a smoke or vapour begins to rise from it, which grows by degrees denser and denser; and at last it begins to shine in some places near the surface of the oil, somewhat like an electric light; yet it does not flame; but if in this state a flaming body, like a candle, a match, &c. be brought within the vapour, the latter will be instantly inflamed, breaking out with a sort of explosion, and will continue to burn until the oil is in great measure consumed.

Besides the use of their light, the flames of candles, and especially of lamps, are often used for the sake of the uniform heat which they give; and when no very great degree of heat is wanted, the use of such flames must be allowed to be incomparably more commodious, and more economical than a common fire. The enameller, the mineralogist, and the philosophical instrument makers, make great use of the heat of candles and lamps, the flames of which they frequently urge by means of the blow-pipe. An Argand lamp, especially when charged with spirit of wine, (for which purpose, however, the lamp must be made in a particular manner,) instead of oil, forms a pretty powerful furnace for small distillations, decoctions, &c. but even the flame of a single common lamp is sufficient for a great variety of delicate purposes.

The word flame, besides its true meaning, which we have already explained, and which denotes the combustion of a volatile combustible body attended with the emission of heat and light, has often been indiscriminately applied to every kind of luminous appearance, provided its light had a pretty evident degree of intensity. Thus all phosphorecent bodies, electrical light, northern lights, &c. have been called flames by a variety of writers. Certain phenomena really have much the appearance of true flames; yet their real nature has not been sufficiently investigated. Thus the *ignis fatuus*, or *Jack-a-lantern*, is supposed to be nothing more than phosphorated hydrogen, which being extricated from certain materials in particular places, comes out of the ground, and burns on the surface of it; for it is a property of that gas to take fire of itself the moment it comes in contact with respirable air. The nature of those appearances in the sky, which have been called flames, is mostly unknown to us. See METEORS, and IGNIS FATUUS.

By some authors, flame is defined to be *light emitted from fire*; by others, who have followed Newton, flame is said to be a vapour heated red-hot; for Newton in his Optics says, "Is not flame a vapour, fume, or exhalation heated red-hot, that is, so hot as to shine? For bodies do not flame without emitting a copious fume, and this fume burns in the flame."

With respect to the first definition, we imagine that the preceding part of the present article has clearly shewn that not all the light which is emitted from a fire is flame; and such for instance is the light emitted from a red-hot cinder, or of a coal nearly exhausted of its gas. As for sir I. Newton's query, it may be justly said, that the state of chemical knowledge at his time could not furnish him with better ideas respecting the nature of flame.

FLAME, *Vital*, *Flamma*, or *Flammula vitalis*, a fine, warm, igneous substance, supposed by many, both of the ancients and moderns, to reside in the hearts of animals, as

necessary to life, or rather as that which constitutes life itself.

To the preservation of this flame they suppose air as necessary as it is to the preservation of common flame; and hence they ascribe the necessity of respiration to animal life.

Mr. Boyle, by experiments in an exhausted receiver, found that the vital flame of animals, if life may be so called, survives or outlasts the flame of spirit of wine, or of a wax or tallow candle, &c. Some animals would remain alive and well *in vacuo* for three or four minutes, whereas no common flame would last there one minute. The light of the glow-worms, he found, would presently be destroyed by exhausting the air, and retrieved again upon its re-admission. Dr. Quincy could find nothing more in the notion of vital flame than the natural warmth, which is the effect of a circulating blood, and which is always as its velocity. See ANIMAL HEAT.

FLAMEEL, or FLAMAEI, BERTHOLET, in *Biography*, a painter of historical subjects, born at Liege in 1614. He began his studies in Flanders, but at the age of 24 he went into Italy to cultivate his talents by a view of the works of the renowned painters of that country. He took up his residence in Rome, there copying the best works of the great masters. He soon acquired a reputation which recommended him to the court of Florence, to which the grand duke invited him, and there employed him in several works, the execution of which acquired for him the esteem of that prince, and the applause of the public.

In returning from hence homewards, after an absence of nine years, he went to Paris, and there painted, in the cupola of the church of the bare-footed Carmelites, Elijah ascending to heaven, and Eliza below endeavouring to catch the falling mantle of the prophet, thus miraculously borne from the earth.

At Liege he was received with great warmth, and to confirm the high opinion which his countrymen had conceived of his merit, he painted a crucifixion for the collegiate church of St. John, in which he introduced a great number of figures with great propriety and perspicuity. He also painted, in St. Paul's church, the conversion of that saint. And in the cathedral of the city another picture, representing the resurrection of Lazarus.

The close of his life is a melancholy instance of the frail tenure on which man holds either his mental or bodily capacities. Notwithstanding that wealth, reputation, and esteem attended him, he fell, unaccountably, into melancholy, and dejection of spirits, which incessantly oppressed him, till ultimately he sunk under it. It was by many supposed to be owing to poison given him by an intimate friend named Brinvilliers, but there is no proof of that supposition being true. He died in 1675, aged 61.

By his residence in Rome, he adopted the taste of design of that school, being careful in his selection of objects, and correct in the representation of them. He introduced into his pictures a great deal of architecture, in which he was a proficient; he had great knowledge also of antiquities, and was careful in observing the costume; these, united with a lively imagination, render his works very interesting.

FLAMEN, among the ancient Romans, was a priest or minister of sacrifice.

There were as many kinds of flamens at Rome as there were gods who had priests and sacrifices offered them.

Romulus and Numa, at first, only instituted three; one for Jupiter, called *flamen Dialis*; another for Mars, called

flamen Martialis; and a third for Romulus or Quirinus, called *flamen Quirinalis*. Plutarch and Dionysius Halicarnassensis maintain, that Numa created only the last in honour of Romulus; but Livy assures us, that Romulus had instituted only the first, and that the two others were added by Numa; and Varro speaks in the plural number of the flamines instituted by Numa. In after-times twelve more were added, which made the number of flamines fifteen.

The three first were taken from among the patricians, and were held of a rank and distinction superior to the rest. They were called greater flamines, *flamines majores*, in contradistinction to the other twelve, who were chosen from among the plebeians, and were therefore called lesser flamines, *flamines minores*. The *flamen Dialis*, or of Jupiter, was the first instituted, and held in the greatest repute. He bore a peculiar ornament on his head, called *allugalerus*, which was made of the skin of a white victim sacrificed to Jupiter.

One of these priests revived an ancient pretension to a seat in the senate in right of his office, which, by the indolence of his predecessors, had not been claimed or enjoyed for many generations. The prætor rejected his claim, nor would suffer him to sit in that assembly; but upon his appeal to the tribunes of the people, that is, to the people, his right was confirmed, and he was allowed to take his place as a senator. Liv. xxvii. 8. Middlet. of Rom. Sen. p. 49.

The cap worn by the rest was called *flamma* or *apex*. It was made of a sheep-skin, with the wool on; to which was fastened a little branch of an olive-tree. That of the flamen of Jupiter ended in a point called *tutulus*. It was tied under the chin with strings; but in the summer-time it was only a woollen thread tied round the head, it being prohibited them ever to appear quite bare-headed. And hence, according to Festus, came their denomination of flamen, viz. from *filamen* or *filum*, thread.

Though the flamines bore one common appellation, yet did not they constitute any company or college. Each god had his several sacrifices, feasts, and ceremonies a-part; nor had one flamen any relation to another, only they were all subordinate to the pontifex maximus. Aulus Gellius assures us, that they were created by the people in the comitia curiata; but the pontifex maximus afterwards consecrated them. Their priesthood, called *flaminatus*, was perpetual, though on some occasions they might be deposed.

The names of the several flamines are as follow: the three great flamines, as already observed, were the *flamen Dialis*, *flamen Martialis*, and *flamen Quirinalis*: the twelve lesser were the *flamen Carmentalis*, or priest of the goddess Carmenta, mentioned by Cicero in his Brutus; *flamen Falacer*, or priest of the god Falacer, a name whose origin, Varro observes, is not known; *flamen Floralis*, or of the goddess Flora; *flamen Furinalis*, whose etymology is not known; *flamen Luvinialis*; *flamen Lucinarius*; *flamen Palatualis*, whom some moderns will have to be the priest of the goddess that presided over the palatum, though Varro owns himself at a loss for its original; *flamen Pomonalis*, or of Pomona, goddess of fruits; *flamen Virbialis*, or of the god Virbius, whom some take for the same with Hippolytus; *flamen Vulcanalis*, or of Vulcan; and *flamen Volturnalis*, or of the god Voltumnus. Some authors also speak of the *flamen Hadrianalis*, priest of Hadrian: *flamen Julii Cesaris*, of Julius Cæsar; and *flamen Augustalis*; and Commodus likewise had a flamen created under the title of *flamen Herculeus Commodianus*.

They had also their *flaminæ* or *flaminicæ*, who were wives

of the flamines, or the priestesses of the deities. In an ancient marble, quoted by Gruter, p. cccclix. n. 9. the word *flamina* is used for priestess; and in the same author, p. cccviii. n. 3, the priestess of the goddess Feronia is called FLAM. FERON. that is, *flamina*, or *flaminica Feronis*. The *flamina* bore the same ornament on her head with the flamen. She had also the same surname of office with her husband, as *flamina Dialis*, *Martialis*, &c.

FLAMETTE, in *Conchology*, a name given by the French writers to a species of chama or shell-fish of the bivalve kind, with its shells always more or less open; this species is as hot as pepper to the taste.

FLAMINGO, in *Ornithology*. See PHOENICOPTERUS *ruber*.

FLAMINIAN WAY, one of the Roman ways, which, as it is corrected from the Itineraries and best modern maps by d'Anville, may be thus stated: Rome to Narni, 51 Roman miles; Terni, 57; Spoleto, 75; Foligno, 88; Nocera, 103; Cagli, 142; Intercisa, 157; Fossombrone, 160; Fano, 176; Pesaro, 184; Rimini, 208; about 189 English miles.

FLAMINIO, MARCANTONIO, in *Biography*, was the son of a man of letters, and born at Serravalle in 1498. He was educated with great care by his father, and when he was about sixteen years of age he was introduced to pope Leo X. who received him very graciously, and in order to put his talents to the trial, caused the youth to dispute on certain questions in the presence of many cardinals, when he acquitted himself so well as to excite the surprize and admiration of all who heard him. His success induced his father to leave him to push his own fortune. The young man went to Naples, and from thence to Urbino, and in both places he had favourable opportunities of exhibiting the great power with which he was gifted. His father, dreading the influence of flattery, removed him to Bologna, to the pursuit of severer studies. In 1523, he re-visited Rome, and from thence he went to Genoa, and was elected one of the academy. After this he passed into the service of Giberti, with whom he resided at Padua, and then, for some years, at Verona. His patron presented him with a farm situated on the bank of Lago di Garda, where he spent much of his leisure time, and wrote a Latin paraphrase of Aristotle's *Metaphysics*, which was printed at Basil in the year 1537. In the following year, being in an ill state of health, he went to Naples, in which city he remained till 1541. Here his health was perfectly restored, and here, by the conversation which he had with some favourers of the Reformation, he was himself almost a convert. On his return from Naples he spent some time at Viterbo with cardinal Pole, who took great pains to restore him to the orthodox faith. In 1543, he was at Trent with the cardinal, and was after this offered the high post of secretary to the council of legates, which he declined. He was, however, the constant attendant and friend of cardinal Pole, and greatly beloved by many other cardinals and great men of his time. After a tedious illness he died at the house of his patron in 1550. His death was universally lamented, and his contemporaries are lavish in his praises, as well for the goodness of his disposition and his Christian virtues, as the depth of his erudition and the elegance of his genius. "His works," says his biographer, "appear to be dictated not by the understanding but by the heart." His poems rank him with the best poets of the Latin school. Of these, some in his early youth partake of the licence of the times, but the admonitions of his father and the sobriety of his own disposition called him

to more serious strains. The greater part of the "Carmina quinque illustrium poetarum" consists of the works of Flaminio. His elegant poetical paraphrases of thirty psalms, published a few years before his death, and his Italian letters, are very highly esteemed. Some years after his decease his orthodoxy was suspected, his works prohibited, and it was intended to dig up his body for the purpose of committing it to the flames; but wiser and more deliberate councils determined otherwise. Moreri.

FLAMINIUS, or FLAMINIVS, TITUS QUINCTIVS, an eminent Roman, was born about the year 228 before Christ. He was brought up to the practice of arms, and acquitted himself so well in several things which he undertook, that he was in early life appointed to the conduct of important expeditions. At the age of 30 he was candidate for the consulship, and was chosen though he had not served any of the inferior and preparatory offices in the state. He obtained, by lot, the conduct of the war in Macedon; and performed, in various parts of Greece, many exploits recorded in history, till at length he treated with Philip, and made a peace on condition that the king should withdraw all his troops from the Grecian towns. Commissioners were sent from Rome to assist Flaminus in disposing of his conquests: these wished Roman garrisons to be kept at Corinth and other places, regarded then as the keys of the country, but the conqueror persuaded them to consent to the full and complete liberation of Greece from foreign dominion. The decree was proclaimed during the Isthmian games. A vast multitude assembled from all parts, uncertain of their future fate, and filled with the utmost anxiety for themselves and their country. Silence was proclaimed by the sound of a trumpet, and a herald advanced into the middle of the arena, where, in the name of the Roman people and of the proconsul Flaminus, he declared by name all those cities and states of Greece free which had been possessed by Philip. The proclamation was repeated, and the people, as with one voice, rent the skies with their shouts: so tremendous was the noise, that the birds were said to have been struck to the ground by the concussion of the air, and Flaminus himself was in danger of suffocation from the people who rushed upon him to kiss his hand in gratitude for his kindness. To him it was a glorious day; but the Romans refused to ratify the decree, and in a short time they dictated what terms they chose to the Grecian republics, which now were declared free by Flaminus. The consul left Greece with many tokens of gratitude of the people, but with none which he so highly prized as a present of 1200 Romans made captive in the war with Hannibal, who had been sold for slaves in the Grecian states, and whom the Achæans had carefully collected and redeemed, in order to send back with him. In the habits of manumitted slaves those men followed the chariot of their benefactor at the splendid triumph granted him on his return. Flaminus was afterwards long kept as a resident in Greece; the attachment of the nation to him, and his accurate knowledge of the views and interests of the several states, rendering him very useful as a negotiator. About the year 190 B. C. he was created censor at Rome, after which he was employed as an ambassador to Prusias, king of Bithynia, whom he persuaded to violate the laws of hospitality in delivering up Hannibal, who had taken refuge in his court, but the veteran soldier prevented the treachery by taking poison. This is the last recorded transaction in which Flaminus engaged. Universal History. Plutarch.

FLAMMA JOVIS, a name given by many writers to a

plant of the *elematis* or *virgin's bower* kind, called by the Greek writers *phlogus*.

FLAMMULA, or FLAMULA, under the *Eastern Empire*, was a kind of flag terminating in a point somewhat like a flame, serving as a mark or badge to distinguish the soldiers of the several companies, battalions, regiments, &c. In Greek it was called *φλαμυλον*: it was sometimes placed on the casque, sometimes on the cuirass, and sometimes at the end or tip of the pike, &c.

The emperor Maurice ordered, that the *flammulæ* of each division should be of a particular colour, to distinguish them from the other battalions or brigades.

They used to lay aside the *flammula* before an engagement, lest it should prove an incumbrance. The cavalry had also *flammulæ* on their horses, to distinguish the troops they belonged to.

FLAMMULA, in *Botany*, a name given by some authors to a particular species of the crow-foot, commonly called the *ranunculus flammæus*.

FLAMMULÆ Auri, in *Natural History*, a name given by Dr. Woodward, and others, to those small pieces of gold found among the sands of rivers in some places. They are sometimes found in roundish pieces, but more usually in their shining flakes, whence the name *flammula* seems to have been given them, as being very bright and glossy. This sort of gold is pure and malleable, and loses scarcely any part of its weight in fusion.

The gold dust, as it is called, which is brought from Guinea, is much of this kind; its particles are usually very small, though sometimes lumps of the size of a pea or horse-bean are found, and sometimes masses of an irregular figure of three or four ounces weight: but these lose the name of *flammulæ* when they become so thick and solid, and so large, and are called by the merchants *rock-gold*. Woodw. Cat. Foss. vol. ii. p. 30. See GOLD.

FLAMSTEED, JOHN, in *Biography*, an eminent English astronomer, was born at Denby, in Derbyshire, in the year 1646. He received his classical education at the free school at Derby, and it was intended that he should pursue his studies at the university, but a very severe illness at the age of 14, when he had attained the highest place in the school, rendered it necessary for his friends to change their original plan with regard to his future pursuits. Soon after he had quitted the grammar school he met with Sacrobosco's work, intitled "De Sphæra," which he read with delight, and some parts of which he immediately translated. He now sought for other treatises connected with the same subject, among which was Street's "Astronomia Carolina;" from this he learned the method of calculating eclipse and the places of the planets. In 1669, having calculate an eclipse of the sun, that was omitted in the ephemeris for the following year, he sent this, with other astronomical speculations, to lord Brouncker, president of the Royal Society, who laid them before that learned body, by whom they were greatly approved. From this period he kept up a correspondence on literary and scientific subjects with many of the most learned men of his time. In 1670, his father made him an offer of taking a journey to London, that he might become personally known to his ingenious and learned correspondents, which he gladly accepted. He was now introduced to Mr. Collins, Mr. Oldenburg, and sir Jonas Moore, the latter of whom became a most valuable friend and patron to Mr. Flamsteed. On his return he passed through Cambridge, visited Dr. Barrow, Mr. Isaac Newton, and other learned men; and entered himself a student of Jesus college. Mr. Flam-

ceeded, applying himself most vigorously to the study of astronomy, wrote in the year 1673 a treatise on the true and apparent diameters of all the planets, which sir Isaac Newton made use of in the 4th book of his Principia. He wrote also on other subjects, as the tides, which were more popular and adapted to practical uses, and of which one was presented to the king. To whom, likewise, by means of his friend sir Jonas Moore, he presented a pair of barometers, with directions for their use. These were new instruments at that period, and excited the attention of the monarch and of the nobility, to whose patronage he had been earnestly recommended. Mr. Flamsteed now determined to take orders, and was ordained in 1675 by bishop Gunning; but he did not obtain any preferment in the church for several years. Sir Jonas, however, prevailed on the king to erect a new office for him, *viz.* that of astronomer-royal, and the foundation of the Royal Observatory at Greenwich was built and named after him, Flamsteed House. In 1681, his work intitled "The Doctrine of the Sphere," was published by sir Jonas Moore in his "System of Mathematics;" and, in 1684, he was presented with the living of Durslow in Surrey, the only instance of preferment to which he attained, notwithstanding the high estimation in which he was held by persons of the first rank among his contemporaries. He now maintained a close and constant correspondence with the immortal Newton, with Halley, and all the great men of that illustrious age, and among his foreign correspondents was the celebrated Cassini, who was held in the highest respect by him. To any and all his friends he was ever ready to give assistance in facilitating their studies, and he took pleasure in contributing, by his suggestions and hints, to the extension of their reputation. He spent the remainder of his life in prosecuting his labours in the improvement of astronomy with unwearied exertion and activity, and died at the end of the year 1719, at the age of 73. He published many small tracts, a vast number of papers in the Philosophical Transactions, in almost every volume from the fourth to the twenty-ninth. But his great work, and that on which his celebrity depends, is intitled "Historia Cœlestis Britannica," in three volumes folio. The first of which contains the observations of Mr. Gascoigne, taken at Middleton in Yorkshire; and likewise those made by Mr. Flamsteed at Derby, between the years 1638 and 1643, with tables, &c. made at the Royal Observatory between the years 1675 and 1689.

The second volume contains his observations, made with a capital telescope, on the zenith distances of the fixed stars, sun, moon, and planets, with their transits over the meridian; also notes and observations on the diameters of the sun and moon, with their eclipses, and those of Jupiter's satellites, between the years 1689 and 1719. The third volume comprises a catalogue of the right ascensions, polar distances, longitudes, and magnitudes of nearly 3000 fixed stars. The preface to this volume contains an account of all the astronomical observations made before his time, with a description of the instruments employed, and much other curious and highly important matter. The printing of this noble work was not finished at the time of our author's death, and the care necessary to its completion devolved on Mr. James Hodgson, by whom it was published in the year 1725. Few men possessed more zeal and application in the pursuit of scientific knowledge than the first astronomer-royal; and scarcely any man ever attained to higher respect among his contemporaries. In common life he was free, easy of access, and pleased with the company

of those who with scientific research could unite their share in the convivial intercourse of life. Biog. Brit.

FLANCH, FLANQUE, or *Flasque*, in *Heraldry*, an ordinary formed by an arched line, which begins at the corners of the chief, and ends in the base of the escutcheon.

He beareth ermin two flanches vert. Flanches are always borne by pairs.

Leigh makes *flanque* and *flask* two distinct bearings, whereof the former is more bent than the latter; but Gibbon judiciously makes them but one, which he calls *flanque*.

FLANCONNADE, in *Fencing*, is the action of dropping the point of your sword under your adversary's hilt, in seizing with force the feeble or foible of his blade; which, binding without quitting it, form the parade in octave, and then throw in your thrust. This thrust is seldom practised, except on favourable occasions, when the adversary holds his wrist low on guard.

FLANDERS, in *Geography*, a maritime province of the Netherlands, was formerly very considerable, and bounded on the north by the mouth of the Scheldt and the German ocean, on the east by Brabant and Hainaut, on the south by Hainaut and a part of France, formerly called Artois and Picardy, and on the west by the English channel and Artois. Its greatest length is estimated at about 60 miles, and its breadth about 50. It contained 30 cities or walled towns, a great number of market towns, 1154 villages, and several religious houses. Flanders was generally divided into Austrian, French, and Dutch Flanders. The first extended from the sea to the Dender, being bounded on the north by Dutch Flanders, on the east by Brabant, on the south by French Flanders, and on the west by the channel, and contained several considerable cities, as Ghent, Bruges, Ostend, Oudenard, Dendermond, Nieuport, Furnes, Dixmude, Courtray, Ypres, Tournay, &c. &c. French Flanders contained Lille, Dunkirk, Gravelines, Cassel, &c. &c. The third, or Dutch Flanders, bordering on the Scheldt, toward its mouth, contains the towns of Hullt, Axel, Bouchoult, Assenede, Ardenburg, &c.; and this seems to be the only part which retains the name of Flanders. By the treaty of Formio, A.D. 1797, the whole of Austrian Flanders was annexed to the dominions of France, and converted into the departments of the Lys and the Scheldt. The climate of this country is temperate and salubrious; the soil in general is fertile and fit for tillage; and in some places it is uncommonly fertile. The land produces all kinds of grain and vegetables. Flax is a very considerable commodity, and has greatly contributed to the wealth of the country. The pasture grounds are excellent, and nourish a valuable breed of cattle, which yield rich cheese and butter. The breed of horses and sheep is also considerable. The Flemings were at one time the principal manufacturers of Europe; and by them the English were taught the art of weaving, and probably that of agriculture. Their trade was also very extensive. The most beautiful table linen is still the manufacture of this country, and its lace is superior to every other. The principal rivers are the Scheldt and the Lys.

FLANDERS, a town of New Jersey; 23 miles N.N.W. of New Brunswick.

FLANEL, or FLANNEL, a kind of slight, loose, woollen stuff, not quilted, but very warm, composed of a woof and warp, and wove on a loom with two treddles, after the manner of bays. As flannel is a bad conductor of heat, it must evidently form an useful garment in cold weather; its unfitness for conducting heat is obvious from its lax structure; for

for the fibres of wool touch each other slightly, and therefore the heat moves slowly through the interstices, which, being filled with air, afford little assistance in carrying it off. Count Rumford made many experiments on this subject; whence it should seem, that though linen, which readily receives humidity from the atmosphere, appears to possess a greater degree of attraction with respect to water than other substances; yet those substances which receive water in its unelastic form with the greatest ease, or are most easily moistened, do not, in all cases, attract the moisture of the atmosphere with the greatest avidity. "Perhaps," says he, "the apparent dampness of linen to the touch arises more from the ease with which that substance parts with the water it contains, than from the quantity of water it actually holds; in the same manner as a body appears hot to the touch in consequence of its parting freely with its heat, while another body, which is really at the same temperature, but which withholds its heat with great obstinacy, affects the sense of feeling much less violently. It is well known that woollen clothes, such as flannels, &c. worn next the skin, greatly promote insensible perspiration. May not this arise principally from the strong attraction which subsists between wool and the watery vapour which is continually issuing from the human body? That it does not depend entirely on the warmth of that covering is clear; for the same degree of warmth produced by wearing more clothing of a different kind does not produce the same effect. The perspiration of the human body being absorbed by a covering of flannel, it is immediately distributed through the whole thickness of that substance, and by that means exposed by a very large surface to be carried off by the atmosphere; and the loss of this watery vapour which the flannel sustains on the one side, by evaporation, being immediately restored from the other, in consequence of the strong attraction between the flannel and this vapour, the pores of the skin are disencumbered, and they are continually surrounded by a dry and salubrious atmosphere." He expresses his surprise that the custom of wearing flannel next the skin should not have prevailed more universally. He is confident it would prevent a number of diseases; and he thinks there is no greater luxury than the comfortable sensation which arises from wearing it, especially after one is a little accustomed to it. "It is a mistaken notion," says he, "that it is too warm a clothing for summer. I have worn it in the hottest climates, and at all seasons of the year; and never found the least inconvenience from it. It is the warm bath of perspiration confined by a linen shirt, wet with sweat, which renders the summer heats of southern climates so insupportable; but flannel promotes perspiration, and favours its evaporation; and evaporation, as is well known, produces positive cold."

It has been observed that new flannel, after some time wearing, acquires the property of shining in the dark, but loses it on being washed. Phil. Trans. N^o 483. § 7. See ELECTRICITY.

FLANK, or FLANC, in the *Manege*, is applied to the sides of a horse's buttocks, &c.

In a strict sense, the flanks of a horse are the extremes of the belly, where the ribs are wanting, and are below the loins.

The flanks of a horse should be full, and at the top of each a feather. The distance between the last rib and haunch bone, which is properly the flank, should be short, which they term *well coupled*, such horses being most hardy, and fit to endure labour.

A horse is said to have no flank if the last of the short ribs be at a considerable distance from the haunch bone;

as also when his ribs are too much straightened in their compass.

FLANK of an Army, in *Military Language*, is the exterior point, or part, towards either end of every line, the same as the terminations of the files of a battalion or company are their flanks respectively. It has ever been held among military men of the first importance to preserve the integrity of the flanks, by supporting them in the most effectual manner against every assault. This, however, is not always practicable when opposed to a superior force, unless by the aid of such a formation of the line as may render any such superiority, not extending to more than a fifth or sixth, of less avail than it would obviously be, were the two armies to be drawn up parallel to each other: in such case the greater force must cover a greater extent of ground, and thus be enabled to "out-flank" its opponent. When such an opportunity may offer, it will generally be seen, that while the residue are left upon equal terms, man to man, and gun to gun, the excess of numbers is devoted to such a powerful charge on one flank as should seem to be irresistible. Thus, the attack is either made in column, usually concealed by a body of cavalry until the moment of assault, or an angle is formed in advance, which is called "offering a flank," for the purpose of beating in the flank by an oblique or a circuitous approach to, not only its extremity, but even towards its rear. In such case the lesser body necessarily avails itself of that simple evolution termed "refusing a flank," by throwing back a portion of its extremity in an angular direction, so as to become parallel with the flank "offered" by the stronger party. The first figure, *Tactics*, Plate II. shews the attack made in column C, by an army A, superior on one flank, together with the deploy of the cavalry B, that covered or masked the manœuvre towards the flank of the line D, with the view to "turn" it; that is, to beat it in towards the centre, and thereby to throw the whole into confusion. The dotted lines at E shew the change made from D, for the purpose of "refusing a flank," and of thus bringing a column to oppose the charge intended to be made. The village G serves to "cover the flank" from the cavalry that deployed for its attack.

In fig. 2. the line H I K is superior to the line L M N: the former "offers the flank" I O, which the latter renders unavailing (at least so far as lesser can resist greater forces,) by "refusing a flank" in the direction M P, parallel to I O. This, considered mathematically, will be found sufficient: because, under the supposition that the lines L M and M P are chords of arcs having their common centre somewhere in their rear, it is evident that the parallels H I and I O, being, of course, concentric therewith, but exteriorly situated, must occupy a greater extent, and yet, in effect, not outflank their inner parallels. We do not mean to inculcate that the superior force is not still the superior force, but only to shew how the lesser body can, by a judicious arrangement, either render that superiority less availing, or, perhaps, induce to a break near the centre, whereby an opening may offer for the cavalry of the weaker army to dash in so as to divide the enemy's line, and to facilitate the defeat of at least one wing.

FLANK of a Bastion, in *Fortification*, is that part which forms an angle, generally of about 110° , or in flat bastions of 130° , with the contiguous face. The flank of a bastion is generally intended to defend the face of the other bastion standing at the further extremity of the same curtain; therefore usually stands at right angles, or nearly so, therewith: hence it is necessary to silence the flanks of the contiguous bastions, both right and left, before the flanked angle

angle of that bastion standing between them, though perfectly breached, can with propriety be stormed.

FLANK, *Low*, *covered*, or *retired*, is the platform of the casement which lies hid in the bastion; otherwise called the orillon.

FLANK *Fitchant*, is that from whence a cannon playing, smeth bullets directly in the face of the opposite bastion.

FLANK *Rasant*, or *rasant*, is the point from whence the line of defence begins, from the conjunction of which with the curtain, the shot only raseth the face of the next bastion, which happens when the face cannot be discovered but from the flank alone.

FLANKS, *Simple*, are lines going from the angle of the shoulder to the curtain, whose chief office is for the defence of the moat and place.

FLANK-walls, in *Engineering*, are the same with wing or return-walls of a lock or bridge. See **CANAL**.

FLANKED, **FLANQUÉ**, is used by the French heralds to express our party per saltier; that is, when the field is divided into four parts, after the manner of an X.

Though Colombiere uses the term in another sense, which appears more natural, *viz.* for the taking of flanches or rounding sections out of the sides of the escutcheons; the first from the angles of it, the latter in straight lines, forming an angle at the fess, without making any saltier.

FLANKED *Angle*, in *Fortification*, is the angle formed by the two faces of the bastion, and which of course forms the point of the bastion.

FLANKED *Line of Defence*. See **ANGLE** and *Line of DEFENCE*.

FLANKED *Tenaille*, is called also tenaille.

FLANKING, in the general, is the act of discovering and firing upon the side of a place, body, battalion, &c.

To flank a place, is to dispose a place or other work in such a manner as that there shall be no part of the place but what may be played on, both in front and rear.

Any fortification that has no defence but just right forwards is faulty; and to render it complete, one part ought to be made to flank the other. Hence the curtain is always the strongest part of any place, because it is flanked at each end.

Battalions also are said to be flanked by the wings of the cavalry. A house is sometimes said to be flanked with two pavilions, or two galleries, meaning it has a gallery, &c. on each side.

FLANKING *Angle*. See **ANGLE**.

FLANKING *Batteries*, are such as defend each other mutually, such as the face of a raveline, and the contiguous face of its lunette; which stand nearly at right angles, and form a re-entering angle. In general, the term is applied only to that battery whose fire, when direct, grazes the front of the work it is to defend, as shewn above in describing the flank of a bastion; but in that instance the defences do not afford reciprocal support. Works that are not flanked by others can be strong only in consequence of natural advantages. See **FIELD Fortification**, and **CONSTRUCTION, Military**.

FLANKING *Line of Defence*. See *Line of DEFENCE*.

FLANNAN ISLANDS, in *Geography*, or *Seven Hunters*, a group of small uninhabited islands in the North sea, about 17 miles N.W. from the island of Lewis. They yield good pasture for sheep. On the largest are the ruins of a chapel dedicated to St. Flannan. N. lat. 58° 26'. W. long. 7° 25'.

FLANSKER, a small island on the E. side of the gulf of Bothnia. N. lat. 63° 24'. E. long. 21° 26'.

FLASHES, in *Engineering*, are a kind of sluices erected upon navigable rivers to raise the water upon any shoals therein, while the vessels or craft are passing. See **CANAL**.

FLASK, in the *Artillery*. See **POWDER flask**.

FLASK, *Flasque*, a bearing more properly called *flanque* or *fluch*.

FLASKET, in *Geography*, an island near the coast of Norway; 88 miles S.W. of Drontheim.

FLAT, is a character in *Music*, expressed by a small b, of which the effect is lowering the note to which it is affixed a semitone minor. Guido d'Arezzo having given names to six sounds of the octave of which he constituted his celebrated hexachord, left the seventh of the natural scale unprovided with any other appellation than the letter b, which is wanted in the molle hexachord, when the same sound becomes the fourth of the key of F. (See **HEXACHORDS** and *Musical CHARACTERS*.) Flats on keyed instruments are the nominal half notes below, that is, on the left hand of the natural notes, as sharps are on the right hand. There are two ways of using flats, the one *accidental*, which has no effect beyond the single bar in which it occurs; the other is the flat or flats placed at the clef, in the beginning of a movement which affect all the notes on the same line or space throughout a movement, unless accidentally discharged by a natural, ♮. The placing the flats at the clef is not arbitrary, as the first necessarily is on B, the second on E, the fourth above or 5th below, &c. in the following order:

$\overset{\flat}{B} \overset{\flat}{E} \overset{\flat}{A} \overset{\flat}{D} \overset{\flat}{G} \overset{\flat}{B}$

For these five flats upon keyed instruments, there are five short keys; flats, however, sometimes occur in C and F, but for these the two long keys are obliged to be used of B and E natural, the two half notes below C and F natural. If it is necessary in practice to lower any sound already flat at the clef a semitone, it is done by double flats: as B $\overset{\flat}{\flat}$ is A ♮, E double flat D natural, &c. See **SCALES, CHARACTERS**, and **TRANSPOSITIONS**.

FLAT *Third*. See **MINOR Third**.

FLAT *Key*. See **MINOR Third**.

FLAT, *Double*, is a term used where a note already flat is required to be again depressed by a half-note, and is marked thus $\overset{\flat}{\flat}$ or $\overset{\flat}{b}$; the quantity or exact depressing effect of which will only be constant in the equal temperament, and in all other systems of temperament will partake of all the uncertainty which we have shewn to prevail with regard to b. See **FLAT**.

Flats are a kind of additional or half-notes contrived, &c. together with sharps, to remedy the defects of musical instruments.

The natural scale of music being limited to fixed sounds, and adjusted to an instrument, the instrument will be found defective in several points; as particularly, in that we can only proceed from any note by one particular order of degrees; that for this reason we cannot find any interval required from any note or letter upwards or downwards; and that a song may be so contrived, as that if it be begun by any particular note or letter, all the intervals or other notes shall be justly found on the instrument, or in the fixed series; yet where the song begun with any other note, we could not proceed.

To remove or supply this defect, musicians have recourse to a scale proceeding by twelve degrees; that is, thirteen notes, including the extremes, to an octave; which makes the instrument so perfect that there is but little

little to complain of. This, therefore, is the present system of the scale for instruments, *viz.* between the extremes of every tone of the natural scale is put a note, which divides it into two unequal parts, called *semitones*; and the whole may be called the *semitonic scale*, containing twelve semitones betwixt thirteen notes in the compass of the octave.

Now, to preserve the diatonic series distinct, these inserted notes either take the name of the natural note next below with a character called a *sharp*; or they take the name of the natural note next above with a mark called *flat*. Thus D flat signifies a semitone below the D natural: and it is indifferent, in the main, whether the inserted note be accounted as a flat or a sharp.

The semitonic series or scale is very exactly represented by the keys of a spinnet; the foremost range of keys being the natural notes, and keys behind, the artificial notes, or the flats and sharps. The flat is denoted by the letter b in the writing and printing of music, and denotes that the note to which it is prefixed is to be lowered a half-note or semitone, and of course made to coincide with the note immediately below, in all such instruments as have but 12 intervals in the octave; it must however be observed, that except in the *EQUAL TEMPERAMENT* of the scale (which see), the flattening effect of a b is not always the same, but varies according to the magnitude of the half-notes in each different system of temperament or part of the same system, as observed under *FINGER-key intervals*.

Writers on the theory of music are by no means agreed on the magnitude of the interval which they assign to a flat. Dr. Robert Smith (*Harmonics*, p. 160.) defines it to mean the *minor LIMMA* of his different tempered systems (which see). Mr. Maxwell, (*Essay on Tune*, p. 51.) fixes

it to his major limma, which has a ratio of $\frac{128}{135} = 47\Sigma + f + 4m$, and is the *medius SEMITONE* (which see). Dr. Calcott (*Musical Grammar*, p. 112.) defines it to mean his chromatic semitone, or the apotome which has a ratio of $\frac{2,48}{2,187} = 58\Sigma + f + 5m$; in numerous other instances, we find

the flat defined to mean the limma whose ratio is $\frac{243}{256} = 46\Sigma + f + 4m$. If we examine the MSS. of Mr. Overend, we find the flat fourth of Tartini and himself, and also what he calls the greater of the flat sevenths and flat eighths, are each of them depressed below their natural intervals by

the minor semitone, whose ratio is $\frac{24}{25} = 36\Sigma + f + 3m$. See *SHARP*.

FLAT, in *Sea Language*, denotes a level ground lying at a small depth under the surface of the sea, and is also called a shoal or shallow.

FLAT Bastion, in *Fortification*. See *BASTION*.

FLAT-bottomed Boats are such as are made to swim in shallow water, and to carry a great number of troops, artillery, ammunition, &c. They are constructed with a twelve-pounder, bow-chase, and an eighteen-pounder, stern-chase; their keel is from ninety to one hundred feet, and from twelve to twenty-four feet beam: they have one mast, a large square main-sail, and a jib-sail, are rowed by eighteen or twenty oars, and can carry four hundred men each. The gun takes up one bow, and a bridge the other, over which the troops are to march. Those that carry horses have the fore-part of the boat made to open when the men are to mount and ride over a bridge. See *BOAT*.

FLAT-bottomed Boat. See *MOAT*.

FLAT Crown, in *Architecture*. See *CORONA*.

FLAT-aj, in *Sea Language*, denotes the fruation of the sails, when their surfaces are pressed aft against the mast by the force of the wind.

To FLAT-in, is to draw in the aftmost lower corner or clew of a sail towards the middle of the ship, to give the sail a greater power of turning the vessel. Thus, if the mizen or after sails are flatted in, this action is intended to carry the stern to leeward, and turn the head nearer to the direction of the wind; and if the head-sails are flatted in, the intention is to make the ship fall off, when by accident or design she has come so near the wind as to make the sails shiver.

To FLAT in forward, is to draw in the fore-sheet, jib-sheet, and fore-stay-sail sheet towards the middle of the ship. This operation is seldom performed, except in light breezes of wind, when the helm has not sufficient government of the ship.

FLAT-bush, in *Geography*, the chief town of King's county, in Long island, New York. This town is healthy and pleasant, and distant five miles S by E. from New York. The inhabitants are chiefly of Dutch extraction; their number is 956, of whom 341 are slaves. The whole township in summer appears like a garden; and its productions, which are various kinds of fruit, vegetables, grain, &c. find a ready market in the capital. The public buildings are a Dutch church, and a flourishing academy, called Erasmus Hall. The Americans were defeated in this place, after a sanguinary contest with the British, and suffered a great loss, August 27, 1776.

FLAT Head, a cape on the S. coast of Ireland, in the county of Cork, seven miles E. of Kinsale.

FLAT Holm, a small island in the Bristol channel, about $\frac{1}{2}$ mile in circumference. On the highest point of land is a light house to guide vessels up the channel. N. lat. $51^{\circ}30'$. W. long. $3^{\circ}5'$.

FLAT Island, a small island in the East Indian sea, near the N. coast of the island of Flores. S. lat. $7^{\circ}59'$. E. long. $120^{\circ}59'$.—Also, a small island in the S. Pacific ocean, near the E. coast of New Zealand. S. lat. $37^{\circ}40'$. W. long. $183^{\circ}15'$.

FLAT Islands, islands of Upper Canada, lying to the west of the Manitou islands, and open to the straits of Michilimackinac, upon Lake Huron.

FLAT Kill, a river of New Jersey, which runs into the Delaware. N. lat. $41^{\circ}4'$. W. long. $75^{\circ}4'$.

FLAT Lands, a small township in King's county, Long island, distant from New York six or seven miles; containing 493 inhabitants, of whom 128 are slaves.

FLAT Point, a cape on the N. coast of the island of Jamaica. N. lat. $18^{\circ}30'$. W. long. $77^{\circ}8'$.—Also, a cape at the southern extremity of the island of Sumatra. S. lat. $0^{\circ}5'$. E. long. $102^{\circ}38'$.—Also, a cape on the S. coast of the island of Borneo. S. lat. $2^{\circ}45'$. E. long. 112° .

FLATA ISLANDS, a cluster of small islands near the S.E. coast of North Uist, and about one mile N.E. of Roda island.

FLATOR TIBIARUM, in *Ancient Music*, a flute player, a Tibicen.

FLATTA, in *Geography*, one of the smaller western islands of Scotland, two miles E. from the island of Barra. N. lat. $56^{\circ}58'$. W. long. $7^{\circ}20'$.

FLATTE, *Fr.* a grace equal to a beat in English music.

FLATTENED, in *Music*, is applied to such intervals as are lessened, or notes which are depressed in their tone, by the intervals which answer to a flat (marked b), which

(except in the equal temperament) are very numerous. See FLAT.

FLATTENED *Fossils*, in *Natural History*, are such mineral substances, organic remains in particular, as seem to have suffered a compression or flattening, since their first deposit in the strata; Mr. W. Martin observes (Outlines, p. 72.) that such compressed, or flattened form of reliquia, "is often the consequence of the *mode* in which the mineral change has been brought about, and not the effect of a similar structure in the original. Some reliquia retain the form only of one side, or of one half, of the organized body represented; while others present the whole of the external or internal organic fabric, according to the manner in which the mineral matter has been united to the animal or vegetable figure." See COMPRESSED *Fossils*.

FLATTER, or FLATTENER. See COINING.

FLATTERY, CAPE, in *Geography*, a cape on the N.W. coast of North America, so called by captain Cook in his Third Voyage (March 1778), because it presented an opening, which flattered the navigators with the hopes of a harbour, but disappointed them; the opening being closed by low land. It lies in N. lat. 48° 15'. E. long. 235° 3'. Over it is a round hill of moderate height; and the adjacent land is well covered with wood, and exhibited a very pleasant and fertile appearance. In this latitude geographers have placed the pretended strait of Juan de Fuca. But our navigators saw nothing like it; nor, say they, is there the least probability that ever any such thing existed.—Also, a cape on the N.E. coast of New Holland. It lies in S. lat. 14° 56'. W. long. 214° 43', and is a lofty promontory, making next the sea two hills, which have a third behind them, with low sandy ground on each side; but it may be better known by three islands out at sea; the largest, and northern most, lying about five leagues from the cape, in the direction of N.N.E. This is supposed to be the same with that which capt. Dixon called Cape Cox.

FLATTING, or FLATTENING. See COINING.

FLATTING-course, among *Brick-makers*. See BRICK.

FLATTING-mill. See MILL and GOLD-wire.

FLATTS, signify the same with dirt-boats or floats, which are rectangular flat-bottomed and very shallow vessels, used on the Mersey and other navigable rivers, for moving stuff to repair the banks of a canal, and other purposes; in some places the ordinary trading boats are so called.

FLATULENCE, in *Medicine*, from the Latin, *flatus*, a puff, or *blast of wind*, signifies the generation and discharge of air, or gas, in and from the human body, especially in the stomach and intestines.

There are only two sources from which air can be generated in the passages just mentioned; namely, their contents, and the blood-vessels which secrete other fluids into them. The first of these, the substances contained in and passing through the alimentary canal, are the ordinary sources of flatus: for although we know that in some animal structures, as in the air-bladder of fishes, the vessels appear to be adapted for the secretion of air; and although it is not improbable that, in some morbid conditions of the organs of the human body, the blood-vessels occasionally secrete air, as was suggested by Mr. John Hunter; yet, in general, we have a much more natural solution of the problem, in the disengagement of air from the substances taken for the purpose of nutriment. All animal and vegetable substances disengage a considerable quantity of air in the course of their decomposition, whether by fermentation or putrefaction. It appears from the experiments of Dr. Hales, that an apple, and many other kinds

of aliment, give out six hundred times their own bulk of an elastic gas during fermentation. But the process of digestion, when well performed, prevents this fermentation from taking place; and the solvent power of the gastric juice converts the food into chyle without any disengagement of air. When, however, the digestive process is imperfectly carried on, the aliment, and especially the vegetable part of it, is suffered to go into a partial fermentation, of which the disengagement of air is a necessary consequence. Flatulence, therefore, is not so much a disease in itself although generally considered so by those who are troubled with it, as a *symptom* of indigestion, or of a weakened condition of stomach; and hence, although a flatulent distension of this organ may be relieved by the means which we shall enumerate, it can only be entirely cured by restoring the strength of the stomach. See DYSPEPSIA, and INDIGESTION.

Flatulence occasions various feelings of distress, according to the part of the alimentary canal in which the wind is generated or pent up. When it is copiously generated in the stomach, and does not pass readily through the upper orifice, to be dispelled by *eructation*, it produces all the distressing consequences which are attendant on great distension of that organ: in some instances great pain of the stomach is excited, either by the simple extension of the fibres, or by partial spasmodic contractions; in others, especially in hysterical habits, the adjoining organs are considerably affected by the pressure of the distended stomach; whence great anxiety and oppression are felt in the chest, from the impediment to the free motion of the lungs and of the heart; the respiration becomes laborious and difficult, with a sense of suffocation, and the heart intermits in its action, giving rise to intermission of the pulse, or is excited to violent palpitations. These symptoms are generally alleviated by the discharge of wind by *eructation*: this alleviation however, is only temporary; for the flatus again accumulates and re-produces the same effects. The generation of air in the stomach, in less degrees, is an ordinary concomitant of indigestion; but it generally passes off readily. Some people, indeed, acquire a habit of voluntary *eructation*, which, however, augments the malady. For, as Dr. Darwin justly observes, "when people voluntarily eject the fixed air from their stomachs, the fermentation of the aliment goes on the faster; for stopping the vessels which contain new vires, retards their fermentation, and opening them again accelerates it; hence where the digestion is impaired, and the stomach somewhat distended with air, it is better to refrain than to encourage *eructations*, except the quantity makes it necessary." (*Zoonomia*, Class i. 3. 1.) It has been suggested, and we think not incorrectly, that in the repeated voluntary attempts to dispel wind from the stomach, which are often continued or some length of time, the atmospheric air is often actually *swallowed*, and the disagreeable sensation of distension thus augmented.

When air passes from the lower orifice of the stomach into the intestines, or when, as is perhaps more common, it is generated from the fermentation or putrefactive changes of the alimentary matters in their course through the canal, other distressing symptoms are produced. The slightest affection of the bowels from flatulence is a sense of uneasiness, with a rumbling or gurgling noise in the belly, termed *borborygmus*. This, however, is sometimes sufficiently distressing, especially from drawing the attention of by-standers, and is not very uncommon in young women, about the age of puberty. "I attended a young lady about sixteen," says Dr. Darwin, "who was in other respects feeble, whose bowels almost incessantly made a gurgling

gurgling noise, so loud as to be heard at a considerable distance, and to attract the notice of all who were near her. As this noise never ceased a minute together for many hours in a day, it could not be produced by the uniform descent of water, and ascent of air through it, but there must have been alternately a retrograde movement of a part of the bowel, which must again have pushed up the water above the air; or which might raise a part of the bowel, in which the fluid was lodged, alternately above and below another portion of it, as might happen in some of the curvatures of the smaller intestines, the air in which might be moved backward and forward like the air-bubble in a glass level." (Loc. cit.)

The colic, which is occasioned by flatulence, (the *windy colic*, or *colica flatulenta*.) arises from partial collections of air, probably pent up by partial spasmodic strictures, especially in the *colon*, or great gut. The distensions, in such cases as Hoffmann has remarked, are most frequently obvious in the right or left hypochondrium (under the short ribs), on account of the curvature of the bowel in those parts, by which the more ready passage of its contents is impeded: and such distensions, he adds, have been mistaken by persons ignorant of anatomy, for tumours of the spleen. Large and painful tumours are also sometimes observed, above the spine of the right ilium, which are augmented by flatulent food. Hoffmann assigns their seat to the head of the colon, which is capacious and muscular for the purpose of propelling the feces upwards, and which has been occasionally seen to much distended, as to push forward the integuments, with considerable pain, and to be in danger of being ruptured. The nature of such tumours may be learnt from the relief to the pain and diminution of the swelling, which follow the emission of flatus, or the copious discharge of a tenacious matter, by vomiting or by stool. A great distension of the colon occasions very similar distressing symptoms, to those which arise from distension of the stomach, from the pressure produced on the surrounding organs. Hoffmann observes, that pains in the loins, intermission of the pulse, œdematous swellings of the feet, &c. originate often in flatulent distensions of the bowels, compressing the great vessels and nerves. (Hoffmann, Med. Rational, sect. i. cap. v. § 57.) See COLICA.

Sometimes the whole abdomen is enlarged by the general distension of the bowels with air, accompanied by constipation. When this distension has been of some duration, a degree of paralysis of the muscular fibres of the intestines is produced, their power in expelling the wind is lost, and the integuments of the abdomen become tense, like a drum; the patient becomes emaciated and tabid. This disease is called *Tympanites*; which see.

For the relief of flatulence, (the radical cure, as we have already observed, can only be effected by curing the debility of the stomach and bowel,) a number of medicines have been devised, from a very early period of time, especially such as are comprehended under the appellation of *Carminatives*, (which see). These are generally substances possessing strong sensible qualities, which render them instantaneously stimulant to the nervous system; and by suddenly exciting the muscular coat of the stomach to action, enable it to overcome the distension, and dispel the distending gas. The aromatic vegetables, containing much essential oil, such as juniper berries, the seeds of anise, caraway, and coriander, the roots of ginger and zedoary, and the waters distilled from these, are among the most esteemed carminatives. To these may be added other stimulant and antispasmodic medicines; such as assafo-

tida, and other strong smelling gums; volatile alkali; opium, ether, &c. Warm fomentation externally to the region of the stomach has been recommended by Dr. Darwin, and other external remedies were employed by Dr. Whytt; especially frictions on the region of the stomach, with liniments composed of the warm oil; such as the expressed oil of nace, oil of mint, &c.; and also the application of large plasters to the belly, made with the stimulating gums and gum-resins. He considered ether and opium, however, as the most effectual remedies for flatulence. Dr. Darwin recommends "ten corus of black pepper swallowed whole after dinner, that its effects may be slower and more permanent," in the horborygms of young women. We have seen them suspended by any substance, taken into the stomach, as a piece of dry biscuit, which, by the way, the late Dr. Buchan considered "as one of the best carminative medicines," and recommends it for all complaints of the stomach, arising from flatulence and indigestion. These disorders are often particularly troublesome when the stomach is nearly empty, and perhaps the operation of a biscuit taken at such times is merely that of relieving this temporary vacuity, which any other light aliment would effect.

As the proper digestion of the food is much aided by a regular motion and discharge of the excrementitious portion of it downwards, wherever the bowels are constipated, particular care should be taken to obviate this tardiness of their action, by conjoining stimulant laxatives with the dispersers of wind. Hence pills, consisting of aloes, calomel, or rhubarb, combined with assafoetida, ginger, &c. may be advantageously administered. To these means the general remedies for indigestion should be added, as well those which strengthen the constitution at large, as those which give vigour to the stomach in particular; such are especially the aromatic bitters, preparations of steel, and exercise. And the diet should be selected from those materials which do not readily pass into the vinous or acetous fermentation, and which are easy of digestion: hence greens, peas, beans, and other similar vegetable matters should be avoided, as well as liquors which are in a state of active fermentation, and consequently disengaging elastic air; and particular attention should be paid to moderation in eating and drinking, so that the digestive powers may not be oppressed and overcome. For, as we have already observed, when speaking of DIET, excess in quantity is, in general, much more productive of injury, than any unwholesome quality in the articles of food which we use.

FLATULENT, something that has a relation to flatuluses, or blasts of wind.

Peas, and most kinds of pulse, onions, &c. are flatulent foods.

FLAT-WORKS, in *Mining*, signify small pipe-works or bodies of ore, which, instead of being deposited in a rake or straight vertical fissure of the rock, is found in an horizontal position, or nearly so, between the beds of stone, or sometimes in the substance of the stone itself, according to Mr. W. Martin; this kind of mine is very rare in Derbyshire.

FLAVEL, JOHN, in *Biography*, a celebrated English divine, was born in Worcestershire about the year 1627. He was educated at the University-college, Oxford, where he took his degree of B. A. In 1650, he settled as assistant minister to Mr. Walpole, rector of Duptford in Devonshire, and shortly after succeeded to the rectory, which, however, in 1656, he resigned in order that he might enlarge the sphere of his usefulness, by becoming minister of a very populous parish at Dartmouth; though the spend in this situation was much less advantageous than that which he had

left. In 1662, [he] was among the number of ejected ministers, for refusing the terms proposed by the act of uniformity. He did not, however, entirely separate himself from his people, but preached and administered the sacrament privately, till the passing of the Oxford act in 1665, which prohibited non-conforming ministers from residing within five miles of any city, corporate town, &c. or any place where they had preached. Mr. Flavel was now obliged to retire to Slapton, a village five miles from Dartmouth, where he preached to those who durst venture to become his auditors, and sometimes he visited his former people, but this required the greatest care on his part to avoid that persecution which would unquestionably follow the violation of the law. His zeal in some instances led him to the exercise of his talents at a hazard of his safety; once in a wood about three miles from Exeter, a congregation assembled to hear him, but he had scarcely begun when a party, sent for the purpose, surrounded the place of meeting, and it was with the utmost difficulty he escaped; others who were supposed the leaders were apprehended and heavily fined. Those who were more fortunately circumstanced, remembering the admonition, "that if persecuted in one place they should flee to another," accompanied their preacher to an adjoining wood, where he preached without molestation. In 1685, the mob was excited against him, and would probably have destroyed him, had he fallen into their hands; to avoid therefore the threatened evil he came to London. Here, however, he was not long safe; in one instance while a number of persons were assembled, a party of soldiers broke in upon them, and though Mr. Flavel again escaped, yet an aged minister, Mr. Jenkins, fell into their hands, and was thrown into Newgate, where he suffered so much hardship, as speedily to terminate his life. After some stay in the metropolis, he returned to Dartmouth, where, a prisoner in his own house, he was useful in affording private instructions to those who resorted to him for the purpose. In 1687, when king James assumed the right of dispensing with the laws, and granting more liberty to non-conformists, Mr. Flavel's congregation immediately obtained for him a large place, in which he was enabled to exercise his ministerial functions; and by the revolution in 1688, he was permitted to do that by law which he had performed before by connivance. He died at Exeter in 1691, in his 54th year, having long possessed, in an eminent degree, the respect and esteem of all good men. He was a man of exemplary piety, and his various works were once much read, and are still regarded by those who hold Calvinistic sentiments. They were collected after his death in two volumes folio. Calamy's Ejected Ministers.

FLAVERIA, in *Botany*, from *flavus*, yellow, because it is used in dyeing that colour by the inhabitants of Chili. Juss. 186. (Eupatorio-phalaeron, n. 5; Vaill. Act. Ed. Germ. 598.)—Class and order, *Syngenesia Polygamia-equalis*. Nat. Ord. *Compositae discoidae*, Linn. *Corymbifera*, Juss.

Gen. Ch. *Common calyx* oblong, of three or four equal, cohering, obtuse, ribbed, unarmed scales. *Cor.* compound, uniform, discoid; florets few, all uniform, perfect, fertile, monopetalous, funnel shaped, with a regular, five cleft, spreading border. *Stam.* Filaments five, capillary, short; anthers united into a cylindrical tube, prominent. *Pist.* Germen slender; style thread-shaped; stignas slender, bluntish, spreading, projecting beyond the anthers. *Peric.* none, except the folded leaves of the permanent calyx. *Seeds* solitary, oblong, striated, naked. *Recept.* very small, naked.

Eff. Ch. *Receptacle* minute, naked. *Down* none. *Calyx* of five equal, ribbed, pointless, at length folded, leaves.

Florets few, tubular. Seeds striated, enfolded in the calyx.

1. *F. capitata*. Juss. MSS. Flowers in aggregate corymbose heads.—(Ethulia bidentis; Linn. Mant. 110. Willd; Sp. Pl. v. 3. 1741. See ETHULIA.—Eupatorioides falicis folio trinervi, flore luteo, vulgo Contrahierba; Feuill. Pl. de Perou & Chili, 18. t. 14.)—Native of Chili, where it was gathered by Feuillée, who mentions its affording a fine yellow dye, if boiled in common water; and subsequently by Mr. Menzies, to whom we are obliged for a specimen in ripe fruit. It has been cultivated in the royal garden at Paris, whence we received a specimen in flower by favour of M. de Jussieu, marked with his own specific name as above. This is precisely the same as the *Ethulia bidentis* of the Linnæan herbarium, whose native country was never before ascertained.—The root is fibrous, and appears to be annual. *Stem* from one to two feet high, erect, straight, angular, striated, smooth, often purplish, solid, leafy, with several opposite, straight, spreading, forked branches. *Leaves* opposite, stalked, spreading, lanceolate, acute, three-ribbed, smooth, with numerous incurved serratures. *Footstalks* dilated at the base, and clasping the stem. *Flowers* terminal, yellow, numerous, in a sort of compound corymbus, very ill-drawn by Feuillée. The ultimate stalks are each a sort of compressed rachis, on which the flowers are ranged alternately, in a spiked manner, with a bractea under each, and several such stalks combine to form a dense level-topped head. All the parts of the inflorescence and flower are smooth, except a few hairs now and then at the edges of the principal stalks. When in fruit, the whole assumes a pale hue, the calyx becomes gibbous, containing rarely more than one grey, slender, obovate, neatly ribbed seed. The inflorescence of this plant greatly resembles that of *Valeriana Cornucopia*, and some others of the same genus.

2. *F. spicata*. Juss. MSS. Flowers in compound spikes. Gathered by the unfortunate Dombey in Peru; see DOMBEY. One of his specimens was given us by M. de Jussieu, with the name we have adopted, and a very fine one was found, without any mark, in the herbarium of the younger Linnæus. This species has altogether the aspect of a *Solidago*; but the stem is shrubby, with many round, or slightly angular, roughish, leafy and flowery branches. *Leaves* opposite, stalked, lanceolate, narrow, smooth above; with three ribs, which are rough beneath; and a few shallow distant serratures. *Spikes* very numerous, opposite, lateral and terminal, with innumerable little, yellow, crowded, sessile, bracteated flowers, whose calyx-leaves are fringed, roughish and very obtuse. *Florets* about three. *Seed* shaped like the last, but smaller, blackish, and with scarcely more than four angles or ribs. The flavour of the plant is slightly bitter and aromatic. S.

FLAVIA CÆSARIENSIS, in *Ancient Geography*, a province of Britain, which extended over the whole breadth of the island where it is broadest, from the Land's End in Cornwall, to the South Foreland in Kent; and was bounded on the S. by the English channel, on the N. by the Bristol channel, the Severn, and the Thames. It comprehended the countries of the Damnonii, Duretriges, Belgæ, Atrebatii, Regni, and Cantii; which are now Cornwall, Devonshire, Dorsetshire, Somersetshire, Hampshire, Wiltshire, Berkshire, Surrey, Sussex, and Kent. This province was not first established, but the countries comprehended in it made a part of the one province in Britain, from the time when they were subdued, to the reign of the emperor Severus. When that emperor divided the Roman territories in Britain into two provinces, these countries

made

made a part of the southern one, and so continued until Constantine the Great formed them into a distinct province, which was called Flavia Cæsariensis, from Flavius, one of the names of that emperor. The other four provinces were Britannia Prima, Britannia Secunda, Maxima Cæsariensis, and Valentia. Britannia Prima was probably so named because it contained some of the countries which first submitted to the Romans, in this island. This province was bounded on the south by the Thames, on the east by the British ocean, on the north by the Humber, and on the west by the Severn; and comprehended the countries of the Dobuni, Cattivellauni, Trinobantes, Iceni, and Coritani; which are now Gloucestershire, Oxfordshire, Buckinghamshire, Bedfordshire, Hertfordshire, Middlesex, Essex, Suffolk, Norfolk, Cambridgeshire, Huntingdonshire, Northamptonshire, Leicestershire, Rutlandshire, Lincolnshire, Nottinghamshire, and Derbyshire.

Britannia Secunda perhaps received that name, when Severus divided the Roman dominions in Britain into two provinces, of which this was the second. It was bounded on the south by the Bristol channel and the Severa, on the west by St. George's channel, on the north by the Irish sea, and on the east by Britannia Prima. This province contained the countries of the Cornavii, Silures, Demetæ, and Ordovices, which are now Warwickshire, Worcesterhire, Staffordshire, Shropshire, Cheshire, Herefordshire, Radnorshire, Brecknockshire, Monmouthshire, Glamorganhire, Caermarthenshire, Pembrokehire, Cardiganhire, Montgomeryshire, Merionethshire, Caernarvonshire, Denbighshire, and Flintshire. For an account of the other two provinces, see MAXIMA CÆSARIENSIS and VALENTIA.

FLAVIANO, ST. a town of Naples, in Abruzzo Ultra, near the Adriatic; 12 miles N. E. of Teramo.

FLAVIANUS, in *Biography*, patriarch of Antioch in the fourth century, is distinguished for his zeal in opposing Arianism. Upon the death of Meletius, he was elected his successor, in the year 381, by the suffrages of the council of Constantinople, notwithstanding Paulinus, the colleague of Meletius, was still living, and that Flavianus himself had formerly sworn not to consent to the election of any successor to Meletius during the life of Paulinus. His election caused a considerable schism in the Christian world. The western bishops declared themselves on the side of Paulinus, and the greater part of the eastern bishops defended the rights of Flavianus. The death of Paulinus, and the prudent conduct of Flavianus, put the latter in quiet possession of his situation. After this he signalized himself in defence of orthodoxy, and in persecuting the heretics; he entitled himself to the gratitude of the citizens of Antioch by his successful interposition on their behalf at the court of Constantinople, when they had incurred the emperor's displeasure, and dreaded his resentment. For during the course of a popular tumult, occasioned by the imposition of a new tax, various outrages had been committed, and the statues of the emperor Theodosius and his empress were overthrown. The most exemplary vengeance was threatened, but, by the eloquent intercessions of the patriarch, pardon was obtained for the offenders. The address which he delivered on this occasion was said to have been composed by St. Chrysostom, who thought very highly of Flavianus, as one of the greatest ornaments of the church. Flavianus died in the year 404. He published some epistles and some homilies. *Moreri*.

FLAVIANUS, patriarch of Constantinople in the fifth century, was elected to that dignity in the year 447. An unfortunate misunderstanding took place between Flavianus and Chrysothimus, the first chamberlain and favourite of the

emperor, which terminated in the ruin of the patriarch. He was deposed and banished; and, unable to sustain the feverities inflicted on him, died in 450, at Hypæpa in Lydia, the place of his exile. Flavianus was the author of "Two Letters" to pope Leo, which are extant in the fourth volume of the "Collectio Conciliorum;" and also of "A Declaration of Faith delivered to the Emperor Theodosius." *Moreri*.

FLAVIGNAC, in *Geography*, a town of France, in the department of the Upper Vienne; 12 miles S.W. of Limoges.

FLAVIGNY, VALERIAN DE, in *Biography*, a French ecclesiastic, was born at Laon early in the seventeenth century. He was admitted to the degree of doctor of divinity by the faculty of the Sorbonne in the year 1628, and shortly was made canon of Rheims. In the year 1630 he was nominated professor of the Hebrew language in the college-royal of France, and discharged the duties of that office with high reputation. In 1656 he became dean of the college-royal, and died at Paris in 1674, at an advanced age. He was esteemed very learned in theology and the oriental languages, but was distinguished by much violence of temper and a very bitter spirit, which he displayed on many occasions. In 1663 he lodged a formal complaint before the faculty of the Sorbonne, against a thesis that had been maintained by the jesuits of the college of Clermont, the object of which was to prove, that as the doctrine of Copernicus was contrary to scripture, condemned by the Vatican, and anathematized by the inquisition of Rome; it was decidedly inconsistent with the faith of the church, and ought not to be defended in France. M. Flavigny, in answer to this, attempted to prove that the thesis went to violate the rights of the king and kingdom, and to set at naught the authority of parliament. He engaged in many other disputes, but his controversies relative to the Polyglott published by M. le Jay, and the purity of the Hebrew text, is his most important work. It is known by the title "Epistolæ de Heptaplis Parisiensibus." *Moreri*.

FLAVIGNY, in *Geography*, a town of France, in the department of the Côte d'Or, and chief place of a canton, in the district of Semur, seated on the Ozerain; 27 miles W.N.W. of Dijon. The place contains 1305 and the canton 12,392 inhabitants, on a territory of 300 kilometres, in 23 communes.

FLAVIOBRIGA, in *Ancient Geography*. VERMEO or BERMEO, a town and colony of Spain, in the Tarragonensis, situated on the coast, at the bottom of a small gulf, in the country of the Autrigones; called also, according to Pliny, AMANUM PORTUS.

FLAVIONAVA, or FLAVIUM, a town of Spain, in the Tarragonensis, in the territory of the Pœnici, according to Ptolemy; situated on the sea coast in the country of the Cantabri; supposed to be the modern SANTANDER.

FLAVIOPOLIS, a town and colony of Thrace, which, according to Pliny succeeded the ancient Zela, and not far from Byzantium. It derived its new name from Vespasian and Titus, who were of the Flavian family.—ALBA, a town of Asia, in Bithynia; called also Cærea and Cæstia—ALBA, a town of Asia, in Cæcia, situated at the foot of mount Taurus, and near the sources of the Calveaders, probably the Flaviada of the Itinerary of Antonine, who marks it on the route from Cæstia of Cappadocia to Anazarbe.

FLAVIUS, in *Biography*, patriarch of Constantinople, the immediate successor of Acacius, was raised to that high dignity, from the situation of protector of the church of St. Thecla, by means of a stratagem, which the superstition of Zeal furnished him with an opportunity of practising.

practising. The prince, on the death of Acacius, deposited on the altar of the great church a blank letter, sealed with his own seal, and accompanied with a writing, in which he and the whole church bound themselves to choose such a person whose name should be found written within the blank letter. The church was shut up, and all the avenues carefully guarded by night and by day. Forty days fasting was enjoined, during which prayers were offered up to the Almighty, that he would be pleased to direct an angel to inscribe in the letter the name of the person most adapted to the office. Flavitas bribed the soldiers or their commander, broke the seal, and inscribed his own name. Such, however, was his renown for piety, that no suspicion of fraud fell upon him, and when it was found that his name had been written by an heavenly hand, he was with loud acclamations proclaimed bishop of Constantinople. His hypocrisy was of little avail, though it cheated the foolish emperor and his superstitious court, for he had no arts to ward off the hand of death, to whose summons he yielded in a few weeks after his advancement. The fraud was now discovered; the estate of Flavitas was confiscated, and the person participating in the villainy was condemned to die. *Morevi.*

FLAUTINO, *Ital.* a small, or octave flute.

FLAUTO, *Ital.* a flute.

FLAW, at *Sea*, signifies a sudden gust of wind, otherwise called *squall*.

FLAX, in *Botany*. See LINUM.

FLAX, *Carolina*. See POLYPREMUM.

FLAX, *Purging*. See LINUM *Catharticum*.

FLAX, *Toad*. See LINARIA and ANTIRRHINUM.

FLAX, *Barard-toad*. See THESIUM.

FLAX, in *Agriculture*, is the name of a plant cultivated equally for the bark, or covering of its stalk, and its seed; the former being used in making linen cloth, and the latter for oil which is drawn from it by pressure, and for the refuse or cake. The stem of the plant, which is round and hollow, grows to the height of about two feet, and then divides into several branches; these are terminated by blue flowers, consisting of five petals, and are succeeded by capsules divided within, into ten cells, in each of which is enclosed a bright, slippery, elongated seed. The leaves are long, narrow, sharp-pointed, and placed alternately along the stem and branches of the plant.

Soil. The most proper sort of soil for flax is a deep, free loam, such as is not liable to become too much charged with moisture, or too dry; but which has been rendered fine by tilth, such as those situated in a valley bordering upon water, or as is thrown up by rivers. If there be water at a small depth below the surface of the ground, it is thought, by some still better, as is the case in Zealand, which is remarkable for the fineness of its flax; and where the soil is deep and rather stiff, with water almost every where, at the depth of a foot and a half, or two feet, underneath it. It is said to be owing to the want of this advantage, that the other provinces of Holland do not succeed equally well in the culture of this useful plant; not but that fine flax is also raised on high lands, if they have been well tilled and manured, provided the seasons are not very dry and unfriendly to its growth in that way.

It has been remarked, in the papers of the Dublin Agricultural Society, that moist stiff soils yield much greater quantities of flax, and far better seed, than can be obtained from light lands; and that the seed secured from the former may, with proper care, be rendered full as good as any that is imported from Riga or Zealand. M. du Hamel, however, thinks that strong land can hardly yield such fine flax

as that which grows on lighter grounds. With due pulverization and preparation, there can be no doubt but that strong lands will afford excellent crops of good flax. It is seldom that either light sandy or gravelly soils answer well for crops of this kind. Land for flax should neither be in too great a state of fertility, or be too much exhausted, as in the former case the flax is liable to become too luxuriant, and the produce in consequence of it, of a *coarse* quality; while under the latter circumstance the quantity of produce is very small.

It has been stated by Mr. Donaldson, that flax is sown after all sorts of crops, but is found to succeed best on lands lately broken up from grass. And that in Scotland, the most skilful cultivators of flax generally prefer lands from which only one crop of grain has been taken, after having been several years in pasture. When such lands have been lined or marled, immediately before being laid down to grass, the crop of flax seldom or never misgives, unless the season prove remarkably adverse to it. It succeeds in general better after green crops, than those of the grain kind.

Preparation. The land, in order to render it fit for the growth of this sort of crop, requires to be rendered perfectly fine and mellow, by being repeatedly ploughed over, and broken down by severe harrowings. Where grass land is to be broken up for this crop, it should be done in the autumn, and left exposed to the influence of the atmosphere, until the early part of the following year, when it should be well pulverized and broken down by heavy harrowing, then in the course of a week or two ploughed again, in which state it may remain till the period of putting in the seed, when another light harrowing should be given, and the ploughing performed afterwards by a very light furrow. But in cases where the crop is sown after grain, or other crops that have the property of keeping the land clean from weeds, the first ploughing need not be given till January, when it may remain in that situation until it becomes pretty dry in the early spring, being then well reduced by good harrowing and rolling; and after continuing in that state about a fortnight, the seed may either be immediately put in, or another light ploughing and harrowing be first given.

Seed.—With regard to the choice of seed, the same writer states that, that which is of a bright brownish colour, oily to the feel, and at the same time weighty, is considered the best. Linseed, imported from various countries, is employed. That brought from Holland is however in the highest estimation, as it not only ripens sooner than any other that is imported, but also produces greater crops, and flax of that quality which best suits the chief manufactures of this country. American seed produces in common fine flax; but neither the quantity of flax, nor of the pods, provincially the “boils” which contain the seeds, is so large as the produce from Dutch linseed. The Riga seed yields a very coarse sort of flax, but a greater quantity of seeds than any other. It is common in some parts of Scotland to sow seeds saved from the crop the preceding year, especially when the crop was raised from seed imported from Holland. The success of this practice is found to depend greatly on changing the seed from one sort of soil to another of an opposite nature; but the saving in the expense of purchasing that sort of seed, in place of what is newly imported from Holland, is so inconsiderable, and the risk of the crop misgiving, so much greater in the one case than in the other, that it is supposed those only who are ignorant of the consequences, or who are compelled from necessity, are chargeable with this act of ill-judged parsimony in the business.

The cultivators of flax in Ireland prefer the American seed for the lighter and more elevated exposed lands; but the Baltic or Dutch for those which are of a heavier quality. The seed of home produce is often sown for white flax in Yorkshire; but the Baltic sort is mostly preferred where feed is the object; which for the ensuing year, and one or two afterwards, is found to answer as well as white-flax. But it is highly probable that if that which has been collected from the perfectly ripened seed of our own growth be made use of, it will be equally productive in both the flaxy substance and the quantity of seed, and the former be equally valuable for all the purposes of the manufacturer.

Proportion of Seed.—In respect to the quantity of seed used, it varies in different places according to the circumstances of the soil, the methods of sowing, and the uses to which the crop is to be applied; but from two bushels, to two bushels and a half, the English statute acre, is the ordinary allowance. In determining the proper quantity necessary for the acre, it is requisite to pay great attention to the condition of the land. When the land is rich and fertile, and the season so favourable that it can be got thoroughly pulverized, if too much seed is sown the crop is in great danger of lodging; and when that happens, particularly before the pods are formed, the flax proves inconsiderable in quantity, and very inferior in quality. When cultivated in the drill mode at narrow distances, a much less quantity will be sufficient than in other cases; and where the intervals are large, scarcely one half the quantity is required. When the crops are intended for feed, in whatever manner the sowing is performed, much less will be necessary, than where flax is the main object of the grower.

Time of Sowing.—It may be observed, that this must depend much upon the soil and situation, but that the ordinary season of sowing flax-seed is from the middle of March to the middle or end of April; but the last week of March, and the first ten days of April, are esteemed the best times; and, accordingly within these periods the greatest quantity of flax-seed is sown in this country. In the county of York, where this sort of crop is grown on land broken up from grass, the seed is commonly sown before the second week in April, where it can possibly be done; while on such lands as have been in a previous state of tillage, the sowing is frequently deferred a week or ten days longer. Wherever it can be safely practised, early sowing has the advantage of getting the flax plants to cover the surface of the land well, before they can run much risk of injury from the rising of weeds, or the parching effects of heat.

In some of the southern counties of Europe, however, the husbandmen who raise flax sow part of their seed in September and October; so that the plants which spring from thence remain of course in the ground all the winter; and this may be a judicious practice in those places, because plants which have not covered the earth well before the summer heats come on, are apt to be parched by the heat and drought which usually prevail in that season. They sow linseed again also in the spring; but the latter does not yield so large a crop; the flax, however, which it produces is more esteemed, because it is finer than that sown in autumn. M. du Hamel seems indeed to think, that the autumnal sowing yields the best seed; but, however that may be, in places where the winter is apt to be severe, and where the flax, which is but a tender plant, would in course be in danger of being destroyed during that season, almost all the flax is sown about the end of March, or in the beginning of April, as already stated.

It may be laid down as a general rule, that the land which is intended for flax crops should be brought to an exceeding fine tilth, in the way directed above, before the seed is put in; and that it should be enriched by some sort of manure suited to the quality of the soil. Thus, when pasture lands are broken up, in order to their being sown with flax, they must be well wrought during several months, before they will be fit for producing such crops, in the manner just described. To defy the expense of this culture, some other crops may be got off the land in the mean time, especially of such plants as do not occupy it long, and particularly of those which are remarkably benefited by frequent stirring of the earth whilst they grow; such as beans, pease, turneps, &c. because these repeated stirrings render the mould fine and looser, and help to kill the weeds, which would otherwise do great damage to the flax. It is asserted that the Livonians, when they clear wood-lands, burn the wood upon them, then plough them, and in this state prefer them to any other kind of soil for flax crops. If the land which is intended for flax be stiff, great care should be taken not to work it when it is wet, for fear of kneading it; but it is often an excellent plan to work it deeply before winter, when dry, laying it up in very high ridges, in order that the winter frosts may the more effectually moulder and loosen its parts. In the month of February, where the land is not too wet, some very rotten dung should be laid on, and immediately covered over with the mould. The seed should afterwards, at the proper season, be sown, and harrowed in with a light or bush-harrow, so as not to bury it too deep. As this, when young, is a very tender plant, and is more easily injured and checked in its progress by weeds than any other that is usually cultivated in the field, it is indispensably necessary that the danger of injury in this way should be well guarded against, in order to save future trouble and expense.

Methods of Sowing.—Where the principal object of the grower is flax, the most general method of putting in the crops is that of sowing them broadcast over the surface of the land. In performing the business, much care is necessary that the seed be dispersed as evenly as possible over the ground, to prevent the plants rising in an unequal or tufty manner. It should be afterwards covered in by regular harrowing, once or twice in a place, with a light common or bush-harrow, as just noticed, not covering it in too deep.

But where the seed constitutes the chief intention of the cultivator, it is contended by some that the drill mode is preferable, as requiring much less seed in sowing, and affording a much better and more abundant produce. Besides, the smallness and weight of the seed render it extremely proper for being drilled; and the crops can be kept clean with greater facility.

In this method, the distances of the rows or drills should vary according to the circumstances of the soil, and the manner in which the crops are to be kept clean. Where the hand-hoe is to be chiefly depended upon, narrow distances may be proper, as ten or twelve inches; but where the work is to be principally executed by the horse-hoe or cultivator, larger intervals may be more suitable, as those of eighteen or twenty inches. Slight harrowing and rolling are sometimes afterwards necessary, especially the latter in dry seasons.

It has been observed that thick sown flax runs up in height, and produces fine soft flax; but that when sown thin it does not rise to such a height, but spreads out more, sending off a greater number of side branches, which produce a great abundance of seed, which is much better fitted,

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more plump and heavy than that which is produced from thick sown flax crops. Flax crops cultivated in this way are not so liable to be beaten down in bad weather, the stems being stronger and better fortified by the more free admission of sun and air among them; and they are not so much exposed to danger in weeding or cleaning the rows.

After-Culture of the Crop.—Where flax crops are sown in the broad-cast method, they are seldom much attended to afterwards: it is, however, highly useful and necessary that they should have one good hand-hoeing, or weeding, as soon as ever the crop is sufficiently up; care being taken not to injure the plants by too much treading amongst them.

In the drill manner of sowing, the after-culture of the crops must be regulated by the distance of the rows; but they may in general be cleaned from weeds, and kept in vigorous growth, by proper implements and horse labour. The ground between the rows is mostly wrought by a proper horse-hoe, cultivator, or small hoe-plough, taking care that none of the mould is thrown against the rows; to prevent which, the intervals may be hoed with a triangular harrow, having a proper number of iron tines in it, and guided by two handles fixed behind. By these handles the tines are made to go deeper or shallower at pleasure; and if the intervals are cultivated with this instrument, beginning before the earth is become stale, and while the weeds are small, the land may be kept very clean, and in fine tilth, at much less expence than by hand-hoeing: for one horse is sufficient for this work. A great deal may be done in a day; and by a frequent repetition of the hoeings, especially when the earth is dry, the weeds may be so effectually kept down, as never to rise to any height. But the rows must be weeded by hand.

With some it has been a custom to sow, with their linseed, either annual or perennial grass-seeds, when they intend to lay the land down for pasture after the crop is taken off. But as grass plants grow but weakly under the flax, it is a practice by no means to be recommended. No other sort of crop should, however, be ever grown with this, as much injury may be done by it.

Flax is sometimes damaged by insects, when it is about three or four inches high. These, it is said, may be destroyed by a slight strewing of soot, ashes, &c. over the crop. At all events, this dressing will give vigour to the flax, though it may not kill the insects.

If any weeds appear afterwards among the flax, as is almost always the case, they must be thoroughly rooted out; and that the flax may be as little damaged as possible in the doing of this, the weeders should work as carefully as possible.

The finest flax is most liable to be laid, particularly in countries subject to storms. To guard against this accident, some people run across their flax-fields slender poles fixed to stakes; but a better method is to run small ropes across the field, both lengthwise and breadthwise, where necessary, for these being fastened where they intersect one another, and supported by stakes at due distances, form a kind of net-work, which is proof against almost every accident that can happen from tempestuous weather. These practices are, however, both troublesome and expensive, and are seldom or ever necessary where the crops have not been sown too thick on the ground.

Pulling the Flax.—Opinions are divided in regard to the degree of ripeness at which it is best to pull flax crops. Some think it should be pulled whilst it is green, in order that its fibres may be the softer and finer. Others, with the same view, pull it up before its seeds are quite formed.

And others, again, think that it should not be pulled till some of the capsules which contain the seeds have begun to open; being of opinion that the fibres of green flax are too tender, and that they fall into tow. On the other hand, it is certain that the fibres of flax which has stood till it is very ripe are always stiff and harsh, that they are not easily separated from the reed, and that they do not bleach well. Here, therefore, as in most other cases, both extremes should be avoided; and it consequently seems most reasonable to think, that the properest time for pulling flax is when its stalks begin to turn from a green to a yellow, when its leaves begin to fall, and when its seeds begin to be of a brownish colour.

Mr. Donaldson observes, that a crop of flax frequently grows short, and runs out a great number of seed-bearing branches. When that is the case, the seeds, not the flax, ought to be the farmer's chief object; and the crop should be allowed to stand till the seeds are in a great measure perfected. But that when the crop thrives, and is likely to become more valuable for the flax than the seeds, it should be pulled soon after the bloom drops off, and before the pods turn hard and sharp in the points. Whenever the seed is the main object, the crops should be perfectly ripened, which is clearly shewn by the points of the seed-pods turning hard and sharp, and the capsules beginning to crack. It usually takes place towards the end of July, or beginning of the following month.

Where the object is the flax, the crop is pulled up by the roots, and placed in small parcels, usually termed *beats*, upon the surface of the land, so as that it may be as fully as possible exposed to the benefit of the sun. It is afterwards tied up, in order to be conveyed to the place where it is to undergo the process of watering.

In the work of pulling the flax, it is usual, when it is intended to save the seeds, to lay it in handfuls, partly across each other: the reason for which is, that the business of *rippling* is thereby facilitated; as the rippers, in place of having to separate each handful from the bundle, find it, by this simple precaution, already done to their hand.

It may be further observed, that although it is of much importance, yet it very seldom happens, that much attention is bestowed to separate the different sorts of flax from each other, in pulling the crops. In most fields there are varieties of soils; of course, some parts of a field will produce fine flax, others coarse; some long, and some short; in a word, crops of different lengths and qualities. It cannot be supposed that all these sorts of flax will undergo an equal degree of watering, grassing, breaking, and heckling, without sustaining great injury. Therefore, when flax of various qualities is promiscuously mixed together in pulling, it is impossible to prevent some part of it from being lost in the after-management; a loss which might be avoided with a small share of attention, and some additional trouble when the crop is pulled. Those who rent flax-mills are often blamed for embezzlement; but, there is reason to believe, very unjustly. Because the crop of a particular part of a field yields such a quantity of flax from one mill, it does not follow that the manager of another mill should return an equal quantity from the same space, probably, of very inferior land. It is certain, in very many cases, that the inattention of flax-farmers to the above very necessary precaution is the cause why crops of flax often turn out of so little value, and is the principal reason why the proportion of tow or inferior flax so often exceeds, in ordinary seasons, that of superior quality; the millers and hecklers being obliged, in the course of their operations, owing to the mixed state in which they receive the crop from the

grower, to reduce the quality of the whole to a lower standard than there would be any occasion for, were the different qualities sorted, and put into their hands in that state.

As the flax is pulled, when for seed, it is, as has been observed above, laid together by handfuls, with the seed-ends turned to the south. These handfuls should neither be quite in a line with each other, nor directly across, but a little slanting upwards, so that the air may easily pass through them. Some, instead of this method, tie the handfuls of flax loosely at the top, then spread out their roots, and thus set several of them together upright upon their roots. In either of these ways the flax is generally left twelve or fourteen days in the field to dry it. This drying is certainly not necessary for the rippling, because the ripple will separate the capsules from the flax as effectually before it has been dried as it will afterwards; and if it be done with a view to ripen the seed, it should be considered, that the flax will be more hurt by the longer time of steeping, which will become necessary in consequence of this drying, than the seed can be benefited; because the more the substance or membrane which connects the fibres to the seed is dried, the greater must be the degree of putrefaction necessary to loosen and destroy the cohesion of this connecting medium or membrane: the finer parts of the flax itself must necessarily be destroyed by this degree of putrefaction; and if the putrefaction does not arise to such a degree as to destroy the cohesion of this substance or membrane, the fibres of the flax will adhere so strongly to the seed, that the force necessary in scutching will prove equally detrimental to the flax. The practice adopted in some parts of Brittany seems therefore much more rational, which is, to ripple the flax after it has lain in the air two or three days; but even one day will be sufficient if the weather is dry. In fact, it is the best method to do it as soon as possible after the flax has been pulled.

Rippling the Seed.—In order to ripple, or force off the seed-capsules of the flax, which is the next operation, a large cloth should be spread on a convenient spot of ground, with the ripple placed in the middle of it. This is a sort of comb, consisting of six, eight, or ten long triangular teeth, set upright, so as to have the angles approaching pretty near each other, by which the parts containing the seed are removed from the flax. In performing the business, the pods containing the seeds are forced from the stalks by means of this iron-comb, which is called a *ripple*, and which is firmly fixed on a beam of wood, on the ends of which two persons sit, who, by pulling the seed-ends of the flax repeatedly through between the teeth of this comb, execute the operation in a very complete manner, and with great dispatch.

After the flax has been rippled, the seeds and pods thereby obtained should be spread out thinly upon a cloth in the sun to dry and harden. Those seeds which separate from the pods of their own accord are the fullest and ripest, and should therefore be set apart for sowing, in case the precaution of raising some flax purposely for seed has not been attended to. The pods or capsules are then broken, either by lightly treading, or by threshing, in order to get out the remaining seeds, the whole of which, as well as the former, should be carefully sifted, winnowed, and cleaned from dirt and chaffy matter. When the seed is laid up, which should be immediately done, it must be frequently stirred and ventilated, to prevent its heating.

This second sort of seed affords a considerable profit by the oil which it yields, and also by being used when broken for fattening of cattle. The cakes of linseed, after the

oil has been pressed out of them, are likewise found to be useful for this last purpose, though they are thought by some to render the fat of cattle yellow; for which reason it is advised not to give it them till within a few weeks before the beasts are to be killed. They are likewise of great utility as a manure, but from the expence can seldom be employed in that way with advantage. See OIL-CAKE.

It has been remarked by the author of the "Present State of Husbandry in Great Britain," that those who bestow most attention on the cultivation of flax in Scotland, generally ripple off the seed, even when there is no intention of saving it; as it is found, when flax is put into water without taking off the pods, the water soon becomes putrid, in consequence of which the flax is greatly injured. This imperfectly ripened seed is improper for being sown, but may be expressed for the oil. But when it is proposed to save the seeds of flax, the pods are carried home from the field as soon as they are separated from the flax; and either laid on cloths, and exposed to be dried by the influence of the sun; or they are spread on barn-floors and turned two or three times a day, till they are so dry that the seeds can be easily threshed out in the ordinary way. This is the general mode adopted in Scotland. But in Dorsetshire till the pods become so dry, that the seeds can be threshed out with a sick; which is done on a board, or log of wood, placed in the field for the purpose. It is likewise the practice with some expert flax growers, where the chief object is the seed, to set it up, after being tied up into sheaves, in the manner of corn, and, when thus rendered perfectly dry, to stack it until the spring following; at which time, by placing the tops of the sheaves so as to incline towards each other, and making use of a roller, the seed is readily forced out. It is supposed that in this mode more time is allowed in the after-management of the produce.

It may be stated, that the quantity of seed produced on the statute acre is generally from six to eight, but sometimes as high as ten or twelve bushels; and that the price depends in a great measure on that of foreign seed imported; as, when sold to oil-makers, it is generally about one-half of that of Dutch seed, sold for the purpose of sowing. The price of home-cultivated linseed is considerably advanced of late in some of the southern and western counties of the kingdom, in proportion to what it is in those of the northern, owing to the circumstance of its being much used as food for fattening cattle. The average price of the linseed cultivated in the kingdom at large cannot, it is supposed, be rated higher than from three to four shillings the bushel. It has, however, lately been considerably higher.

Watering.—This is the next operation that becomes necessary with this sort of produce. The intention of this process, is that of inducing the separation of the flaxy material, by exciting a slight degree of fermentation in the substance which attaches it to the stem of the plant. It is accomplished in two ways, namely, by steeping the flax in water; and exposing it to the action and influence of the atmosphere. The former is the most common and safe method; the latter being less certain and exact in producing the necessary changes. The first mode is termed *water-retting*, and the last *air-retting*.

In *water-retting*, when the flax has been cleared from the seed, it is loosely tied up into small bundles, and put into pools or ponds of soft stagnant water, where it is suffered to continue several days, according to the natural warmth of the water. As soft clear stagnant water has

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been found by long experience to be superior for this purpose to any other, where that cannot be obtained without art, a pit or canal may be formed adjoining a river or stream, whence water can be readily brought. This pit or canal is filled with water for some time (a week or two) before it be proposed to pull the flax: by this means the water acquires a greater degree of warmth than river-water possesses, and which contributes greatly to facilitate the object farmers have in view in immersing green flax in water, namely, to make the harl or flaky substance part easily and completely from the boon or reed.

With respect to the period that flax ought to remain in the water, it depends on various circumstances; as the state of ripeness in which it was pulled, the quality and temperature of the water, &c. The most certain rule by which to judge when flax is sufficiently watered is, when the boon becomes brittle, and the harl separates easily from it. The method of depositing the flax in the water is in general that, after having it tied in small bundles, often at both ends, of placing it in a sort of square bed, the bundles being laid lengthways and crossways of each other, so as to bind firmly together; the whole is kept down by having a weight laid upon it. Some, however, instead of this mode, have the small bundles set in an erect position, the tops of every layer, except the lowest, being upwards; and in place of keeping them down by the application of heavy weights, they use sods or earth, treading the whole down occasionally, once or twice at first in the course of the day, so as to keep the whole below the surface of the water, as, where the contrary happens, the flax is greatly injured by being rendered black. The first is, most probably, the best mode of management.

When the flax has remained the proper length of time in these pits, it is taken out by means of a tool called a drag, and deposited in a straight manner on the sides or banks of them, in order to its becoming in some measure dry, and in a state for being spread out on the grass.

With regard to *dew-resting*, although it is in general the practice, where flax is cultivated in this country, to immerse it in water for some time after it is pulled, yet in Dorsetshire, and the neighbourhood, it is seldom done. There the flax is allowed to arrive at that state in which the harl parts most easily from the boon or reed, by a more gradual process, that of ripening or producing the necessary putrefaction, by the action and influence of the dew, which is nothing more than exposing the flax to the influence of the weather, thinly spread out upon a grass field for a longer period than is necessary, when the operation of watering has been previously performed. When the flax has been so long exposed as to be judged sufficient for effecting the separation of the harl, nothing more is requisite than putting it up in parcels, or bundles, in order to its being broken and scutched.

Grassing.—After steeping the flax, where the watering method is pursued, the only other operation which properly falls under the farmer's attention is grassing it. For this purpose it is commonly spread very thin on the ground, and in regular rows; the one being made to over-lap the other a few inches, with a view of preventing, as much as possible, its being torn up and scattered by gales of wind. Old grass-ground, where the herbage does not grow to any great height, is the best for the purpose; as, when the grass or weeds spring up so as to cover the flax, it is frequently rotted, or at least greatly injured thereby.

Flax is allowed to remain on the ground, being occasionally turned, till, by repeated trials, it is found that the

boon has become very brittle; so that on being broken, and rubbed between the hands, it easily and freely parts from the harl. It is then taken up, a dry day being chosen for the purpose: and, being bound in sheaves, is either sent directly to the mill, which is the usual practice in the northern districts, or broken and scutched, in the manner they do hemp, by a machine or tool contrived for that use.

But before these operations are capable of being performed, it is necessary that the flax should be exposed to the heat of the sun, by placing it against a wall or paling, in a sloping direction, or to the gentle heat of a fire, by putting it over hurdles, or by introducing it into an oven, heated by the refuse flax. The heat in any way should be very moderate, and regulated in an equal manner. And in either case the flax should only be suffered to remain just long enough to dispel any dampness that it may have acquired. The sun is, however, always to be preferred where it can be had.

With respect to the produce, there is scarcely any crop that is more variable than that of flax in the quantity and quality. From twenty to seventy stones of fourteen pounds each have been produced from an acre of land; but from forty to fifty stones may be considered a medium crop. The expense of the cultivation, and management of this crop afterwards, cannot be estimated on the average at less than from nine to twelve or fifteen pounds the acre, where flax is the object.

It has been calculated in these ways in a northern and southern district of the kingdom, before the late great advance in the price of labour.

Expense per Acre.

	<i>£.</i>	<i>s.</i>	<i>d.</i>
Working land - - - - -	0	16	0
Seed and sowing - - - - -	1	1	0
Cleaning and weeding - - - - -	0	5	0
Pulling - - - - -	0	10	0
Loading and watering, &c. - - - - -	0	10	0
Taking and grassing - - - - -	0	12	0
Turning and taking up - - - - -	0	5	0
Rent of Land, as let - - - - -	5	5	0
Dressing 50 stone of flax, at 1s. 6d. per stone	3	15	0
Profit - - - - -	7	11	0
	20	10	0

Produce.

50 stones of flax, at 8s. per stone -	20	10	0
The neat profit stands higher in the following:			

Expences per Acre.

Preparation of land for sowing -	6	0	0
Rent, tythes, and taxes, &c. -	2	13	4
	8	13	4

Produce.

Forty stones of flax, at 9s. per stone -	18	0	0
Bounty, at 4d. per stone -	0	13	4
	18	13	4
Profit - - - - -	10	0	0

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In Scotland, where the flax is often sold before it is pulled, the usual price was formerly from six to ten pounds the statute acre.

The produce and value of the seed has been shewn above.

It seems, on the whole, not improbable but that flax crops may be grown in many situations with advantage.

It is usual for farmers in different parts of Scotland, who rent lands in the vicinity of large towns or villages, to let fields to the inhabitants, for the purpose of raising flax; which is supposed by some the most advantageous mode of any that can be adopted in cultivating the crop. The rents in these cases are mostly fixed at from 3*l.* 10*s.* to 4*l.* the statute acre, according to the quality of the land, the farmer constantly undertaking to cultivate the land in a proper manner. The same practice, with a little variation, is also established in some parts of England; the farmer rents or lets the land to a person who is denominated a middleman, or flax-jobber, and whose business it is to perform all the various operations after the seed is sown; which, as in the former case, is always furnished by the renter, the farmer having nothing more to do than to plough and harrow the ground.

When not grown upon newly broken upland, flax may succeed turnips and potatoes with great propriety. The seed is usually called *linseed*, which see. See also OIL.

FLAX-DRESSING, denotes the various operations which are necessary for bringing flax into a state of preparation proper for being formed into cloth or other articles. These are very different, and require different sorts of implements and machinery, in order to their being properly performed. Flax, for the purpose of being formed into cambric, fine lawn, thread and lace, is dressed in a rather different manner to that which is commonly employed. It is not scutched so thoroughly as common flax, which from the scutch proceeds to the heckle, and from that to the spinner: whereas this fine flax, after a rough-scutching, is scraped and cleaned with a blunt knife upon the workman's knee, covered with his leather apron; from the knife it proceeds to the spinner, who, with a brush made for the purpose, straightens and dresses each parcel, just before she begins to spin it.

And in the Swedish Transactions for the year 1747, a method is given of preparing flax in such a manner, as to resemble cotton in whiteness and softness, as well as in coherence. For this purpose, a little sea-water is directed to be put into an iron pot, or an untinned copper kettle, and a mixture of equal parts of birch-ashes and quick-lime strewed upon it; a small bundle of flax is to be then opened and spread upon the surface, and covered with more of the mixture, and the stratification continued till the vessel is sufficiently filled. The whole is then to be boiled with sea-water for ten hours, fresh quantities of water being occasionally supplied in proportion to the evaporation, that the flaxy matter may never become dry. The boiled flax is to be immediately washed in the sea, by a little at a time, in a basket, with a smooth stick at first, while hot; and, when grown cold enough to be borne by the hands, it must be well rubbed, washed with soap, laid to bleach, and turned and watered every day for some time. Repetitions of the washing with soap expedite the bleaching; after which the flax is to be beat, and again well washed; when dry, it is to be worked and carded in the same manner as common cotton, and pressed between two boards for forty-eight hours. It is now fully prepared and fit for use. It loses in this process nearly one-half its weight, which, however, is abundantly compensated by the improvement

made in its quality, and its fitness for the finest purposes.

FLAX-Brake, a hand-instrument, or machine, which was originally, and for many ages, chiefly employed in breaking and separating the boon or core from the flax, which is the cuticle or bark of the plant. In performing this business, the flax being held in the left hand, across the three under teeth, or swords of the brake, shewn at A, *Plate (Flax) Agriculture, fig. 1*, and *a, fig. 2*: the upper teeth or swords B, *fig. 1*, and *b, fig. 2*, are then, with the right-hand, quickly and often forced down upon the flax, which is artfully shifted and turned with the left hand, in order that it may be fully and completely broken in its whole length,

FLAX-Foot-Brake, an implement or machine of the brake kind, invented in Scotland, by which flax is broken and scutched with much greater expedition than by the hand-instrument just described; and in a more gentle and safe manner than by the flax-mill. By this contrivance, the boon or stem is well broken, and the sloping stroke given as with the scutcher, while the machine is moved by the foot. The treadle is of considerable length, on which account it is put in motion with great facility, and assisted in it by means of a fly. The scutchers are fixed upon the rim of a fly-wheel. But though these machines may be highly useful where mills turned by water cannot be established, they are probably much inferior in point of expedition, and the economy of labour. A brake of this kind is represented, in different views, at *figs. 3* and *4*, in which is shewn, by A, the three under-brake teeth, or swords, seventeen inches long, three inches deep, one and a quarter inch thick at the back, and a quarter of an inch at the fore-part or edge.

B, the edges, two and three quarters of an inch asunder at the end next the guide B, and two inches asunder at the other end.

C displays the two upper teeth, about an inch shorter than the under teeth; and

D represents the brake-mallet, about thirty-three pounds English weight.

E is a compound foot-treadle, which is eight feet four inches between the fulcra F, raised at F eight inches above the ground, (or rather five inches higher than the stance of the workman); E is two feet four inches between the fulcra G, and is raised at G eighteen inches above the ground; that is, fifteen inches higher than the stance of the workman.

H, the sword, or upright timber-rod, which turns the wheel by the treadle-crank.

I, the treadle-crank, of seven and a half inches radius.

K, the fly-wheel, four and a half feet diameter, above sixty pounds English weight. As here represented, it is beat or cast-iron, but it may also be made of timber.

L, brass cogs or bushes.

m M, the lifting crank; M is fixed firm upon the axle of the fly, while the crank m, about eight inches radius, plays freely round the axle. In position first, M begins to take round the crank (which by the lever R pulls up the mallet); when it comes to position second, the mallet is again at liberty, and by its weight pulls up the crank (faster than the fixed pieces move) into position third.

It may be observed that the treadle-crank is advanced about one-eighth part of the circle before the lifting crank.

n, a small pulley which turns easily round on the end of the crank, and to which a rope is fixed.

The filamentous parts of different vegetables have been employed in different countries for the same mechanic uses as hemp and flax among us. Putrefaction, and in some degree alkaline lixivium, destroy the pulpy or fleshy matter, and leave the tough filaments entire. By curiously putrefying the leaf of a plant in water, we obtain the fine flexible fibres which constituted the basis of the ribs and minute veins, and which form, as it were, a skeleton of the leaf. In Madagascar different kinds of cloth are prepared from the filaments of the bark of certain trees boiled in strong ley; and some of these cloths are very fine, and approach to the softness of silk, but in durability come short of cotton; others are coarser and stronger, and last thrice as long as cotton: and of these filaments they make sails and cordage to their vessels. The stalks of nettles are sometimes used for like purposes even in France; and Sir Hans Sloane relates, in one of his letters to Mr. Ray, that he has been informed by several, that muslin and calico, and most of the Indian linens, are made of nettles. A strong kind of cloth is said to be prepared in some of the provinces of Sweden of hop-stalks; and in the Transactions of the Swedish Academy for 1750, we have an account of an experiment relating to this subject: a quantity of the stalks was gathered in autumn, which was equal in bulk to a quantity of flax, sufficient to yield a pound after preparation. The stalks were put into water, and kept covered with it during the winter. In March they were taken out, dried in a stove, and dressed as flax. The prepared filaments weighed nearly a pound, and proved fine, soft, and white; they were spun and wove into six ells of fine strong cloth. Unless the stalks are fully rotted, which will take much longer time than flax, the woody part will not separate, and the cloth will prove neither white nor fine. See Dr. Lewis's notes to Newmann's Chemistry, p. 428, 429.

FLAY-CRAKE, in *Agriculture*, a provincial term, which is frequently applied to the scare-crow employed to keep rooks from new-sown lands.

FLAYL. See FLAIL.

FLEA, PULEX, in *Natural History*, a genus of the *aptera* class of insects; of a roundish compressed figure, with two eyes; six feet, formed for leaping, and filiform antennæ; the mouth is bent downwards, and conceals a small sting or piercer. The generation of this familiar vermin affords something very curious, first discovered by Sig. Diacinto Cestone. See PULEX.

Fleas bring forth eggs, or nits, which they deposit on animals that afford them a proper food; these eggs being very round and smooth, usually slip straight down; unless detained by the piles, or other inequalities of the cloaths, hairs, &c.

Of these eggs are hatched white worms, of a shining pearl colour, which feed on the scurfy substance of the cuticle, the downy matter gathered in the piles of cloaths, or other the like substances.

In a fortnight they come to a tolerable size, and are very lively and active; and, if at any time disturbed, they suddenly roll themselves into a kind of ball.

Soon after this, they come to creep, after the manner of silk-worms, with a very swift motion. When arrived at their size they hide themselves as much as possible, and spin a silken thread out of their mouth, wherewith they form themselves a small round bag, or case, white within as paper, but without always dirty, and fouled with dust. Here, after a fortnight's rest, the animalcule bursts out, transformed into a perfect flea; leaving its exuviae in the bag.

While it remains in the bag it is milk white, till the

second day before its eruption; when it becomes coloured, grows hard, and gets strength; so that, upon its first delivery, it springs nimbly away. (Phil. Trans. N^o 249). The flea, when examined by the microscope, affords a very pleasing object. It is covered all over with black, hard and shelly scales, or plates, which are curiously jointed, and folded one over another in such a manner, as to comply with all the nimble motions of the creature. These scales are all curiously polished, and are beset about the edges with short spikes in a very beautiful and regular order. Its neck is finely arched, and much resembles the tail of a lobster; the head also is very extraordinary; for from the snout part of it there proceed the two fore-legs, and between these is placed the piercer or sucker, with which it penetrates the skin to get its food.

Its eyes are very large and beautiful, and it has two short horns or feelers. It has four other legs joined all at the breast. These, when it leaps, fold short one within another, and then exerting their spring all at the same instant, they carry the creature to a surprising distance. The legs have several joints, and are very hairy, and terminate in two long and hooked sharp claws.

The piercer or sucker of the flea is lodged between its fore-legs, and includes a couple of darts or lancets, which, after the piercer has made an entrance, are thrust farther into the flesh, to make the blood flow from the adjacent parts, and occasion that red round spot, with a hole in the centre of it, vulgarly called a flea-bite.

This piercer, its sheath opening sideways, and the two lancets within it, are very difficult to be seen, unless the two fore-legs, between which they are hid, be cut off close to the head: for the flea rarely puts out its piercer, except at the time of feeding, but keeps it folded inwards; and the best way of seeing it is by cutting off first the head, and then the fore-legs, and then it is usually seen thrust out in convulsions.

By keeping fleas in a glass tube corked up at both ends, but so as to admit fresh air, their several actions may be observed, and particularly their way of coupling, which is performed tail to tail; the female, which is much the larger, standing over the male; they may also be thus seen to lay their eggs, not all at once, but ten or twelve in a day for several days successively, which eggs will be afterwards found to hatch successively in the same order. The flea may easily be dissected in a drop of water, and by this means the stomach and bowels, with their peristaltic motion, may be discovered very plainly, as also their testes and penis, with the veins and arteries, though minute beyond all conception. Mr. Leewenhoek affirms also, that he has seen innumerable animalcules, shaped like serpents, in the semen masculinum of a flea. Baker's Microf. p. 191, and 194.

Flea is also an insect which often does great mischief to crops of the hop kind. See HOPS.

FLEA-bane, in *Botany*. See CONYZA.

FLEA-bane, the common name of a plant of the weed kind, which is perennial, and common in pasture lands. It has a round, bending, solid, heavy stem. The leaves are oblong, sharp-pointed, wrinkled, downy, and embrace the stalk, on which they grow very thickly, without any regularity. It has yellow flowers, radiated and inclosed in a flower-cup, composed of narrow scales like bristles. And it has sometimes the name of *flea-wort*.

FLEA-bane, *Marsh*, and *Middle*. See INULA.

FLEA-bane, *Shrubby African*, and *Flea-bane-tree*. See TARCHONANTHUS.

FLEA-wort, *Pysillum*. See PLANTAGO.

FLEA-wort. See *FLEA-lane*.

FLEA-bitten colour of a horse, is white, spotted all over with dark reddish spots.

FLEAK, a common name, sometimes applied to a wattled hurdle, or kind of gate, which by negligent farmers is occasionally set up in the gaps of their hedge-fences. See *HURDLE*.

FLEAM, a small instrument of pure steel, composed of two or three moveable lancets, for-bleeding a horse, or the like.

A case of fleams, as it is called by farriers, comprehends six sorts of instruments: two hooked ones, called drawers, and used for cleansing wounds; a penknife, a sharp pointed lancet for making incisions; and two fleams, one sharp, and the other broad pointed: these last are somewhat like the point of a lancet, fixed in a flat handle, only no longer than is just necessary to open the vein.

There are many surgeons in Germany who bleed, or perform the operation of phlebotomy with this instrument, which they use in this manner: they hold one finger upon the end of it, which serves as a handle, and applying the point to the vein they are to open, strike upon the back over the point with one of the fingers of the other hand, opening the vein much as farriers bleed horses. Others use a spring fleam, something like a single point of the scaring instrument used in cupping; and others employ a sort of instrument in form of a dart; but as the position and size of the veins is different, in different subjects, no instrument will ever be found so useful as the common lancet of a proper size.

FLECHA, MATHEW, in *Biography*, a Spanish Carmelite Monk, born at Prades, a small town in Catalonia: he was Maestro di Cappella to the Emperor Charles V. Amongst many other works in Spanish and French, he published "*Divinarum completarum Psalmos*," "*Sectionem Brevem*," and a "*Salve Regina*," together with a book of Motets, at Prague, 1581; and died in 1604. in the Benedictine's College at Salsona, a large town in the state of Catalonia.

FLECHE, LA, in *Geography*, a town of France, and principal place of a district, in the department of the Sarthe, seated in a pleasant valley watered by the Loire; 21 miles S.S.W. of Le Mans. N. lat. 47° 42'. E. long. 0° 1'. The place contains 5,099, and the canton 15,453 inhabitants, on a territory of 255 kilometres in 11 communes. In 1603, a college of Jesuits was founded here, by Henry IV., for the descendants of nobility only: the centre is converted into a town-house, and the wings have been rebuilt as a seminary for the education of youth.

FLECHE, the name of a small work used in *Fortification*, having two equal faces, generally standing at an angle of about 85° or 90°, perhaps rather more, and deriving its designation from the French word *fleche*, meaning an arrow, to the head of which it bears much resemblance. This work is generally constructed along the foot of the glacis, before the re-entering and salient places of arms: it consists only of a parapet, forming a salient angle. The length of the faces may be from 20 to 25 toises, and the height of the work may be 8 feet; communicating with the covert-way by means of a cut through the body of the glacis in a direct line; so that, by means of traverses, the defenders may make one or more stands, and prevent their assailants from making any lodgement within the fleche, or in any degree commanding the place of arms before which it may stand.

FLECHIER, ESPRIT; in *Biography*, a French prelate,

was born at Pernes, in the county of Avignon, in the year 1632. Though his parents were but of low rank, they contrived to give him a good education; and he made a rapid progress in the different branches of literature. At an early age, he was appointed professor of rhetoric in the college belonging to his order at Narbonne. In this situation he was called on to deliver, before the states of Languedoc, a funeral oration for Claude de Relè, archbishop of Narbonne. His discourse was received with rapture; and the success of this first attempt at such composition indicated the road which would lead him to celebrity. Some circumstances arose which induced him to try his fortune at Paris, where he was desirous of distinguishing himself as a poet; but he not only failed in his expectation of a patron, but was obliged to drudge in the most subordinate duties of education to obtain a scanty livelihood. He was afterwards appointed preceptor to the son of M. de Caumartin, counsellor of state, and remained some time in that situation. But still thinking himself adapted for a more conspicuous place, he determined to bend his mind to pulpit elocution, and almost immediately rose to considerable celebrity: but his reputation is built on his funeral orations. In these he exerted all his talents, and with so much success, that he ranks next to Bossuet. Of Flechier's orations, that for the great Turenne is the most celebrated. In 1673, he was chosen one of the forty members of the French academy; and in 1679 he published his "*History of the Emperor Theodosius the Great*," which was drawn up for the instruction of the dauphin, as a model of a pious and Christian monarch. After this he published "*The Life of Cardinal Ximenes*," in which he seems to have forgotten the character of this man as an intriguing politician. In 1685, Flechier was nominated by Lewis XIV. to the bishopric of Lavaur, on which occasion the sovereign paid him the highest compliment: "I have," says he, "made you wait some time for a place which you have long deserved, but I was unwilling sooner to deprive myself of the pleasure of hearing you." Two years afterwards he exchanged the see of Lavaur for that of Nîmes, but not without great reluctance; though in a pecuniary point of view he was much benefited by the translation. Nîmes abounded with protestants, and the edict of Nantes had been just revoked. The persecutions which had followed that revocation had produced a crowd of martyrs, though it had added very few, if any, real converts to the catholic religion. In these circumstances, Flechier was considered as peculiarly qualified by his learning, eloquence, and zeal, to preside over that see. His moderation gained him the esteem of the protestants, who, in their retaliations on cruel persecutors, always held his dwelling in reverence. He was eminent for benevolence; and, during the scarcity in 1709, his charities were very great, and equally divided between the protestants and papists. He was free from pride, but never at a loss to chastise those who were ready to look down upon him on account of his low origin. Some time before his death he had a dream, which he regarded as a presage of his approaching dissolution. He accordingly ordered a sculptor to attend with some designs for his tomb: he selected the most simple, being anxious that after his death there should be nothing ostentatious erected to his memory. When he had made his choice, he said to the artist, "Begin your work without delay, for there is no time to lose." He died shortly afterwards, in the year 1710, lamented, says d'Alembert, by the catholics, and deeply regretted by the protestants; and leaving to his brethren a worthy model of zeal and charity, simplicity and eloquence. He was author

of many works, which, in the year 1782, were collected and published at Nismes, in ten volumes octavo. Of his funeral orations, d'Alembert says, "their style is not only pure and correct, but full of sweetness and eloquence. They were truly pathetic; but this property became still more sensible, when the orations were pronounced by the author. His serious action, and his slow and somewhat feeble voice, brought the hearers into a disposition of sympathetic sorrow: the soul felt itself gradually penetrated by the simple expressions of the sentiment, and the ear by the soft cadence of the periods. Hence he was sometimes obliged to make a pause in the pulpit, that he might leave a free course to plaudits, not of the tumultuous kind which resound at our profane spectacles, but expressed by that general and modest murmur which eloquence wrests, even in our temples, from an audience deeply moved; a kind of involuntary enthusiasm, which not even the sanctity of the places can repress." Morell. Gen. Biog.

FLECKED, in *Rural Economy*, a term signifying pied, or streaked with different colours, as is often the case with cattle.

FLECKERAC, or **FLECKAREN**, in *Geography*, an island near the coast of Norway, in the North sea. Between the island and the continent is a famous harbour, which may be entered or quitted by the same wind. In the 17th century a fortress was built for its defence, so that the largest fleet may lie in it secure from storms or enemies. N. lat. 58° 4'. E. long. 8° 18'.

FLEDWITE, or **FLIGHT-WHITE**, in our *Ancient Laws*, a discharge, or freedom, from amerements: when one, having been an outlawed fugitive, comes to the peace of our lord and king, on his own accord, or with licence. Rastal.

Others rather take it to denote a mu'ct, or fine, set upon a fugitive to be restored to the king's peace.

FLEECE, the name of the woolly covering shorn from off the body of the sheep, and rolled up in a long round form. Fleeces are of different weights and sizes, according to the breed of sheep. See **WOOL**, and **SHEEP**.

FLEECE, the *Golden*, is famous among the ancient writers. It was this that the Argonauts, under the command of Jason, went in pursuit of to Colchis, a province of Asia, now called Mingrelia.

The mystery of the golden fleece is variously explained; either of the profit of the wool-trade to Colchis; or of the gold that they commonly gather there, with fleeces, in the rivers. Arbuth. Diff. p. 224. See **ARGONAUTS**.

FLEECE, *Order of the Golden*. See **GOLDEN FLEECE**.

FLEECY HOSIERY, a kind of manufacture of modern invention and use, consisting of fine fleeces of wool interwoven into cotton pieces of the common stocking texture. The process of this manufacture may be thus described. Having twilted silk, cotton, yarn, &c. in the common stocking-frame, let the work be begun as in the common hosiery; and when a few courses are wrought in the usual method, in order to add a coating, draw the frame over the arch, and then hang wool or jersey, raw or unspun, upon the beards of the needles, and slide the same off their beards upon their stems, till it comes exactly under the ribs of the sinkers; then sink the jacks and sinkers, and bring forward the frame, till the wool or jersey is drawn under the beards of the needles; and having done this, draw the frame over the arch, and place a thread of spun materials upon the needles, and proceed in finishing the course in the usual way of manufacturing hosiery with spun materials. The article thus manufactured has, on the one side, the appearance of

common hosiery, and on the other side the appearance of raw wool.

FLEET, a number of vessels, going in company, whether on a design of war, or commerce.

In times of peace merchants ships go in fleets, for their mutual aid and assistance: in times of war, besides this security, they likewise procure convoys of men of war; either to escort them to the places whither they are bound, or only a part of the way, to a certain point or latitude, beyond which they are judged out of danger of privateers, &c.

The admirals of his majesty's fleet are classed into three squadrons, *viz.* the red, white, and blue. When any of these officers are invested with the command of a squadron, or detachment of men of war, the particular ships are distinguished by the colours of their respective squadron; the union is common to them all, and in those of the red squadron it is displayed on a red field; on a white for those of the white squadron, and on a blue field for the blue squadron. A fleet, whatsoever be the number of ships of which it consists, is usually divided into three squadrons; and these again, when the ships are numerous, into three divisions, distinguished by a particular flag or pendant, and usually commanded by a general officer. The admiral, or principal officer, commands the centre; the vice-admiral, or second in command, superintends the van-guard; and the operations in the rear are directed by the rear-admiral, or officer next in rank. The most convenient order of a fleet, proceeding on a voyage, is that in which it is ranged into three lines or columns, each of which is parallel to a line close-hauled, according to the tack on which the line of battle is designed to be formed. The fleet being thus more inclosed, will more readily observe the signals, and with greater ease form itself into the *LINE of battle*, which see. See also **ENGAGEMENT**.

The Spanish fleet sent against England by Philip II. consisted of a thousand vessels. In the East there have been fleets seen of three thousand vessels.

Merchant fleets generally take their denomination from the place to which they are bound; as the Turkey fleet, East India fleet, &c.

The Spaniards call simply the fleet or flota, a certain number of vessels, belonging partly to the king, and partly to merchants, sent every year to Vera Cruz, a port of New Spain.

The flota consists of the captain, admiral, and patach or pinnace, which go on the king's account; and about sixteen ships, from four hundred to a thousand tons, belonging to particular persons. They are all so heavy laden, both going and coming, that they have much ado to defend themselves when attacked. The fleet puts out from Cadiz about the month of August, and makes it eighteen or twenty months before its return.

The fleet sent annually from the same port to Peru, they call the galleons.

When the two fleets put out together, they go in company as far as the Antilles, where they separate; the galleons for Carthagena and Porto Bello; and the flota for Vera Cruz: at their return they join at the Havanna.

Of the two fleets the galleons are the most richly laden; not but the cargo of the flota is also very considerable.

FLEET is also a famous prison in London, thus called from the river Fleet, on the border whereof it once stood.

To this prison persons are usually committed for contempt of the king and his laws; or upon absolute command of the king, or some of his courts, particularly that of chancery; and lastly, for debt.

FLEET, in *Geography*, a river in Kirkcubright-shire, in Scotland, is navigable from Murray's isle in Wigton bay, into which it enters by a wide mouth, called "Fleet bay," up to Gate-house bridge. N. lat. 54° 54'. W. long. 4 15'. — Also, a river of England, in Dorsetshire, navigable for barges from Portland Road at Passage-House to near Abbotsbury, at the back of that remarkable ridge of pebbles and sand called Cocfil-bank — Also, a river of Nottinghamshire, which runs into the Trent 8 miles N. of Newark.

FLEETING, in *Sea Language*, is the act of changing the situation of a tackle, when the blocks are drawn together; or what is called block and block by sailors. The use of fleeting is to replace the mechanical powers into a state of action, and the operation is nearly similar to that of winding up a clock of watch.

FLEETWOOD, WILLIAM, in *Biography*, a learned English prelate, was born in the Tower of London, in the year 1656. He was initiated in classical learning at Eton, from whence he was elected to King's college in the university of Cambridge. He took orders about the time of the Revolution, and became distinguished for the excellence of his pulpit talents. He soon obtained the honour of being chaplain to the king, and some other valuable preferment. He was appointed rector of St. Aulin, and, almost immediately, lecturer at St. Dunstan's, Fleet-street, where his sermons attracted great crowds of hearers. In the year 1691, he published an useful introduction to the knowledge of antiquities, entitled "Inscriptionum Antiquarum Sylloge, in duas Partes distributa," &c. octavo. The first part containing remarkable pagan inscriptions, collected from Gruter, Reinsius, and other writers; and the second consisting of ancient Christian monuments: the whole illustrated with short notes, which were partly original, and partly selected from other writers. This work was well received, and contributed not a little to maintain the high reputation which the author had already acquired during his residence at the university. Mr. Fleetwood was next known as a theological writer. Of his works under this character, the principal was published in 1701, under the title of "An Essay on Miracles," which is reckoned a very ingenious performance, and was pronounced, by Mr. Farmer, as abounding in excellent reflections. A short time before king William's decease, Mr. Fleetwood was nominated by his majesty to a canonry of Windsor; but, as the grant had not passed the great seal before the king's demise, the house of commons addressed queen Anne to bestow that dignity upon their chaplain. She, however, attentive to the late king's wish, confirmed the grant in favour of Mr. Fleetwood, and also appointed him her own chaplain. About the year 1705, he resigned his rectory and lectureship, and retired to a small living which he had in the neighbourhood of Eton. He indulged his inclination for privacy, and applied much of his time to the study of British history and antiquities. In 1707 he published a work, entitled "Chronicon Preciosum," or "An Account of English Gold and Silver Money, the Price of Corn, and other Commodities, and of Stipends, Salaries, Wages, &c. in England, for six hundred Years last past." In the following year he was appointed, without his request, and even without his knowledge, to succeed bishop Beveridge in the see of St. Asaph. At this period, party rage and animosities ran very high, and no where more so than in the diocese of St. Asaph: but so high was the reputation of the new prelate, so great his prudence and address, so amiable and conciliating his manners, and so unblemished and exemplary his life and conduct, that he not only escaped all indecent and disrespectful treatment, but secured the reverence and affection of his clergy,

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who almost all differed from him in principle. The queen now frequently attended the sermons of her bishop, many of which were made public at her desire. He likewise constantly attended his place in the house of lords, where he conducted himself with dignity and spirit, maintaining his independence; and he was invariably governed in his votes by a regard to what he considered to be the true interests of his country. In his first episcopal visitation, he delivered and published a charge, which has been generally regarded as one of the most perfect performances of that kind. This was early in 1710; and towards the close of that year a change in the ministry took place, and tory principles became triumphant at court. From these the bishop was very averse, and nothing could induce him to give his support to the measures of the new ministry, which he conceived to be equally prejudicial to the glory of the queen and the true interest of the nation. In the year 1711-12, he was appointed to preach before the house of Lords; but by some means it was known that the discourse which he had prepared was very hostile to the sentiments of ministers, and they accordingly adjourned the house beyond the day on which it was to have been delivered. The bishop determined to print what he was prevented from preaching, and published it under the title of "A Sermon preached on Fast-day, Jan. 16, 1711-12, against such as delight in War, by a Divine of the Church of England." In the political part of this discourse, the bishop spoke his mind with the utmost freedom, relative to what he judged to be the disgraceful and ruinous measures of administration; which so exasperated them that they resolved to lose no opportunity of resenting the insult, as they deemed it. He next engaged in the controversy respecting lay-baptism, excited by Mr. Dodwell and others. In 1712, the bishop published four sermons, which he had formerly preached with great applause on the deaths of queen Mary, the duke of Gloucester, and king William, and on the accession of queen Anne. In his preface he assigned the reasons for their publication at this particular period, and made some severe animadversions on the fashionable politics of the day. It was now determined to crush the bishop. With this view, ministers carried in the house of commons a motion that the objectionable work should be burned by the hands of the common hangman: to which it was replied, "the fire is certainly a conclusive, but not a convincing argument; it will destroy any book, but it refutes none." In 1713, bishop Fleetwood published, without his name, "The Life and Miracles of St. Wenefrede, together with her Litanies, and some Liturgical Observations made thereon." He undertook this work to counteract the artifices of popish emissaries, who made use of it to seduce to their faith the weak and unwary among the crowds who resorted for the benefit of the waters to the well of Holywell, which was in his diocese. On the accession of the house of Hanover, Dr. Fleetwood was translated to the see of Ely; which new and unexpected dignity served only to spur him on to be more diligent in the discharge of those duties which belonged to the episcopal office. His indefatigable labours by night upon his infirmities, which produced a gradual decay, under which he sunk at Tottenham, Middlesex, whither he had removed for the benefit of the air. This happened in 1723, when the worthy bishop had attained his sixty seventh year. He had ever maintained an excellent character, and was a bright pattern of innocence of life, integrity of heart, and sanctity of manners. *Biog. Brit.*

FLEGA, in *Geography*, a small island in the gulf of Engia; 8 miles E. of Engia

FLEICHER, JOHN CHRISTOPHER, in *Biography*, a

very celebrated instrument-maker of Hamburgh, at the beginning of the last century. He had harpsichords from 60, 70, and 100, to 1000 dollars each. His theorbo and other lutes were in the greatest request; and in all his instruments the imitative stops were ingenious, and the mechanism excellent.

FLEISCHER, M., a Brunswick composer of great merit, in 1772, whose church music, comic operas, and harpsichord lessons, are all written in an elegant and pleasing style.

FLEMEN, a term in *Surgery*, having two different significations, *viz.* a tumour near the ankles, and the hardened furrows which occur on the hands and feet. Flemen (*quasi flegmen*) is said to be derived from *flecto*, to incline downwards.

FLEMENEFRIT, FLEMENEFRINTHE, or FLYMENAFRYNTH, in our *Old Writers*, signifies the receiving or relieving of a fugitive or outlaw.

FLEMESWITE. Fleta, who writes of this word, interprets it *habere catalla fugitivorum*.

FLEMING, ROBERT, in *Biography*, son of a learned Scotch presbyterian minister, was born in Scotland, where he received the early part of his education, which was completed at the universities of Leyden and Utrecht, where he prosecuted all those branches of learning which were deemed necessary to qualify him for the ministerial profession. His first settlement was with the English church at Leyden, whence he afterwards removed to become minister of the Scotch church of Amsterdam. In the course of a few years, he accepted of an invitation as pastor of a Scotch church in Lothbury, London. Here he expected to become more extensively useful as a minister of the gospel: he was moreover urged to make the exchange by king William, who often advised with him on the concerns of his own country. So great was his modesty, that he requested he might at all times be called to court with the utmost privacy. His great learning and talents procured him much respect abroad, and also in this country, where he was greatly esteemed by churchmen and dissenters, as well as by those belonging to the Scotch presbytery. He was on terms of friendship with the archbishop of Canterbury; and was chosen one of the preachers of the lecture, instituted by the merchants of London, at Salters'-hall, every Tuesday. From his early years he was eminently devout; and he was firmly attached to the British monarchy and constitution. He died in 1716. He published several works; but that by which he was chiefly known is entitled "Chirillology, a Discourse concerning Christ." This excited much attention in the early part of the French revolution, on account of the striking coincidence between the author's interpretation of the fourth vial in the book of Revelation, and the events which were taking place at that period. Gen. Biog.

FLEMING, CALEB, was born at Nottingham in the year 1698, and, while very young, he discovered an uncommon taste for literature, and employed every leisure moment in improving his mind, in which he had the assistance of a learned and liberal divine of his native town, who took the care of a small number of pupils. He continued at Nottingham some years, engaged in a secular employment, and then removed to London. He became intimate with Mr. Holt, afterwards one of the tutors at Warrington, who assisted and encouraged him in those studies which enabled him afterwards to embark in the work of the Christian ministry. His abilities and acquirements had attracted the notice of Dr. Thomas, bishop of Winchester, who was desirous of making provision for him in the established church. A living was

offered him in Cumberland, and Dr. Thomas benevolently proposed advancing a sufficient sum of money to defray the expences of his journey and removal to so great a distance. His scruples upon the subject of conformity prevented him from accepting this liberal and very handsome offer; but he never ceased to acknowledge with sentiments of unfeigned gratitude the kindness of the worthy prelate. Nothing but a sense of right, and an ardent love of the truth, could have led him to decline the proffered introduction to the national church; for he, at that time, had a wife and several children, and was almost destitute of every resource to provide for their wants. In forming his determination, he was encouraged by the magnanimity of his wife, who assured him she was ready to undergo any privations, and suffer any hardships, rather than accept of affluence at the expence of his integrity and peace. From this moment he resolved to engage in the work of the ministry among the protestant dissenters, and was, after an interval of some years, chosen pastor of a congregation in Bartholomew-cloze, London. Here he continued to officiate till the year 1752, when he was chosen assistant to the celebrated Dr. Foster at Pennershall, whom in a short time he succeeded in the pastoral office, the duties of which he discharged with exemplary diligence, until he became incapacitated for public service by the infirmities of age. He died in the year 1779, in the eighty-first year of his age. He was the author of numerous publications on important and interesting topics, relating to morals, the cause of Christianity, and of civil and religious liberty. The titles of many of these are given in the General Biography. He was an able and judicious defender of the truth of divine revelation, and a close and diligent inquirer into its doctrines. He was led to renounce what are called the orthodox tenets of established systems, and to embrace the simple unitarian creed. He was a steady and resolute assertor of the rights of conscience, and of private judgment; and considered the interposition of human power in matters of religion as the principal source of the corruptions of Christianity. His piety was cheerful and rational; his character and manners upright and exemplary; and his private and social virtues such as rendered him the object of warm esteem among those who enjoyed his acquaintance.

FLEMING, in *Geography*, a county of Kentucky in America, bounded N. by Mason, S.E. by Virginia, S.W. and W. by Montgomery: it is mountainous, and watered by several streams which fall into Sandy and Licking rivers; it contains 4,893 inhabitants, of whom 240 are slaves. The chief town of this county is *Flemingburgh*, containing 123 people, and a post-office.

FLEMINGIANS, or FLANDRIANS, in *Ecclesiastical History*, a sect of rigid Anabaptists, who acquired this name in the sixteenth century, because most of them were natives of Flanders, by way of distinction from the Waterlandians. In consequence of some dissensions among the Flemings, relating to the treatment of excommunicated persons, they were divided into two sects, distinguished by the appellations of Flandrians and Frieslanders, who differed from each other in their manners and discipline. Many of these in process of time came over to the moderate community of the Waterlandians; and those who remained separate are still known by the name of the old Flemings, or Flandrians; but they are comparatively few in number. These maintain the opinion of Menno, with respect to the incarnation of Christ, alleging, that his body was produced by the creating power of the Holy Ghost, and not derived from his mother Mary.

FLEMINGS, natives of Flanders, a colony of whom were established in South Wales by Henry I., in order to

strengthen those provinces that remained under the power of England. During the reign of his father, a great number of them, having been driven out of their dwellings by an extraordinary inundation of the sea on that coast, had come over to England; where they hoped to receive protection from the queen, who was a daughter of Baldwin earl of Flanders. The king entertained them with great hospitality and kindness, not only from a regard to her patronage of them, but from true notions of policy; with a view of increasing, by such an accession of useful inhabitants, the wealth and strength of his kingdom. Many of them were planted by William Rufus in the waste lands of Northumberland, and about Carlisle; and others were dispersed all over England, and began by their multitude to give some uneasiness, which Henry removed, and availing himself of them to still greater advantage, he sent them all to settle in South Wales; where he gave them the district about Tenby and Haverfordwest, in which their posterity remain to this day. They were very industrious, and, at the same time, very valiant; skilful in husbandry, manufactures, and commerce, and equally expert in the use of arms: so that they answered all ends which can be proposed in planting a colony, cultivation of lands, improvement of trade, and defence of the country. William of Malmsbury speaks of them as a strong barrier, which restrained the Welsh in those regions from insulting the English territories: and certainly such a plantation was a more effectual security than any fortrefs or bulwark. This colony was farther strengthened by Henry II., who allowed some of the Flemish mercenaries, whom, in the first year of his reign, he banished out of England, to go to their countrymen established in Pembroke-shire, and settle among them. This proved in the event a very politic measure; for this reinforcement of brave and veteran soldiers was sufficient to defend the Flemish colony, and a cessation of hostilities on the part of the Welsh soon followed that event. This colony was attacked in the year 1164, and their country ravaged by Rhys ap Gryffyth of Dynevor.

FLEMINGS. If the Natives of Flanders and the Netherlands were not the inventors of counterpoint, many proofs are extant of their having successfully cultivated it at a very early period. Almost all the elder great contrapuntists, of whose works there are many remains, such as Okenheim, Jusquin du Prez, Adrian Willaert, &c. were Flemings; as the most curious specimens of early counterpoint, among the printed music in the Museum, there is a collection of masses in four parts, the first that issued from the press after the invention of printing. They consist of the first and third set of the masses which Jusquin composed for the pope's chapel, during the pontificate of Sixtus the Fourth, who reigned from 1471 to 1484; the masses of Pierre de la Rue, sometimes called Petrus Platenfis, a set of masses by Anthony de Feven or Feum, Robert de Feven, and Pierzon. The masses of John Mouton; ditto of different composers, ("Missæ diverforum Auctorum,") viz. Obrecht, Phil. Bafiron, Brumel, Gaspar, and de la Rue.

All these were printed by Ottavio Petruccio da Fossebrone. He first published the masses of de la Rue at Venice, 1503, and in 1508 those by different authors. In 1513, removing to Fossebrone, in the Ecclesiastical State, he obtained a patent from Leo the Tenth in behalf of his invention of types, for the sole printing of figurative song, ("Cantus Figuratus,") and pieces for the organ, ("Organorum Intabulaturæ,") during the term of twenty years. This patent is signed by the learned cardinal Bemboe, Leo's secretary.

The masses are followed in this collection by the second,

third, and fourth sets of Latin motets, in four or five parts, called "Mottetti della Corona." from the figure of a crown stamped on the title page. The words of these excellent compositions consist of short portions of Scripture, and hymns of the Romish church, set by Jusquin, Carpentras, Mouton, Adrian Willaert, Constantius Festa, and other great masters of the same period: they were all printed at Fossebrone, in 1519 by Petruccio, and published with the same patent as the masses.

The only Italian composer amongst these is Constantio Festa, but there is so much of that grace in his melody, clearness and facility in his harmony, as have always been the distinctive characteristics of masters of the highest class in his country, that we can hardly think a genius so highly polished stood alone among such a number of foreigners at this early period; or that such regular compositions, and learned and ingenious contrivances, could be attained by the gigantic stride of any one musician, however superior his genius may have been to that of his predecessors.

FLEMINGTON, in *Geography*, a small post-town of New Jersey, in Huntingdon county, about 6 miles N.E. of Amwell or Delaware river; 53 miles N.E. by N. from Philadelphia. It has a post-office and about 12 compact houses.

FLEMISH, or the *FLEMISH Tongue*, is that which we otherwise call *Low Dutch*, to distinguish it from the German, whereof it is a corruption, and a kind of dialect. See *Flemish BIBLES*.

The Flemish is the language used throughout the provinces of the Netherlands. It differs considerably from the Walloon, which is a corrupt French.

FLEMISH Bricks. See **BRICKS**.

FLEMISH Husbandry, in *Agriculture*, a name sometimes applied to that sort which was introduced from the Low Countries, and which consisted in the combining of the green crop system with that of corn. It is supposed to have been practised there at an early period. See **HUSBANDRY**.

FLEMISH School of Engravers. See **NETHERLANDS**.

FLEMMING, RICHARD, in *Biography*, an English prelate, who flourished in the fifteenth century, and who was founder of Lincoln college, Oxford. He was born at Crofton, in the county of York. He finished his studies at the University college, Oxford: and was, in 1406, collated to a prebend in the cathedral church of York; and in the next year, he had the honour of being one of the proctors of the university. He now espoused warmly the cause of Wickliff, and, by his zeal, induced others to join in the same business. Some preferment in the existing church induced him to change sides; and he became more violent in defence of what he had been in the habit of holding to contempt as gross corruptions, than he had been in the cause of reform. He obtained the friendship of Henry V., and was promoted, in 1420, to the bishopric of Lincoln. After this he was sent deputy to the council of Constance, where he obtained great applause by an eloquent speech delivered in the presence of pope Martin V., in vindication of his country against the calumnies and aspersions of the French, Spanish, and Scottish deputies. He was now probably appointed chamberlain to the pope; and, on his return, to exhibit his zeal, in subservience to the decree of the council of Constance, he caused Wickliff's bones to be dug up and burnt. The see of York being vacant, the pope, by his own authority, translated Dr. Flemming from Lincoln to that archbishopric; but the king put in his veto, and the disappointed prelate was obliged to be contented with Lincoln. After this he formed the design of founding a college, avowedly as a seminary for divines to write, preach, and dispute

against Wickliff. Before he had made much progress in the building, he died at Sleaford, in 1430-31; leaving, however, sufficient money and effects in the hands of trustees to complete the undertaking. Biog. Brit.

FLEN, in *Geography*, a town of Sweden, in Sudermania; 22 miles N.N.W. of Nyköping.

FLENSBORG, a sea-port town of Denmark, situated on the eastern coast of the duchy of Sleswic, in a gulf of the Baltic, called "Flensborgerwiek," which extends about 18 miles inland, and forms a good harbour, so that the largest vessels are unloaded at the quay, and secured from all winds by surrounding hills. It is the capital of a district, and one of the handsomest and most commercial towns in the duchy; 22 miles N. of Sleswic. N. lat. $54^{\circ}47'$. E. long. $9^{\circ}27'$.

FLEIRON, a town of France, in the department of the Ourte, and chief place of a canton in the district of Liege. The place contains 950, and the canton 15,412 inhabitants, on a territory of 130 kilometres in 23 communes.

FLESBERG, a town of Norway, in the province of Aggerhuus; 36 miles W. of Christiania.

FLESH, in *Anatomy*, is understood to denote only the muscular substance of an animal body, although in common language it seems to include all the soft parts of the frame, except the skin. Yet it is used sometimes more loosely by the old anatomists, who speak of muscular flesh, glandular flesh, &c.

FLESH, in *Rural Economy*, the fine healthy fibrous matter that constitutes the principal value of domestic animals. The nature and properties of flesh are of great importance to the breeding and grazing farmers, in respect to the feeding and fattening of their animals. Such breeds as do not possess perfectly good flesh should never be encouraged either in sheep flock or neat cattle.

FLESH is also used, in *Theology*, in speaking of the mysteries of the incarnation and eucharist.

The word was *made flesh*, *Verbum caro factum est*.

The Romanists hold, that the bread in the sacrament of the supper is turned into the real flesh of Jesus Christ. See TRANSUBSTANTIATION.

FLESH, *Fungous*. See FUNGUS.

FLESH is sometimes also used by botanists for the soft pulpy substance of any fruit, inclosed between the outer rind or skin, and the seeds, or stone; or for that part of a root, fruit, &c. fit to be eaten.

FLESH-colour. See CARNATION.

FLESH Bay, in *Geography*, a bay of the Indian sea, on the coast of Africa. N. lat. $34^{\circ}35'$. W. long. $22^{\circ}20'$.

FLESHY, *CARNOSUS*, in *Botanical Phrasology*, is used to express any more than ordinary degree of thickness or juiciness in such parts as are naturally in some degree pulpy, as leaves. Witness the whole tribe of succulent plants, comprehending the genera of *Aloe*, *Crassula*, *Mesembryanthemum*, *Sedum*, &c. all which have *folia carnosa*, fleshy, or very pulpy, leaves. It is also applied to parts usually dry or juiceless, when they happen, contrary to their general nature, to be pulpy, as the capsule in *Chironia baccifera*, and the receptacle of the seeds in the Strawberry; but in these last instances the word *baccatus*, expressing a fruit assuming the nature of a berry, is more precise. Several species of *Euphorbia*, *Pelargonium*, &c. have fleshy stems; and a great number of perennial plants, few annual ones, have fleshy roots. In all such cases the part is more durable, more tenacious of life, and less dependent on contingencies than it might otherwise be. The roots of some grasses, as *Phleum pratense*, though naturally fibrous, become fleshy, when they are exposed to occasional

privations of food or moisture, by which they become more independent of such accidents in future. S.

FLESHY Roots, in *Gardening*, are all such as are constituted of a large mass of pulpy matter, whether in a laminated form, or the contrary. See ROOT.

FLESK, in *Geography*, a river of Ireland, in the county of Kerry, which flows into Lough Lane, better known as the lake of Killarney.

FLESUS, in *Ichthyology*, a name used by some authors for the common flounder: the *passer fluviatilis* of most writers. See PLEURONECTES *Flejus*.

FLET-MILK, in *Rural Economy*. such milk as has been skimmed, or had the cream taken off from it. This sort of milk is sometimes employed in forming a poor kind of cheese, termed *skim-milk-cheese*.

FLETA, in *Biography*. It is not a little singular that this, which is the title to one of our early law-books, should almost uniformly have been noticed as the name of a writer on law, and that by lawyers themselves. Even professor Blackstone, in his Commentaries on the laws of England, speaking of the legal period, which commenced in the time of Edward I., when enumerating the great law writers of that reign, mentions Britton, Fleta, and Hougham, as eminently conspicuous. The commentary under the title Fleta was evidently written at the assigned period in 1342. But Nicholson, in his invaluable work, "The Historical Library," observes, that the writer is unknown; that it was some person resident in the Fleet, and who thence adopted the name of the place as a title for his work. Yet Moreri says the authors of it were some lawyers, who wrote it in the prison of the Fleet, where they had been confined for the crime of concussion, the particular nature of which has been discussed at large by the learned Selden. Grand Dict. Hist.

FLETCHER, GILES, brother of Richard, bishop of London, was born in Kent, and educated at Eton school, whence, in 1565, he was elected king's scholar at Cambridge. He obtained at the university the character of an accomplished gentleman and an excellent poet, and after he had taken the preliminary degrees, he took that of doctor of laws in 1581. He was employed by queen Elizabeth as commissioner in Scotland, Germany, and the Low Countries, and in 1588 was sent ambassador to the czar Theodore Ivanovitch, with the charge of re-establishing the commercial concerns of the Russian company, which had fallen into decay. His reception at first was very unfavourable, but he at length succeeded in concluding an advantageous treaty, by which the former privileges of the company were renewed and confirmed. After his return, in 1591, he published an account "Of the Russe Commonwealth," which contains many curious and authentic particulars of that country, then little known to the rest of Europe. The freedom of certain remarks and strictures in the book caused it to be suppressed, through fear of giving offence to the reigning prince, but it is to be found in Hakluyt's collection. After this he was made secretary to the city of London, a matter of requests, and treasurer of St. Paul's church.

FLETCHER, JOHN, a dramatic writer, son of Richard Fletcher, bishop of London, was born in Northamptonshire in 1576, and received his education at Cambridge. It does not appear that he followed any profession except that of a poet, in which capacity he was the inseparable companion of Beaumont. He died of the plague in 1625, and was buried in the church of St. Mary Overy. Several of the plays of Beaumont and Fletcher were published during their lives, and various editions have been given of them in a collective form. The ten volumes edited by Theobald, Symphon, and

Seward,

Seward, in 1751; and the same number published by Colman in 1778, are esteemed the most correct. The poetical powers of Fletcher are advantageously displayed in a piece which was certainly his own unaided composition, entitled, "The Faithful Shepherdess," a dramatic pastoral on the model of the Italian. "It possesses," says an able critic, "many beauties, and has been honoured with a close imitation of some of its passages by Milton in his *Comus*. Its plot, however, is defective and unpleasant, to which may be attributed its unfavourable reception on the stage." *Biog. Brit.*

FLETCHER, PHINEAS, son of Giles, was educated at Eton school, and from thence he was elected to King's college, Cambridge, in 1600. In 1621 he obtained the living of Helgay, in Norfolk, on which he appears to have passed the greater part of his mature life. Little more is known of this person but that he was addicted to poetical composition at a very early period. His principal works are "The Purple Island," "Piscatory Eclogues," and "Miscellanies," all printed together at Cambridge in 1633. An edition of his *Piscatory Eclogues*, with some of his *Miscellanies*, was published at Edinburgh in 1781; and all his poetical compositions have been received into Dr. Anderson's collection. He wrote a book in prose, entitled "*De Literatis Antiquæ Britannia*."

FLETCHER, ANDREW, son of Sir Robert Fletcher of Saltown, in Scotland, was born in 1653. Being left fatherless while he was a child, he was placed under the tuition of Dr. Gilbert Burnet, then rector of Saltown, from whom he imbibed the learning, piety, and attachment to the principles of a free government, by which that eminent prelate was distinguished. He spent some years of his youth in foreign travel, and first appeared as a public character in the station of a commissioner for East Lothian in the Scotch parliament. He became so distinguished by his opposition to the arbitrary measures of the court, that he thought it advisable to withdraw to Holland, and upon being cited to appear by a summons from the lords of the council, which it was known he could not obey, he was outlawed, and his estate confiscated. In 1683 he came over to England to assist, with his friend Mr. Baillie of Jerviswood, in the consultations held among the friends of liberty in England and Scotland, to concert measures for their common security; and by his prudence and address he avoided giving any pretext to the ministry for his apprehension. He returned to the continent, and in 1685 engaged in the enterprize of the duke of Monmouth. He landed in the west of England, but was obliged to quit the country again on account of a dispute which he had with a rude, vulgar, and violent man, whom he shot dead. From England he embarked for, and landed in Spain; he afterwards passed into Hungary, where he engaged in the war with the Turks, and distinguished himself by his valour and skill. The interest which he took in the fate of his country soon brought him back to join in the conferences which were held among the Scottish refugees in Holland, for the purpose of effecting a revolution. When that event took place, he returned to Scotland, and resumed the possession of his estate. He was a member of the convention for the settlement of the new government in Scotland, and in all his political conduct he shewed himself the zealous asserter of the liberties of the people, without any regard to party distinction, and free from all views of his own interest. In 1698 he printed "A Discourse of Government with relation to Militias." Also "Two Discourses concerning the Affairs of Scotland." In one of these he suggests a plan for providing for the poor by domestic slavery, which, to say the least of it, comes with a very ill grace from

so zealously attached to the cause of liberty as Mr. Fletcher. When a bill was brought into the parliament of Scotland for a supply to the crown, in 1703, he moved, that previously to this or to any other business, the house should consider what acts were necessary to secure their religion and liberties in case of the queen's death, and he proposed various limitations of the prerogative, which were received in the "Act of Security," passed through his exertions into a law, but rendered ineffectual by the subsequent union. Of this last measure he was a zealous opposer, and made many speeches on the subject, but it was not a matter to be decided by eloquence, or else that of Fletcher, which was more nervous and correct than that of any other speaker in the Scotch parliament, enforced by his known patriotism, would have had much weight. He died at London in 1716. His publications, and some of his speeches, were collected in one volume octavo, entitled, "The Political Works of Andrew Fletcher, Esquire." As a writer he possessed great power: his style was perspicuous, elegant, and energetic, and his mind was enlarged by acquaintance with the best authors, ancient and modern, and by every species of knowledge which forms the politician. "He was," says one of his biographers, "a sure friend, but an irreconcilable enemy: would lose his life readily to serve his country, and would not do a base thing to save it. His thoughts are large as to religion, and could never be brought within the bounds of any sect, nor will he be under the distinction of whig or tory, saying these names are only used to cloak the knavery of both parties." Hume.

FLETCHER, in *Geography*, a township of America, in Franklin county, Vermont, containing 200 inhabitants, having Cambridge on the S. E. and Georgia on the W.

FLETCHER'S *Nook*, a cape of America, on the coast of Main. N. lat. 43° 25'. W. long 70° 29'.

FLETZ, or FLÖTZ, among German miners, a term of high antiquity, generally denoting a layer of any kind of rock, the position of which approaches the horizontal line. The word, thus applied, being vague and insignificant, it would scarcely claim our notice in this work, but for the more fixed and scientific meaning it conveys in the compounds "Fletz Mountains" (*Flätz gebirge*), and "Fletz-rocks" (*Flätz-gebirge-arten*), which terms, as proceeding from the country which may properly be called the cradle of mineralogy and geology, are now admitted into the technical dictionaries of most European languages. We too (in the succeeding article) have adopted the prefix "fletz," in preference to "secondary," which latter, (not to mention other objections against it,) cannot be adopted by those who, with Mr. Werner, admit a formation of rocks, intermediate between the primitive and secondary rocks of other geologists.

With regard to the spelling here proposed, it is to be observed that, although "flötz" with a diphthong may be conformable to the rules of modern German orthography, yet the ancient mode of spelling the word is "fletz;" and this we prefer, partly because the sound of the letter ö, as pronounced by the Germans, is foreign to the English language, and partly because the old spelling and pronunciation (which latter is still heard in several parts of Germany) are more correct, as they approach nearer those of other words, which in various dead and modern languages equally convey the idea of a horizontal even plane, such as πλάτυς, *latus*, *flat*, *plat*, *flat*, &c.

FLETZ Mountains, *Fletz-Rocks*; *Flätz Gebirge*, *Flätz-Gebirge arten*, Germ. The mountains and rocks to which these names are given by the German school of geology, are obviously of much more recent origin than those called primitive (see *Rocks*, *Primitive*). They bear more distinctly

tinctly than these latter the marks of being deposited from a fluid, and of their having been formed when animals and vegetables existed in abundance. They have their history imprinted in characters more legible than those of all the other rocks, the alluvial alone excepted: but from the youngest Stetz lime-stone, to the oldest of the primitive rocks we know, namely granite, the records before us become gradually more illegible, till at last not a character is found but the attempt to decipher it leads the observer into the mazes of fancy and surmise.

From the alluvial, the Stetz rocks are distinguished by all those positive and negative characters that bespeak an earlier origin, being the result of a general revolution that extended over the whole surface of the globe; while the former can, without any gratuitous assumption, be considered as partial formations produced by the detritus of all the others: they have originated, as it were, under the eye of the geologist, who discovers in their softer substance, in the compounds of loam, marle, &c. the remains of substances known to him, as belonging to the present creation, and swept together by partial inundations, by overflows of rivers, &c. (See *Rocks, Alluvial*). From the primitive, the Stetz mountains are in general easily distinguishable: for while the former, (such as the Hartz, the Saxon Erzgebirge, a great part of the Fichtelgebirge, &c.) usually tower to a majestic height, divided up to their summits by ravines and chasms, the Stetz mountains are generally of a less bold and steep ascent, and run along in more uniformly undulated ranges. Viewed on a large scale the Stetz-rocks are much more compound than the primitive; but they appear much less so, and often of a perfectly homogeneous nature, when viewed in small masses. Though lime-stone is already seen to occur in the primitive rocks, yet this formation owes its principal character to the siliceous and argillaceous earths, (from granite to clay-stone); while calcareous with argillaceous earth, appear to be the leading features in the composition of Stetz-rocks. Very characteristic of these rocks are the petrifications with which they abound, and which decrease in number as the Stetz approaches the primitive formation, where they are no longer observed. These petrifications consist in part of vegetables, and shells of various marine animals, most of the prototypes of which no longer exist; and frequently one particular species occupies a stratum throughout a considerable tract of country, while the adjoining stratum is stocked with a species totally different from, and unmixed with the others. Bituminous fossils, of rare and ambiguous occurrence in primitive rocks, have their principal depositories in Stetz mountains. Thus coal, most frequent in the comparatively new formations, can scarcely be traced higher than to the oldest sand-stone, where it becomes unfrequent and disappears. But a great feature of the mountains under consideration is their stratification, marked by many peculiarities not observable in other formations. The strata generally run parallel with one another; their position, though sometimes scarcely deviating from the horizontal, is often highly inclined; they accompany the sides of primitive mountains, either partially, or they surround them; while the summit of the latter, projecting over the encompassing Stetz-rocks, will often make the superficial observer suppose to see a primitive rock superincumbent on a more recent formation. Thus, for instance, we have the Schweitzerling, an old porphyry mountain, near Wettin, in the district of Halle, rising in the shape of an insulated mass out of the surrounding Stetz strata. It has been said above that Stetz mountains are less rapidly rising, and it may be added that they do not generally attain any considerable height, if we except some

of those belonging to the class which Mr. Werner calls the newest Stetz-trapp formation, comprising basalt, wacke, &c. rocks, some of which, by other geologists, are classed with the genuine volcanic productions. If, however, the Stetz mountains can be said in general to possess many characters that keep them distinct from the primitive, this is not strictly applicable to all of them; for there is a small series of rocks of an ambiguous nature, which, being often intermediate between the two formations, and participating of the characters of either, have frequently embarrassed the framers of geological arrangements. These rocks have been formed by Mr. Werner into a particular class, under the title *Uebergangsgebirge*, (see *TRANSITION MOUNTAINS*); a distinction which is not admitted by Mr. Voigt and others.

As the ideas which the two last mentioned geologists entertain relative to the origin of the Stetz mountains have regulated their classification of the rocks belonging to that and the transition formation, it will be proper, before we proceed, to give a short outline of their respective theories, as far as they relate to the subject under consideration. Werner accounts for the difference that subsists between the rocks of his three first classes of the aquatic formation, from the oldest granite down to the newest Stetz lime-stone, by the gradual diminution of the water on the surface of the earth. At that period, when the earth was in a chaotic state, and entirely encompassed by the ocean, which contained their first materials, the primitive mountains were formed by the laws of crystallization. As the volume of the water gradually diminished, and dry land made its appearance, in short, when the earth passed into an inhabitable state, a series of rocks originated, which participate, in some measure, of the nature of the primitive, at the same time that they display the first traces of remains of simple organic bodies that inhabited the sea, and of mechanical deposition, which could take place only near the surface of the water. The increase of these mechanical depositions corresponded to the diminishing level of the ocean, from the transition to the more recent periods, each of which furnished the successive Stetz-strata with their peculiar contingents of organic bodies, most of which remain only as petrifications. It is in this manner that the celebrated professor of Freiberg assigns to all the known rocks their respective places in his arrangement, the whole forming an uninterrupted series from the granite to the youngest of the alluvial mountains. There is, however, another assemblage of rocks allied to those of the Stetz formation, and which, (being superimposed promiscuously on other formations, from the primitive to the most recent,) is kept separate by Werner, as one of the subdivisions of that class; to this belong basalt, the kindred wacke, porphyry-slate, amygdaloid, and other rocks enumerated by Werner as members of the Stetz-trapp formation. The whole of this is supposed by him to owe its origin to a posterior deluge, or a sudden rising and retiring of water, and is considered as the newest member of the Stetz formation.

Mr. Voigt, who has given a classification of rocks, though he rejects the transition period adopted by Mr. Werner, still divides the Stetz rocks into those of older, and those of newer formation. As his ideas on this subject are but little known to the English reader, we shall here give a short sketch of his theory, omitted under the article *EARTH*. His hypothesis is, that in its primordial state, our planet was entirely encompassed by water, in which, without having either mountains or valleys, it floated like the yolk in the albumen of the egg. Of the substances that composed the earth in this state of submerision, some were apt to undergo

fermentation, to ignite, to give out elastic vapours and gases, and to produce explosions. It was by these energies that masses were raised from the bottom of the ocean towards its surface, where they formed islands, which afterwards constituted the principal ranges of primary mountains. The body of water displaced by these elevated masses filled up the space the latter originally occupied; and this diminution of the water was the cause of the appearance of an additional portion of dry land. Of the detritus of these primary mountains, and by the deposition of mineral substances, still dissolved or floating in the ocean, the fletz mountains were produced, which formed layers surrounding the original islands.

As according to this theory (which the reader will observe is not unlike that of Lazzaro Moro), no considerable time intervened between the formation of the primary and fletz mountains, it is no matter of surprize that the newest of the former should show considerable affinity to the oldest of the latter formation; and that intermediate kinds of rocks should have been formed, which appear of an ambiguous origin only when viewed out of connection with the rest.

But, though our author does not admit transition rocks in the sense in which this word is taken by some geologists, he nevertheless thinks that there are stratified or fletz rocks that, strictly speaking, might be referred to the primary; namely, such strata of lime and sand-stone, that, according to his theory, were raised at the same time with the primary mountains on which they were deposited at the bottom of the sea. To this division belong those strata which are sometimes observed in such places, which, from their elevation, cannot be supposed to have been reached by the water when the regular fletz rocks were deposited. Thus, for instance, we see on the primitive granite mountains of the Hartz, not far from Clausthal, a calcareous rock called the Hübigenstein, which constitutes a reef almost entirely made up of corals, which prove its having been formed at the bottom of the ocean. Not less remarkable in this respect is the Hanskühnen-burg, a huge sand-stone rock, on the high Bruchberg, one of the Hartz mountains, at an elevation which precludes the idea of its having been produced at the same time with the younger fletz-sand-stone, from which it differs also in its external characters. In the same manner, our author refers to the older fletz rocks those strata that are met with on the declivities and in the chasms of high primitive mountains, at a greater elevation than the younger fletz formation reaches; and which were deposited soon after the summits of the primitive mountains were raised above the surface of the ocean. The *first* of Voigt's older fletz-rocks is what he calls the *old sand-stone*, the same which has been above alluded to, and which is totally different from that of Werner, as we shall see hereafter. The old sand-stone of Voigt is of a much rougher nature than the common fletz sand-stone, and always occurs in very elevated situations.

2. The principal *coal formation*, considered by Werner as of much later date. The geognostic relation of this interesting inflammable substance, much as has been written on it, is still involved in obscurity; more recent observations appear, however, to be in favour of Voigt's ideas respecting it. 3. *Slate-clay* (Schieferthon) nearly of the same age with coal and its sand-stone, it being found alternating with these latter, and in general occurring under similar circumstances. In this rock are found the most perfect impressions of vegetables which the earth produced in its primordial state, probably belonging to the arundinaceous and fern tribes, the former of which required nothing for their growth but water, the latter nothing but naked rocks. 4. The *red sand-stone* as Mr. Voigt calls it, of yellowish, and sometimes of a grey colour, coarse grain, considerable hardness, and minute of

petrifications. It never occurs distinctly stratified, but generally as insulated amorphous masses and rocks in more elevated situations. The highest masses are seen at Reichl in the forest of Thuringia, where they rest on high porphyry mountains; and lower down it frequently encompasses those mountains in grotesque groups of mafly rocks. Ladius has described the same kind of lime-stone in his work on the Hartz mountains. Some kinds of rocks, described by pupils of Werner, as transition lime-stone, appear to be the same with the oldest lime stone of Voigt.

From what has been said, (and from what remains to be said under the article *TRANSITION-ROCKS*), it appears that, however the followers of different geological systems may be agreed with regard to the nature of primitive and fletz mountains in general, their opinion will be found to diverge at those points where adjoining distinct formations, by mutually borrowing of each other geognostic and oryctognostic characters, baffle discrimination, and cause theorists to draw lines of demarcation that are more or less derived from hypothetical propositions.

In order to illustrate the different strata of the fletz formation more generally acknowledged as such, we shall cast a view over the tract of country extending in an eastern direction, from the forest mountains of Thuringia to the Hartz, and enumerate them in the order in which they succeed each other, according to the observations of Mr. Voigt. This succession, however, should not be supposed to prove exactly the same in all parts of the world: the fact is, that often entire strata, especially subordinate ones, are wanting without being supplied by others, and sometimes strata are substituted in their room that are foreign to other countries, such as the vast rock-salt strata in Hungary, Poland, the chalk in England, &c.

The strata, which almost without interruption fill up the space between the two above-mentioned ranges of mountains, whose distance from each other is about twenty-two miles, are the following:

The *old red sand-stone* of Werner, called by the miners of Germany, *das rothe Todt-liegende* (i. e. the red dead or barren rock). It occupies the lowest situation of all the newer fletz rocks. In the Hartz it rests on grey-wacke, one of the transition rocks of Werner, but referred by Voigt to the primitive. (See *GREY WACKE*.) Where this sand-stone baskets out it appears in pretty high mountains, and often covers considerable tracts of land, as, for instance, at Eifenach, Eisleben in Mansfield, &c. It is often difficult to distinguish it from the newer fletz sand-stone, when not viewed in its connection with the formations that accompany it (see *SAND-STONE*); but in general it is much harder, and of a coarser grain than the latter, often appearing as conglomerate; and its colour is usually brick and cochineal red, from which its name is derived; but is also found grey. The coarse grained often alternates with fine grained varieties, in layers of various thickness. Mr. Jameson insinuates that, if the observations lately made in Germany by Karsten, Buch, and others, be correct, much of the red sand-stone of England will be found to belong to this old sand-stone formation. This stratum, in the above-mentioned tract of country, is regularly followed by

Bituminous Marl-Slate, for the description of which, see *MARL-SLATE, Bituminous*.

The most distinct line is drawn between this and the preceding stratum. It bears evident marks of being deposited on the old red sand-stone from a calm and undisturbed fluid. Impressions of fishes are frequently seen in it, but none of vegetables. It is rich in metals, especially copper ore, whence

whence the appellation *copper slate fletz*; sometimes the metallic veins, those of copper and silver, penetrate through the bituminous marl-slate to the surface of the old sand-stone stratum underneath, which thus becomes metalliferous. (See SAND ORE.) The bituminous marl-slate is classed by Werner under his first lime-stone formation, as is likewise the

Zechstein, which rests on the preceding. This is a coarse splintery ash-grey compact lime-stone (in some places it approaches the nature of indurated marble); it does not pass over into the adjoining strata, but is separated from them by a marked line. It contains neither bitumen nor metals, nor impressions of fishes as the bituminous marl-slate. This stratum, and the two following, are wanting in some parts of the forest of Thuringia, but their places are supplied by a bed of yellowish-brown lime-stone, accompanied by considerable beds of brown iron stone, and containing a great quantity of the petrification called *Anomia gryohus*. The *zechstein* is succeeded, upwards, by a stratum of

Gypsum, called the first fletz-gypsum by Werner. It is composed of granular and compact gypsum, of a white and grey colour, often variegated and veined, penetrated by bitumen, and containing selenite, fibrous gypsum, stink-stone, &c.; but petrifications are seldom found in it. See GYPSUM *Compact, Granular*.

By what chemical combination it happened that the *zechstein*-stratum, being a carbonate of lime, was immediately succeeded by a combination of lime with sulphuric acid, is a question not easily to be answered; but the circumstance is the more striking, as this sulphate is immediately succeeded by another carbonate, called

Stink-stone, a stratum considered by Werner as subordinate to his first fletz gypsum (See STINK-STONE.) On this rests another,

Sand-stone, which appears to belong to the variegated or second sand-stone formation, as characterized by Werner. Its colour is partly yellowish-white, partly light grey-brown and red. This is succeeded by another stratum of

Gypsum, being the second fletz-gypsum, which, though in some parts of Thuringia it assumes considerable thickness, is entirely wanting in others, as for instance in the principality of Fulda. But a more constant attendant on the last-mentioned sand-stone is the superincumbent stratum of

Clay, mostly of a brown-red colour, often intermixed with other tints, such as light mountain-green and blueish-grey. Mr. Voigt observes, that most rivers of Thuringia, Franconia, and Hesse have cut their way through the fletz lime-stones, through this reddish clay and the gypsum (where they met with it) down to the last-mentioned sand-stone; and in most low grounds and valleys of those countries, the arable land consists almost entirely of that clay, which, though unfavourable to vegetation in its pure state, becomes the most fertile soil when mixed with sand, gypsum, and lime, as is the case in the neighbourhood of Erfurt, and in several other parts of Thuringia.

The common clay belongs partly to the alluvial, partly to the fletz formation, and principally to that sub-division of the latter called the newest fletz trap formation by the Wernerian school. The uppermost stratum, and the most considerable next to sand-stone, is

Fletz lime-stone. Like the sand-stone, and almost all other rocks of the fletz formation, it is composed of several strata, each constituting a different variety of compact lime-stone. Those of Thuringia, according to Mr. Voigt, are, 1. A compact lime-stone of yellowish-white or blueish-grey colour, of even and earthy fracture, wrought as a marble at Weimar. Except *cornua ammonis*, few petrifications are found in it;

but often indistinct, vermicular, and serpentine elevations are discovered on the planes of its principal fracture. 2. A light ash-grey lime-stone, entirely composed of small petrified pectinites, and called by the provincial name of toad-eye. 3. A light ash-grey splintery lime-stone, with here and there some petrification, and also containing nodules of grey flint, which, however, on account of its fracture not being conchoidal, does not answer the purpose of making gun-flints of. (See FLINT, GUN-FLINT.) 4. Compact lime-stone, apparently composed of irregularly cubic fragments, into which it separates on being struck upon; it is by far the most common variety in those parts. 5. Lamellar lime-stone, fissile into thin layers; only found in the vicinity of Jena by professor Voigt. These five layers, constituting the above fletz lime-stone strata, follow each other, though in irregular succession. The whole formation corresponds with that of the second fletz or shell lime-stone of Werner, so called from containing a great number of petrified shells, but seldom any other secondary fossils; though in the upper of the beds also petrifications of fishes, crabs, vermiculites, &c. are frequently met with. It is in this lime-stone that most caverns are found containing remains of land animals. Various distinct lime-stone formations are probably included in this; but the observations of well-informed travellers on this subject are as yet too scanty and imperfect to be turned to account by the geologist.

Mr. Werner has adopted twelve formations in the class of the fletz rocks. 1. First or old red sand-stone. 2. First or oldest fletz lime-stone. 3. First or oldest fletz-gypsum. 4. Second or variegated sand-stone. 5. Second fletz-gypsum. 6. Second fletz or shell lime-stone. 7. Third fletz sand-stone. 8. Rock-salt formation. 9. Crank formation. 10. Fletz-trap formation. 11. Independent coal formation. 12. Newest fletz-trap formation.

The principal of these formations being illustrated by the above series of strata in Thuringia, we shall here add a few words on those that are not found in that district. First, with regard to the second of Werner's formation it is to be observed, that in several countries a stratum of porous grey lime-stone is found subordinate to it, called *rauch wacke*, which is wanting in that part of Thuringia; and the same is the case with *roe-stone*, considered as subordinate to the fourth of Werner's formations, and of which considerable strata are seen in other countries, though it does not appear to constitute an independent formation. The seventh formation, being the third fletz sand-stone, is represented by the commentators on Werner's arrangement as a very extensive one; but its geognostic relations do not appear to be sufficiently determined. It is supposed to be of much newer origin than the other preceding sand-stone formations; it exhibits many traces of coal; is constantly of a white colour, and as negative characters are given its not containing any clay-galls, or gypsum, its not alternating with sand-stone slate, or roe-stone. The hills formed by this sand-stone have a peculiar appearance: they are conical and steep, and exhibit in the variously shaped and arranged masses of which they are composed, a striking scene. "One of the most striking appearances of this kind," says Mr. Jackson, "is at Anderuach in Bohemia, where we observe numberless cones, pyramids, and pillars, sometimes isolated, sometimes joined together, and from two to three hundred feet high, spreading over a considerable tract of country. In other places, caverns or grottos appear, from which there issue many streams, that give rise to waterfalls, and thus increase the beauty of this striking scene. These caverns are wide at the mouth, but become very narrow towards their farther extremity, and are generally very short. This form shows, that

that they owe their existence to external agents, particularly water. A more near examination discovers, that the seams of the strata of the different isolated masses correspond to each other, which renders it probable that all these cones, pyramids, and pillars, have been formerly united, and that the perpendicular rents or fissures have given rise to this diffusion, which has been afterwards increased by the action of the air, and by the water carrying away the softer or more loosely aggregated parts of the sand-stone, and leaving the harder parts in these various forms. A similar appearance of sand-stone occurs near Tunis; and, from its striking resemblance to ruins, is described as the remains of a great city, by some travellers who saw it at a distance. In the land of the Namaquas in southern-Africa, and on the banks of the Volga, there are similar appearances. This formation passes through Saxony, Lusatia, into Silesia and Bohemia, and is wrapped around almost the whole of the Riesen-Gebirge."

An excellent characteristic of this sand-stone formation, as it appears in Bohemia, we possess from the able pen of Dr. Reuss.

Another formation, not in the above series of Thuringian stetz rocks, not, indeed abundantly met with in many parts of Germany, is the rock-salt formation. It generally occurs with the first stetz-gypsum; and in the territory of Sannes of Upper Austria may be considered as subordinate to the first stetz limestone, the principal formation of that country. It is almost constantly accompanied by beds of that clay called by Humboldt *salt-clay*, which being a variety but little understood, we shall here add Buch's description of that occurring at Halstadt, Ischel, &c. in the just-mentioned Austrian territory. Its colour is smoke-grey, and it also occurs greyish-black and greyish-white, more seldom reddish-brown and tiled-red. It is perfectly dull, but always mixed with minute glimmering saline particles; fracture fine earthy, and in large pieces, flat conchoidal; fragments indeterminate angular. It is perfectly opaque, does not soil, is soft, approaching to very soft, rather brittle, and not particularly heavy. Its streak is light ash-grey. This clay is said to become of a darker colour when exposed to the air, which is the more singular, as, according to Humboldt's experiments, it eagerly absorbs the oxygen of the atmosphere. It is quite penetrated by salt; and the small angular fragments, approaching more or less to the cubical form, are often seen coated with a crust of saline particles. Rock-salt is generally found in huge masses, in low parts between mountains, or at their foot, such as in Transylvania; though vast depositions of it also occur in high situations, such as at the foot of the elevated range of mountains which, to the north-west from Tibet, encompasses Cashemire; a situation equally elevated with a great part of the European Alps. For a more detailed account of this interesting formation, see the article *Rock Salt*.

The seventh of Werner's stetz formations, that of *chalk*, is but little understood with regard to its geognostic relation: all we know is, that its occurrence in low situations on the sea coast, where it forms high and rugged cliffs, and its earthy aspect, bespeak its more recent origin. In England it occurs in considerable strata, forming cliffs and high mountains. We do not know much of its occurrence in Germany; it is, however, said to be found at Lunenburg, alternating with thin strata of clay. Chalk contains no metals except some iron ores, and but few petrifications have been found in it; but the nodules of flint imbedded in this rock are almost characteristic of it. See *FLINT*.

As to the eleventh or independent coal formation, we have already had occasion to mention it as one of Mr. Voigt's

older stetz rocks. We shall here add a few words on Mr. Werner's coal formation in general. According to Emmerling, who gives us an exposition of the Wernerian system, the coal-mountains (Kohlengebirg:) are to be divided into four distinct formations: to the oldest belong the coal strata occurring in stetz lime-stone, as, for instance, the strata of the Braterberg, near Kratige, on the Thuringia. Younger than this, but of the same age with one of the newer sand-stone formations, is the independent coal formation: of still more recent origin is the coal which is subordinate to the trap formation: and the newest of all is that contained in alluvial mountains. Mr. Jamefon, on the other hand, informs us that Werner has ascertained three distinct formations, without including the beds of coal found in sand-stone and lime-stone formations, which latter, he says, are in general of no importance. According to that new arrangement, therefore, the independent coal formation is the oldest; the second is that of the newest stetz-trap formation; and the third, that which occurs in alluvial land. Again, according to later accounts, it is understood that Mr. Werner has adopted another arrangement of that formation which approaches to that of Karsten, who makes the independent coal formation dependent on the elder sand-stone, and that of the lime-stone subordinate to the first stetz, or Alpine lime-stone. From these frequent changes it would appear that the history of the different formations of coal and their relative age are still involved in considerable darkness. What is known with certainty amounts, we suppose, to this, that coal is of early as well as of late formation; the former is found under the older sand-stone, sometimes even resting on primitive rocks; the latter, on the newer sand-stone in the vicinity of the rocks that belong to Werner's younger stetz-trap formation. We are happy to find that Mr. Jamefon has promised to publish the results of his observations on the relation in which these formations of coal stand to the other stetz-rocks; and, indeed, many doubts remain to be cleared up respecting the determination of this point, as well as of many others intimately connected with the natural history of those important mineral depositions.

The last of Werner's formations of stetz-rocks is called the newest stetz-trap formation, comprising principally those enigmatical masses, known by the names of basalt, porphyry stone, wacke, and amygdaloid; rocks which, though they contain no organic remains, cannot be ranked with the primitive, since they rest both on these and the stetz-mountain-rocks which are considered by many geologists as the principal products of volcanic agency, but which, according to Werner, are the results of a deluge or sudden rise of the waters at a more recent period than that in which the other stetz-rocks were formed. Besides the just-mentioned, the following rocks are referred to this formation: green-stone, grey-stone, pitch-stone, compact feldspar, obsidian, pumice; and those that are merely local depositions, viz. gravel, sand, bituminous wood, brown coal, clay, and trap-stone; to which articles we refer our readers, as likewise to the article *TRAP*.

For further remarks on the subject of stetz strata, and on the order in which they succeed each other in various parts of the world, see *STRATA*.

Not unconnected with the history of the strata of stetz-mountains are these remarkable appearances well known to the miners under the appellations of *flugschichten*, or *falling*. They are dislocations that have happened to the strata, after being divided by vertical fissures; the opposite sides of the fissures, which are generally filled up, do no longer correspond, the strata of the one being either above or below

those of the other side, with which they were connected before the disturbance took place. See the articles SLIP and VEIN.

FLEUKAN, FLOOKAN, in *Mining*, denotes rubble and unconsolidated earth contained between the sides of strata vertically divided by a fissure and dislocated. See SLIP and VEIN.

FLEUR-DE-LIS, FLEURETTE', *Fleuronné*, and *Fleury*, in *Heraldry*. See FLORY.

FLEURENCE, in *Geography*, a town of France, in the department of the Gers, and chief place of a canton, in the district of Lectoure, seated on the Gers; 4 miles S. of Lectoure. N. lat. 43° 51'. E. long. 0° 15'. The place contains 3,021, and the canton 12,159 inhabitants, on a territory of 300 kilometres, in 22 communes.

FLEURIEU, CAPE, a cape on the W. coast of North America, so called by Perouse. It is supposed to be the same with that which captain Dixon called Cape Cox. N. lat. 51° 45'. W. long. 128° 55'.

FLEURTIS, a term in French *Musik*, now obsolete. It implied florid counterpoint, such as is not note against note, but compounded of notes of different value and proportion as to measure. It likewise implied the graces or ornaments of a melody when too simple. See BRODERITS, DOUBLES, VARIATIONS, and PASSAGES.

FLEURUS, or FLORUS, in *Geography*, a village of France, in the department of the Sambre and Meuse, remarkable for having been the place near which three battles were fought, viz. the first August 10, 1622, the second between the allies and the French, and the third between the Austrians and the French, in June 1794, in which the former were defeated with great loss; 6 miles N. E. of Charleroy.

FLEURY, ANDREW-HERCULES DE, in *Biography*, cardinal and prime minister of France, was born in 1653. He was educated at Paris in the Jesuits' college, and became, at a proper age, canon of Montpellier, and doctor of the Sorbonne. Possessing an agreeable person, and those manners that never fail to recommend a man at court, he obtained the post of almoner to the queen, and afterwards to the king. In 1698, he was nominated to the bishopric of Frejus, when Lewis XIV. paid him a high compliment; "I have made you wait a long time," said the monarch, "but you have so many friends, that I was desirous you should be obliged for your advancement to no one but myself." Fleury, however, was not always pleased with his situation, the diocese was in a distant and disagreeable country, and he became disgusted, probably, for the want of that kind of society which was conformable to his wishes. In a letter to a friend he subscribed himself, "Fleury, by divine indignation, bishop of Frejus." He nevertheless held the see many years, and on one occasion, when the allies under the duke of Savoy and prince Eugene made an irruption into France, the bishop, by his prudent conduct and engaging manners, saved his city and its neighbourhood from pillage, and persuaded the generals to be contented with a moderate contribution. He was nominated by the will of Lewis XIV. preceptor to his successor, the young king, with whom he so completely ingratiated himself, as to inspire him with a profound esteem and attachment. Nor was he less anxious to pay his court to the marshal Villeroy, the king's governor, and to the regent the duke of Orleans, by the most respectful demeanor. The regent would have conferred upon him the archbishopric of Rheims, but he refused that splendid promotion, dreading, perhaps, that it might be a pretext for removing him from the person of the king. At the

death of the regent, it was through his recommendation that the duke of Bourbon was appointed prime minister, though in truth it was Fleury who governed, by means of the influence which he possessed over the king's mind. This was put to the trial, when the duke, urged by his mistresses, attempted to exclude the bishop from his private consultations with the king. Fleury immediately retired, and wrote to his sovereign a letter filled with expressions of tenderness and regret, the effect of which was such, that it was impossible to pacify the king, till he was recalled and restored to his presence. From this time Fleury became chief minister, without assuming the title and apparent functions which pointed out the premier. He was created cardinal in 1726, and at the age of seventy-three devoted the remains of life, which had hitherto challenged the public esteem, to the ungrateful toils that attend ministerial power, and at a period when the most ambitious are ready to seek repose, he avowedly entered the lists of fame. The spirit of his administration was economy in the public revenue, and the preservation of peace. The pacific disposition of this great man corresponded with the immediate welfare of France, and he quietly left the kingdom to repair its losses, and to enrich itself by an advantageous and extensive commerce, without making any innovations. This tranquil and unenterprising disposition was not calculated to gain the respect of a nation like the French, who have ever been more desirous of being thought great, than anxious to be really prosperous. Peace the cardinal could not always attain, but he terminated in three years the war of 1733 with the emperor Charles VI., and obtained for France the important acquisition of Lorraine. In the year 1741, Frederic III., king of Prussia, laid claim to four duchies in Silesia; he suddenly entered that country, defeated the Austrians near Molwitz, and occupied the whole of the duchy. This victory was the signal for war to France; but Fleury, now in his eighty-fifth year, was but little inclined to relinquish the pacific system that he adored, but he was overwhelmed by the impetuosity of the marshal and chevalier de Belleisle, who represented to Lewis that the period was now arrived of finally breaking the power of the house of Austria, and exalting that of Bourbon on its ruins; and that so favourable an opportunity never again would offer of raising the elector of Bavaria to the imperial throne. The monarch assented, and cardinal Fleury, tottering on the brink of the grave, yet still desirous of keeping his power, sanctioned with his name an enterprize he had never approved, and consented to preside over a people whose councils he was not permitted to direct. This war embittered the close of his life, which, however, by habitual temperance and natural cheerfulness, was protracted to nearly his ninetieth year. He died in 1743, and was buried in the church of the Louvre at the king's expense. In private life he was simple and modest, content with a moderate income, and remote equally from avarice and ostentation. Moreri. *Histoire de France*.

FLEURY, CLAUDE, was born at Paris in the year 1640. His father was an esteemed advocate, and he intended his son for the same profession. Claude, indeed, was admitted an advocate of the parliament of Paris in the year 1658, and from this period, for the next nine years, he diligently applied himself to the study of jurisprudence, and the belles lettres; after this he determined to embrace the ecclesiastical state. To forward himself in this new course he attended the conferences which the celebrated Bossuet held at his house on the scriptures, and on subjects of religion and literature. During his interviews with this excel-

excellent man he translated his well-known work, entitled, "The Exposition of the Catholic Doctrine." Fleury soon acquired a high character for abilities and literature, while he was equally the object of respect for his piety and virtues. In the year 1672, he was chosen preceptor to the princes of Conti, and afterwards sustained the same character with respect to the count de Vermandois, the favourite natural son of Lewis XIV. In the year 1689, the king fixed upon him as the fittest person to be associated with the great Fenelon in the education of his legitimate offspring, and made him sub-preceptor to his grandsons, the dukes of Burgundy, Anjou, and Berry. In the year 1696, he was admitted a member of the French academy, at the meetings of which he assisted as often as his other duties and engagements would permit. He had not been overlooked by the king in church preferment; but being a very disinterested man, he was content with comparatively small emolument, and sought nothing for himself till the priory of Argenteuil became vacant, which, from its proximity to Paris, offered a commodious retreat for study within reach of desirable sources of assistance and information. This benefice the abbe Fleury obtained from the king without difficulty; at the same time he resigned an abbacy into the sovereign's hands which he had held before. In his retreat at Argenteuil he continued till the year 1716, when he was drawn out of it by the duke of Orleans, the regent of the kingdom, after the death of Lewis XIV. to occupy the place of confessor to the young king. His own infirmities, and the intrigues of the Jesuits, obliged him to resign his office in the year 1722, and in the following year he died, leaving behind him a character estimable for extensive learning, firm and nice integrity, true modesty and candour, great purity and simplicity of manners, and ardent and unaffected piety. He was author of numerous works of merit, but his most considerable and important, the fruit of thirty years study, was his Ecclesiastical History, in 20 vols. 12mo., of which the first was published in the year 1691, and the last in the year previously to his death. This work has been published since his death in 13 vols. 4to. It contains the history of the Christian church, from the earliest times to the council of Constance in 1414: his facts are collected with great industry and impartiality from the best authorities, and they are, in general, combined in a simple and unornamented style. Moreri. Hist. de France.

FLEURY, in *Geography*, a town of France, in the department of the Loiret; 2 miles N. of Orleans.—Also, a town of France, in the department of the straits of Calais; 4 miles N.W. of St. Pol.

FLEWS, in *Rural Economy*, a name sometimes provincially applied to the phleemes employed in bleeding cattle.

FLEXIBLE, in *Physics*, is applied to bodies that are capable of being bent, or changed from their natural form and direction.

A body is not capable of being inflected or bent, unless the whole thereof be at rest. In bending a body, it constitutes, as it were, two levers; and the point it is to be bent in, is a fulcrum; hence, as a moving power, the farther it is from the fulcrum, it acquires a greater force; the longer the flexible body is, the easier it is bent.

FLEXION, in *Anatomy*, the act of bending, or the attitude into which any part of the body is brought by the action of the flexor muscles. When the parts composing an articulation are so situated with respect to each other, as to form one straight line, the joint is said to be extended: when they are moved so as to form an angle with each other

it is bent. Some joints, as those of the hip, knee, and elbow, admit of being bent only in one direction; and from this bent attitude, they can be moved in the opposite course only so far as to bring the two parts of the limb into the same straight line. In other cases, as at the wrist, motion is almost equally free in both directions, from the attitude in which the limb describes a straight line. Yet here the term flexion is confined to one of these motions; and the other is called extension, although the joint is not then straight.

FLEXOR, a name given to those muscles, particularly of the wrist, fingers, and toes, which have the office of bending those organs: they are the antagonists of the extensors.

FLEXOR *brevis minimi digiti manus*; flexor proprius; flexor parvus, Alb.; carpo-metacarpian. This is sometimes wanting, and in all cases it is a very small muscle. It arises from the annular ligament and os unciniforme, is situated at the side of the abductor minimi digiti, and inserted in company with it into the outer and anterior part of the last phalanx of the little finger. It is covered by the skin, and by the palmaris brevis, and covers the adductor ossis metacarpi minimi digiti. It will bend the first phalanx of the little finger on the metacarpus.

FLEXOR *brevis minimi digiti pedis*; peroneus minor of Winslow; tarso-phalangien du petit orteil. This muscle, situated within the abductor minimi digiti, has an elongated form, and is thicker in the middle than at the two extremities. It is attached, by means of aponeurotic fibres, to the under surface of the tarsal extremity of the last metatarsal bone, and to the sheath of the peroneus magnus. Advancing forwards, it first increases in size, and then diminishes again, and is fixed to the metatarsal extremity of the first phalanx of the little toe, adhering closely to the joint. It is covered by the abductor, and by the palmar fascia; while its superior surface corresponds to the last metatarsal bone, and to the interosseous muscle of the little toe. It bends the little toe on the metatarsus.

FLEXOR, *Carpi radialis brevis*

FLEXOR, *Carpi radialis longior*

FLEXOR, *Carpi radialis ulnaris*

FLEXOR *brevis pollicis manus*; thenar of Winslow; carpo-phalangien; is a short muscle belonging to the ball of the thumb, and placed within the opponens pollicis. It has two origins, one from the annular ligament and os trapezium, the other from the os magnum and the third metacarpal bone. The two fleshy portions of which it consists run parallel to the metacarpal bone of the thumb, and unite at the opposite end, still leaving a channel between them for the tendon of the flexor longus. It is inserted into the two sesamoid bones of the thumb, being connected to the abductor and adductor muscles of this organ. The abductor pollicis, the skin, the tendon of the flexor longus, that of the flexor profundus, and the two first lumbricales, cover this muscle externally. It covers the first metacarpal bone, the tendon of the flexor carpi radialis, and the first interossei.

This muscle will bend the articulation between the metacarpal bone and the first phalanx of the thumb; and it will also draw the metacarpal bone towards the carpus.

FLEXOR *brevis pollicis pedis*; flexor brevis pollicis; thenar; tarso-phalangien du pouce; is a short and thick muscle, simple behind, and bifurcated in front, and placed on the inferior surface of the first metatarsal bone. It arises by a flattened, but clearly marked tendon, from the under surface of the os calcis and two of the cuneiform bones, and the ligaments which join these. It is also attached to the plantar fascia, where that covers the flexor brevis digitorum

FLEXOR.

pedis, and the abductor pollicis. The fleshy fibres, collected into a thick fasciculus, marked below with a groove for the tendon of the flexor longus, proceed forwards to the great toe, and are inserted in two divisions. The inner and largest, closely connected to the abductor, is fixed with it by tendinous fibres to the internal sesamoid bone, and to the corresponding extremity of the first phalanx. The external, which is smaller, is fixed to the external sesamoid bone. Both are closely attached to the synovial membrane of the articulation, which joins the great toe to the first metatarsal bone. Its upper surface is covered by the first metatarsal bone, and by the tendon of the peroneus longus; its under surface rests on the tendon of the flexor longus and the plantar fascia. By bending the great toe at its metatarsal articulation, this muscle contributes to render the sole of the foot concave.

FLEXOR digitorum pedis accessorius. See *FLEXOR digitorum pedis longus*.

FLEXOR digitorum sublimis; sublimis, Alb.; flexor perforatus; epitrochlo-phalaginien; fléchisseur digital superficiel. This muscle is thick, elongated, and flattened. It arises, 1st, by means of the common tendon, from the internal condyle of the humerus, and then from the corresponding lateral ligament, and from the coronoid process of the ulna, by short aponeurotic fibres; 2dly, from a septum which separates it from the flexor carpi ulnaris; 3dly, by tendinous fibres from a considerable portion of the front edge of the radius, between the supinator brevis and the flexor pollicis longus; 4thly, from septa which separate it from the flexor carpi radialis and palmaris longus. From the origin just enumerated, a thin portion of muscular fibres is produced; but the muscle grows thicker towards its middle, runs in a direction parallel to the bones of the fore-arm, and divides into four fleshy portions, corresponding to the four fingers; of which, the two belonging to the middle fingers are the most superficial, and those of the fore and little fingers the most deeply seated; the latter is the smallest. These end in tendons proportioned to their bulk; which are completely disengaged from the muscular fibres at the annular ligament. The four tendons, connected together in the manner which will be presently explained, pass in the deep channel formed by the annular ligament, in front of the tendons of the profundus, separate as they proceed, and continue their course towards the fingers under the palmar fascia. They become broader and thinner, enter the tendinous theca of the fingers, and each presents, at the commencement of the sheath, a concavity adapted to the corresponding tendon of the flexor profundus. As the tendon passes over the first phalanx, it divides into two portions, which separate to allow the passage of the tendon of the profundus, then unite together behind that tendon, so as to form a channel, with its concavity in front, lodging the tendon of the profundus; and afterwards separate again to be implanted, distinctly from each other, in the lateral and anterior margins of the second phalanx.

Thus each tendon is first concave posteriorly, where it lies on the tendon of the profundus; then presents a large slit for the passage of the latter; is afterwards concave anteriorly, from the two sides of the slit uniting below, and then ends by a double insertion in the bone.

On the fore-arm, the posterior surface of this muscle is in contact with the profundus, the flexor longus pollicis, and the median nerve; while its anterior surface is covered by the pronator teres, flexor carpi radialis, palmaris longus, and the fascia of the fore-arm. It covers the profundus and lumbricales in the hand, and is covered by the annular ligament and palmar fascia. In the fibrous sheath of the fingers,

it is placed first between the sheath and the tendon of the profundus, and lower down between the latter and the bone.

FLEXOR digitorum profundus; profundus, Alb.; flexor perforans; cubito-trochlo-ouguien; fléchisseur digital profond. This muscle is situated in the fore-arm, under the former, which it very much resembles. It is thick, flattened, elongated in its form, fleshy above, and tendinous below. It arises, 1st, from the aponeurosis extended from the flexor carpi ulnaris to the ulna, and from the inner surface of that bone in one-third of its length; 2dly, from the anterior surface of the bone for three-fourths of its length, next to the elbow, and from the corresponding portion of the interosseous ligament, by aponeurotic fibres. Smaller at its origin, it swells in the middle, and diminishes again, dividing into four more or less distinct portions, terminated by four tendons, which are at first concealed by the fleshy fibres, but become entirely disengaged at the annular ligament, where they are deeply connected by cellular substance. They pass in the deep channel of the ligament, behind those of the flexor sublimis, separate as they proceed into the hand, give origin to the lumbricales, enter the tendinous sheaths, perforate the tendons of the flexor sublimis, and lie in the channels formed on the anterior surfaces of the two first phalanges. Each tendon terminates in a slightly flattened form, by an insertion in the anterior surface of the last phalanx.

In the fore-arm this muscle is covered by the flexor carpi radialis, the flexor sublimis, the median and ulnar nerves, and the radial artery; and it covers the surface of the ulna, the interosseous ligament, and the pronator quadratus. The bones of the carpus and metacarpus, and the interossei muscles, lie behind it in the hand; and the lumbricales and tendons of the sublimis are before it. In the fingers, its tendons lie on the bones, being covered by the tendons of the sublimis and the fibrous sheaths. It is furnished with certain synovial membranes, common to it with the preceding muscle.

The annular synovial Membrane.—On cutting the annular ligament of the hand, and lifting up the subjacent packet of tendons, we observe a cavity terminated by a cul-de-sac above and below, and formed by a membrane, which envelops the tendons of the flexor sublimis and profundus of the flexor longus pollicis, and the median nerve; and which is spread over the surface of the annular ligament and the carpal ligaments. This membrane connects all the parts into one fasciculus, lends numerous folds between them, is very soft and yielding, but contains so little synovia, that a doubt may be entertained whether it should properly be regarded as a synovial membrane. Yet its office and use are exactly the same as those of the bursa mucosa; it enables the tendons to play easily in the channel of the annular ligament. The latter part confines the tendons in their proper situation; they would otherwise start up from the wrist when the hand is bent on the fore-arm, and describe the chord of an arc formed by the fore-arm, wrist, and hand.

Synovial Membranes and fibrous Sheaths of the Fingers.—These membranes are expanded on the tendons of the two flexor muscles just described, and on a canal containing them, formed partly of bone, and partly of a strong fibrous substance. The anterior concave surface of the phalanges, and the front of their articulations, form the bony portion of the canal. The fibrous part is a dense strong layer, attached to the sides of the bony channel, and terminating below by a connection to the flexor profundus. Thus the cavity ends in a cul-de-sac. The sheath is very thick and strong

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strong at the middle of the first and second phalanges, and composed of femicircular fibres of cartilaginous firmness; the rest is weaker, and composed of decussating fibres. A synovial membrane lines this cavity, and is reflected at its commencement over the tendons, so as to form here also a cul de-sac. The tendons are completely unconnected in this sheath, being lubricated, as well as the containing cavity, by a synovial fluid: there are, however, one or two slender vascular threads going from the sheath to the tendon. The use of this sheath is the same with that of the annular ligament, *viz.* to confine the tendons in their situation. When it is divided in the dead subject, and the muscles are drawn so as to bend the fingers, the tendons immediately start up from the bones. As they move considerably within the canal during the motions of the fingers, the necessity of the parts being lubricated by synovia is obvious. No similar apparatus belongs to the extensor muscles of the fingers; because those members cannot be moved in that direction beyond the point at which they form straight lines with the hand, and their extensor tendons do not consequently admit of displacement; which would be prevented too by the attachment of the lumbricales and interossei to those tendons. At the wrist the extensor tendons are confined as well as the flexors; because the hand can be moved in this direction beyond the straight line, and the tendons would be subject to start from the bones.

The *lumbricales* muscles are small, slender, and elongated muscular fasciculi, so named from a comparison to earth-worms. Their number is four, and they are designated by numerical epithets, counting from the thumb to the little finger. They are placed in the palm of the hand, and derive their origin from the tendons of the profundus. The first arises from the anterior and radial side of the first tendon, and the succeeding ones from the bifurcations of the tendons, so that each of the latter has an attachment to two tendons. They accompany the tendons towards the fingers; are small at first, then grow larger, and afterwards contract again, and end at the first phalanx in small flattened tendons. These turn round the articulation, which joins the metacarpus to the phalanges, and go towards the back of the fingers. The expanded tendons are connected to those of the interossei, and are joined by a broad surface to the edge of the extensor tendons. They then run along the side of the finger, and terminate by an insertion at the back of the third phalanx. The first lumbricalis runs along the radial side of the fore-finger; and the succeeding ones hold the same relation to the other fingers. The middle or ring-finger may have a lumbricalis on each side, and then the little finger has none. They are covered by the flexor sublimis, the palmar fascia, the digital nerves and vessels, and lie upon the interossei muscles. In the fingers their tendon covers the phalanges, and is covered by the skin.

The flexor sublimis and profundus, and the lumbricales, are flexors of the three joints of the fingers: the first bending the middle joint; the second, the last joint; and the third, the first or that which connects the metacarpus to the first phalanges. When the two first have produced their effect upon the articulations to which they belong, they have the further power of bending the first joint, concurring in this office with the lumbricales. Since the latter muscles turn round the first joints, and run afterwards along the back of the phalanges, being confined in their situations by their connection to the extensor tendons, they will extend the second and third joints, although they are placed in the palm of the hand: for their peculiar course alters the direction of the force. It is necessary, in order to the flexion of the first joints by the lumbricales, that the flexor

profundus should be in action; that its tendons may be fixed, so as to afford a firm point, to which the lumbricales may move the fingers. Hence, where all the three joints are bent, as in clenching the fist, in grasping a stick, &c. the middle and last are bent first, and afterwards the first. The latter, however, may be bent, while the others are kept straight; but this requires a painful effort. Here, the flexor profundus is put in action, and the extensor communis also contracts, to prevent the fingers from being bent. By feeling in the fore-arm, we can ascertain that both the flexors and extensors are exerted on this occasion, and the effort is attended with considerable pain. Thus a fixed point is produced for the action of the lumbricales. The sublimis and profundus, after bending the fingers, or if the fingers are kept extended, will concur very powerfully, with the flexors of the carpus, in bending the wrist. As they arise chiefly from the inner side of the fore-arm, they will also co-operate in turning the palm towards the ground, or producing the state of pronation. Inasmuch as any of their fibres are derived from the humerus, they will have the power of bending the elbow joint. We cannot avoid noticing, even on the most superficial examination, the great superiority in bulk of the flexors over their antagonists the extensors of the fingers. The sublimis or profundus alone contains twice or three times as many fibres as the extensor communis: and this disproportion becomes still more striking, when we observe that the internal condyle, from which the flexor muscles arise, is very prominent, so as to give them a mechanical advantage in their action. The bending of the fingers is employed on many occasions, which require great muscular forces: the lifting of heavy weights is an example of this kind; where the ring of a weight is grasped by the fingers, and the weight elevated, it is entirely supported by these muscles. Now any individual can easily lift, in this way, from fifty to a hundred pounds and upwards, by his little finger only. In seizing and holding bodies firmly great power is required, on occasions which are constantly occurring, not merely among the laborious parts of the community, but also in those who do not depend for support on their personal exertions. In the latter, indeed, the fact is more obvious: the act of rowing, the handling of cables, the use of the hammer, the mallet, the pick-axe, and similar instruments, all exemplify the great importance of the flexors of the fingers. No effects of any analogous description are produced by the extensors: they merely restore the fingers from their bent state. The fingers may be rendered the fixed point, and then their flexor muscles will bend the fore-arm on the hand. In climbing, we grasp firmly an object above our heads; and we then see the fore-arm moved upon the hand. The whole weight of the body is sustained in that position, without any difficulty, by the flexors of one side; and it can be supported even by the flexors of a single finger.

Flexor longus digiti in pedis: flexor profundus or communis, or *profundus*: *tibio-tarsus*: *grandis* *ch. fib. ar. des. orteilis*: is placed on the posterior surface of the tibia, between the bone and the muscle of the calf, possesses an elongated form, is thin and flattened above, and divided into four tendons below. From its origin in the leg it enters the sole of the foot, and receives, before dividing into its four tendons, the insertion of the *flexor accessorius*, which comes from the under surface of the os calcis. The lumbricales pass under its separate tendons. It is attached on the inner side, by three aponeurotic bands, to the back of the tibia, from the oblique line of that bone to its inferior fourth part; on the outside to a broad aponeurotic septum, which separates it from the *tibialis posterior*, and *flexor longus pollicis pedis*. From this double origin it

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Fleshy fibres descend obliquely on each side to a tendon, concealed in the substance of the muscle at first, but soon appearing superficially at the back of the muscle. The fibres of the second origin continue to enter the tendon as low as the ankle; but those of the first cease higher up in the leg. The tendon passes in a superficial groove behind the internal malleolus, separated by a fibrous septum from that of the *tibialis posterior*; and then passes behind the astragalus, turning afterwards horizontally forwards in the sole of the foot. It now turns rather outwards; passes under the tendon of the *flexor longus pollicis pedis*, to which it is connected by a small tendinous chord; then becomes considerably broader and flattened, and shews the marks of a division into four portions. Here it divides into four tendons, which proceed towards the four smaller toes, entering with the corresponding portions of the *flexor brevis* into the tendinous sheaths of the toes, passing in the slits of those tendons, and inserted into the lower and posterior part of the last phalanges. The relative positions, the insertions, and the fibrous sheaths of these tendons are analogous in the toes to those of the *flexor sublimis* and *profundus* in the fingers; to the description of which the reader is referred.

In the leg this muscle is covered by the soleus, the fascia of the leg, the posterior tibial artery and nerve; and it covers the tibia and the *tibialis posterior*. The tendon reflected behind the ankle, at its entrance into the sole, is confined in a fibrous sheath attached successively to the groove at the back of the tibia, to the malleolus internus, the astragalus, and front of the *os calcis*. On flitting up this canal, we find it lined by a distinct synovial membrane, lubricated with a mucous fluid, and reflected over the tendon above and below so as to form two cul-de-sacs. The deep-seated muscles of the foot, and particularly the *flexor accessorius*, lie over the tendon in the sole. The abductors of the great and little toes, the plantar nerves, and the *flexor brevis*, are under it.

The *flexor accessorius*, or *massa carnea Sylvii*, is a thin, flattened, and rather square portion of muscle, situated under the tarsus, and above the preceding tendon. There is nothing analogous to it in the *profundus* of the hand. It arises, by aponeurotic fibres, from the inferior and internal surface of the *os calcis*; these proceed horizontally forwards parallel to each other. The muscle is inserted, either by fleshy fibres or by a tendon, into the upper and outer surface of the *flexor longus*, where it expands previously to the division into its four tendons. It is interposed between the under surface of the tarsus and the tendon of the *flexor longus*.

The *lumbricales pedis* arise from the tendons of the *flexor longus* in the foot, as those of the hand do from the *profundus*. Their number, size, figure, and course correspond very much to those of the *lumbricales manus*. They are inserted, at the roots of the toes, into the metatarsal extremities of the first phalanges, detaching a thin production to the extensor tendons.

The *flexor longus* will bend the last joints of the toes, and afterwards the middle and first articulations. In the latter effect it is assisted by the *lumbricales*, which at the same time will give a slight degree of lateral motion. The toes being bent, or kept straight by the extensors, the foot will be carried upon the leg by the *flexor longus*, in which case it assists the muscles of the calf. It will also aid these muscles in elevating the leg, and through it the whole body, while the foot rests on the ground; it acts therefore when we stand on our toes, as well as in the office of progression. When it bends the toes, or extends the foot upon the leg, it draws them at the same time inwards, so

that the sole faces backwards and inwards, in consequence of its tendon going behind the internal malleolus. This effect is counteracted by the *flexor accessorius*, which draws the tendon outwards; and the toes are consequently bent without any obliquity to either side. Its action, when the body is erect and supported by the feet, fixes the sole to the ground; and by bending the front of the foot accommodates the organ to inequalities of surface. When the foot is firmly fixed to the ground, the *flexor longus* may draw the leg backwards upon the foot; in this way it will restore the legs to their upright bearing upon the astragalus, when the knees have been bent forwards.

FLEXOR longus pollicis manus; *radio-fous-onguier*; *grand fléchisseur du pouce*; is a peculiar and separate flexor of the thumb, placed on the surface of the radius, and on the same level, in the fore-arm, with the *flexor profundus digitorum*. It has an elongated form, and is flattened at the sides. It arises from the anterior surface of the radius, commencing in a narrow pointed form just below the tubercle, and continued as far as the origin of the *pronator quadratus*; being also attached to a small part of the interosseous ligament. Sometimes a small fasciculus joins it from the coronoid process of the ulna. From this origin the fibres descend successively in an oblique direction, and terminate in a tendon lying on the front of the muscle, and passing with the flexors of the fingers, to which it is united by the synovial membrane already described, under the annular ligament of the carpus. It then turns outwards, passes between the two portions of the *flexor brevis pollicis*, and between the two sesamoid bones; it is continued over the first phalanx of the thumb, and is inserted in the root of the second, being previously marked by an impression dividing it superficially into two portions. In the fore-arm, the *flexor sublimis*, *flexor carpi radialis*, *supinator longus*, and radial artery and nerve lie on this muscle, which covers the surface of the radius, a little of the interosseous ligament, and the *pronator quadratus*. In the hand, it occupies first the radial side of the channel formed by the annular ligament, and then is surrounded by the two portions of the *flexor brevis pollicis*: being afterwards contained in a fibrous sheath. The latter is fixed to the two edges of the first phalanx of the thumb, and to the whole surface of the second, where it is continuous with the insertion of the tendon, and, together with the concavity of the bone, forms a complete canal including the tendon. It is lined by a synovial membrane, reflected at the commencement of the canal over the tendon, so as to form a cul de sac. It will bend the last joint of the thumb towards the palm of the hand; and afterwards also the articulation of its metacarpal bone with the carpus. Further, it may assist in bending the wrist on the fore-arm.

FLEXOR longus pollicis pedis; *flexor longus pollicis*; *grand fléchisseur du gros orteil*. The great toe, like the thumb, has a separate long flexor, which is a thick and strong muscle, lying on the back of the fibula, and covered by the muscles of the calf. On the outside, it arises from a kind of septum placed between it and the *peroneus longus* and *brevis*; on the inside, from a more distinct tendinous production separating it from the *tibialis posterior* and the *flexor longus digitorum*; between these points, from the two inferior thirds of the back of the fibula, to which the above-mentioned septa are also attached. It has above a thin and pointed form, but grows considerably thicker as it descends; becoming thinner again below. A middle tendon receives the muscular fibres, appears at the back part of the muscle, from which it is completely disengaged at the ankle. It goes behind that joint, and then turns horizontally forwards in the sole of the foot; passes over the *flexor longus digitorum*, being connected

connected to it by a portion of tendon, continues its course along the inner side of the foot, between the two portions of the flexor brevis pollicis, and afterwards between the two sesamoid bones of the great toe. Here it generally expands, then proceeds in a narrowed form, under the first phalanx of the great toe, and is inserted into the under and back part of the second phalanx. In the leg, this muscle is covered by the soleus and by the fascia of the leg; and covers the fibula and tibialis posticus.

It then lies on the back of the tibia, and is confined to the astragalus and os calcis by a fibrous sheath, lined with a synovial membrane. On the first phalanx of the great toe it is contained also in a sheath with a synovial lining. This muscle has the same uses with respect to the great toe and foot, as the flexor longus digitorum has in regard to the other toes. See the account of the action of that muscle.

FLEXOR brevis digitorum pedis; flexor perforatus or sublimis; calcaneo-sous-onguien. This muscle is placed in the middle of the sole, and is one of the superficial muscles of the foot. It is moderately thick, of an elongated form, and possesses four tendons in front. It arises behind from the os calcis, on the sides from two septa, which separate it from the abductors of the great and little toe, and below from the plantar fascia; proceeds in a straight direction to the end of the metatarsus; and then divides into four portions, which give origin to four tendons. The latter pass in the intervals of the double insertions of the plantar fascia, and enter the fibrous sheaths of the toes. At first they are concave above, to receive the tendons of the flexor longus, then they are divided for the passage of the latter, unite again, and afterwards separate to be attached by means of distinct portions to the edges of the second phalanges.

The edges of this muscle correspond to the abductors of the great and little toes; its inferior surface is covered by the plantar fascia; and the superior by the flexor accessorius, tendons of the flexor longus, lumbricales, and plantar nerves and vessels. By bending the toes, this muscle renders the inferior surface of the foot concave, and thus enables it to accommodate itself to uneven ground, and in a manner to grasp such unequal surfaces. This effect is much limited in the human subject by the practice of wearing shoes. By drawing the toes downwards, it tends to fix the foot to the ground.

FLEXORES primi internodii digitorum; a name given by some of the older anatomists to the lumbricales.

FLEXOR primi internodii minimi digiti pedis; is the name under which Douglas describes the flexor brevis of the little toe: Cowper calls it flexor primi ossis minimi digiti.

FLEXOR secundi internodii digitorum; is a name by which the flexor sublimis of the hand, and the flexor brevis of the foot, have been described. The flexor profundus of the hand, and the flexor brevis of the foot, have been called *flexores tertii internodii digitorum*.

FLEXOR primi internodii pollicis; is the opponens.

FLEXOR secundi internodii pollicis; is the flexor brevis.

FLEXOR tertii internodii pollicis; is the flexor longus.

FLEXOR primi et secundi ossis pollicis of Cowper, includes the adductor, opponens, and flexor brevis.

FLEXUOSUS CAULIS, in *Botany*, a zigzag stem. See *CAULIS*, n. 3.

FLEXURE, or *FLEXION*, in *Geometry*, is used to signify that a curve is both concave and convex, with respect to a given right line, or a fixed point. And the point which limits the concavity and convexity is called the point of contrary flexure. See *RETROGRADATION of Curves*.

As to the method of finding the points of the contrary flexure, see *INFLECTION*.

FLIDETHRIFT, or more truly *Slidethrift*, is the

game we now call *shovel-board*. It is otherwise called *shovel-groat*, and is mentioned in the statute 33 Hen. VIII. cap. 9.

FLIE, or *FLY*, that part of the mariner's compass on which the thirty-two winds are drawn, and over which the needle is placed, and fastened underneath.

FLIE, or *Vlie*, in *Geography*, a river or channel, which runs from the Zuyder sea, near the coast of Friesland, into the German ocean, between the island of Schelling and Vlielandt.

FLIE's Bay, a bay on the W. coast of Africa. S. lat. 14° 50'.

FLIES, a river of Lusatia, which runs into the Spree, near Luben.

FLIGHT, the act of a bird in flying; or the manner, duration, &c. thereof. See *FLYING*.

The feathers of birds are admirably contrived, and fitted for the ease and convenience of flight. See *FEATHERS*.

Almost every kind of bird has its particular flight: the eagle's flight is the highest; the flight of the sparrow-hawk and vulture are noble, and are fit for high enterprise and combat. The flight of some birds is low, weak, transient, and as they call it, *terra à terra*; the flight of the partridge and pheasant is but of short continuance; that of the dove is laboured; that of the sparrow undulatory, &c.

The augurs pretended to foretell future events from the flight of birds.

FLIGHT, in *Rural Economy*, a young brood of different sorts of birds, as pigeons, &c.

FLIGHT. In melting the lead ore in the works at Mendip, there is a substance which flies away in the smoke, which they call the flight.

They find it sweetish upon their lips if their faces happen to be in the way of the smoke, which they avoid as much as possible. This, falling on the grass, kills cattle that feed thereon; and, being gathered, and carried home, kills rats and mice in their houses; that which falls on the sand they gather, and melt upon a slag hearth, into shot, and sheet-lead.

FLIGHT, Capon's, in some *Customs*, is a compass of ground, such as a capon might fly over. due to the eldest born of several brothers, in making partition of the father's effects with them, where there is no principal manor in a lordship. It is usually estimated by a bow-shot.

FLIGHT of a Stair-case. See *STAIR-CASE*.

FLIGHT, in *Heraldry*. See *VOL*.

FLIGHT of an Army. Were it possible for each individual of an army to be sufficiently impressed with the inevitable consequences of "taking to flight," such an occurrence would be extremely uncommon. Whatever may be the dangers of opposing an enemy front to front, they certainly fall very short of those inseparable from that disorderly evasion, which, while it disgraces the whole, subjects each to be massacred in detail. Very fortunately for the British service, and with the most heartfelt pride do we declare it, very, very few instances could be adduced wherein our soldiery have so far lost sight of subordination, or been so far overcome by panic, as to induce them to adopt this ruinous conduct. That they have been led very improperly into such situations as to render their valour and discipline of no avail, cannot be denied; but even under such disheartening circumstances their exertions have kept pace with surrounding difficulties, and taught their enemies to respect them, even when compelled to surrender at discretion.

The flight of an army is usually attended with great carnage, and with the total loss of its artillery, ammunition, baggage, stores, treasure, &c. This rarely happens when the discomfiture is unconnected with the precipitate abandonment of positions, and of the ordnance; in this latter

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case, the reserve commonly offers an asylum to the defeated corps, enabling them at least to retire, if not to make head against their pursuers. The French, in their usual mode of varnishing over blemishes in their conduct, and of reconciling, at least to themselves, the errors of their generals, as well as the misconduct of their soldiery, never admit the assertion that their troops were "put to flight," but with much *sang froid* observe, that "they made a precipitate retreat." This is something on a par with the defence made by a gentleman, who, having been unhorsted rather abruptly, was found lying in the mud; but denied having been *throcun*. Oh, no, "he had only *dismounted*, to get a *better seat*."

In that neat little volume, "The Pocket Gunner," published by captain Ralph Willett Adye, of the Royal Artillery, is the following maxim, which cannot be too assiduously circulated, not only among artilleryists, but among every class of soldiery. He says, "never abandon your guns till the last extremity. The last discharges are the most destructive; they may be your salvation, and crown you with glory."

FLIGHT of a Shot or a Shell. Reserving ourselves for an ample dissertation on the flight of missiles in general, under the head of *projectiles*, (which see,) we take the opportunity of offering some remarks regarding those very erroneous opinions which are, in many instances, prevalent regarding the line in which a shot proceeds from the mouth of the cannon to that object towards which it is directed.

The term *point-blanc* has been greatly misunderstood. It originated in the practice among the French artilleryists, of firing at a *white* centre within various concentric circles of black; whereas we commonly make the centre of a target black; designating it "the bull's-eye." Therefore, when a piece was laid for the centre of the target, it was supposed to be exactly horizontal, so far as related to the line of the chace; the target being only eight feet in its whole height, which corresponds with the average height of a man on a middle-sized horse: the centre of the *point-blanc* (or white spot) was then about as high from the ground, supposing the intermediate distance to be level, as the muzzle of the gun.

Now it was found, that with the proper service-charge, a gun would at a certain distance throw the shot to the height of the *point-blanc*, and, if correctly "laid," that it would strike with exactness thereon. This gave rise to the opinion, that the shot proceeded to that distance in a direct line, after which it began to form an angle downwards. That such an error should maintain its ground while science was only in the womb of time, may not be extraordinary; but that any man who has either observed the practice, or considered the theory, should for a moment attempt to uphold so false a position, must appear absolutely wonderful. Were no such opinions extant, we should not have expended one drop of ink towards explaining the real flight of a shot, and to remove the vulgar error of what are called *point-blanc* ranges, being rectilinear.

In confuting the popular opinion on this subject, we must observe that, exclusive of the perpetual tendency of all bodies in motion, (from whatever impetus,) to descend according to the rules of *gravity*, (which see,) certain circumstances, particularly relating to artillery, seem to combine for the purpose of giving an ascending direction to all shots impelled by the action of gunpowder. We are to consider, that every piece of ordnance, when discharged, rises from the ground in proportion to the quantity of gunpowder used, and to the weight of metal, of the carriage,

&c. in opposing ratios. This alone would probably give some determination upwards to the shot at the moment of its quitting the piece, and when the air, opposed to the expanding flame, so forcibly occasions the piece to recoil; but if we call to mind, that that flame being to much lighter than the atmosphere, must instantly be forced upwards thereby, (especially as the concussion upon the soil below would add to such a tendency), we may at once find sufficient cause for the ascent of a shot at the very moment it quits the cannon; for both will, with the action of the cannon and the rarefaction of the air at its debouchure, whereby a rapid and strong current of ascension is given, tend to cause some departure from a horizontal direction.

The fact lies in a nutshell; for, unless when following the line of gravity, which is every where locally perpendicular, and of course always points to the centre of that globe we inhabit, nobody can maintain a rectilinear motion; there will always be a tendency to gravitation. This being admitted, it follows, that in order to arrive at a certain level, at a certain distance, an elevation must, either naturally or artificially, be given, whereby the line of flight will be found to describe that unequal curve called a *parabola*, (which see). Every boy that uses a sling, or throws up a cricket-ball, must be convinced of the truth of our position. The fact may, however, be fully certified to the eye, by standing rather behind a cannon (the greater its bore the better) and at about an angle of 20° from the line of fire, when the flight of the shot will be seen to give a curve upwards.

With respect to shells, their lines of flight are exactly on the same principles, but their altitudes being considerably greater in proportion than their bases, the parabolic curve generated assumes a different figure. It should be particularly noticed, that, for the sake of giving effect to the fuses driven into shells, the ordinary periods of flight for particular ranges, *i. e.* distances horizontally, together with the charges of powder, and the angle of elevation, (usually 45°) are to be carefully noted. If the powder were all of equal strength, the fuses all exactly similar, and equally well driven, or filled, the weight of the atmosphere always the same, and the angle of elevation ever fixed immovably, the lengths of fuses for particular ranges might be always determined; as it is, we see that considerable variation often takes place even with the same powder, the same gun, the same temperature, and, in fact, with every thing perfectly similar, to all appearance. Observing that the more protracted the line of flight, the greater the force with which a shell will fall, we shall submit the following table of ranges made with sea-service iron mortars, at 45° upon a horizontal plane.

13-Inch Mortar.			10-Inch Mortar.		
Charge.	Flight.	Range.	Charge.	Flight.	Range.
lbs. oz.	Seconds.	Yards.	lbs. oz.	Seconds.	Yards.
2	13	690	1	13	680
4	18	1400	2	18	1340
6	21	1900	3	21	1900
8	24½	2575	4	24½	2500
10	26½	2975	5	26	2800
12	29	3500	6	27	3200
14	29½	3860	7	29	3500
16	30	3900	8	30	3800
18	30½	4000	9	30½	3900
20	31	4200	9 8	30½	4000

The great increase of velocity gained by the heavier charges must be apparent; in the first instances the time of flight is 13 seconds to about 680 yards of horizontal distance, which gives only 50 yards for each second; whereas the latter flights gain on the several preceding ones so rapidly, as to give 400 yards in every added second. From this we see, that, unless fired at an improper elevation, mortars cannot be used with their greatest effect, unless so far removed from their object, as to admit of their being charged as high as the metal will bear.

FLING, in the *Manege*, is the fiery and obstinate action of an unruly horse.

To fling like a cow is to raise only one leg, and give a blow with it.

To fling or kick with the hind legs, see YERKING.

FLINGING, among *Bowlers*. See BOWLING.

FLINK, GOVAERT, in *Biography*, a painter of history and portraits. He was born at Cleves in 1616. Early in his youth he exhibited a strong inclination to painting, from which neither the desire of his father that he should pursue a mercantile occupation, the influence of his friends, nor the prospect of making a fortune, could divert him. He was therefore placed under Lambert Jacobs. With him, at the same time, Barker also studied under Jacobs, and the emulation which existed between these two greatly advanced their progress in the art, but Flink outstepped his companion considerably. He afterwards entered in the school of Rembrandt, and imitated the works of that extraordinary man with great success, and his pictures are now frequently sold as the productions of his master.

He very soon rose into high repute, and was almost constantly employed in painting the portraits of distinguished personages, although his genius inclined him to paint historical subjects, and several of his performances in that style were admired for the goodness of the design and the beauty of their colouring. He died in the year 1660, at the age of 44, very much regretted. After his death his collection of prints and drawings were sold for twelve thousand florins.

FLINT, in *Geography*, a small borough town in the hundred of Colehill, and capital of the shire to which it gives the appellation. Though almost destitute of trade, it is conveniently situated upon the river Dee; distant from London 204 miles, and 12 W.N.W. of Chester. This place was formerly fortified, having been surrounded by a double foss and vallum, and, during the struggle of Cambria for her independence, was celebrated for its strong castle, begun by king Henry II. but not completed till the time of Edward I. This fortress stands upon an isolated rock in a low marsh, which is occasionally overflowed by the tides. Anciently the estuary of the Dee laved the walls, and a communication was formed between the castle and the advanced works, called the barbaean, by means of a bridge; but the channel of the river is now at some distance. The structure is formed of a reddish grit-stone from quarries in the vicinity. The form is a right-angled parallelogram, having three of its angles defended by polygonal towers, some remains of which are still standing, including an area within the walls of about an acre. At the south-east is a detached tower of angular construction. It is of a circular form, consisting of two concentric arches, leaving a space between for a gallery eight feet broad; the diameter of the inner circle is twenty feet. In this castle the unfortunate Richard II. took shelter, on his arrival from Ireland; when, quitting it, he was seized by the duke of Lancaster, and carried prisoner to Chester. During the civil wars it

was garrisoned for the king, but surrendered to general Mytton in 1646.

Flint is a corporate town, governed by a mayor, two bailiffs, and other inferior officers; and, in conjunction with Rhyddlan, Overton, Caerwys, and Caergwle, sends one member to parliament. The voters are such as pay scot and lot in the respective places, and the returning officer is the mayor of Flint. The church, which is a chapel of ease to Northop, is a mean looking building, having for a steeple a boarded turret. In 1785 a new county gaol was erected upon the plan of one previously built at Ruthin; although the assizes are regularly held at Mold. In the summer season Flint is frequented as a bathing place, but the marshy nature of the coast, over which the sea at high tides flows, renders the bathing inconvenient, and the air rather insalubrious. Though privileged as a market town, the market has been long discontinued. By the returns made to parliament in 1801, the number of houses was 309, and inhabitants 1169.

A wood in the vicinity of Flint is celebrated, in the annals of history, for having been the scene of many a sanguinary conflict, and as ominous to the English cause. Here Henry II. was twice defeated in one campaign, losing not only his principal officers, among whom were included many of the nobility, but the king himself was frequently in imminent danger of being killed, and narrowly escaped being taken. Pennant's Tour in North Wales. Skrine's Tour.

FLINT, a considerable river of America, in Georgia, which rises in the country of the Creek Indians, and pursuing first a south, and then a south west course, joins the Appalachicola at its entrance into Florida. The territory adjoining this river affords a rich soil capable of profitable cultivation, and offering an uninterrupted navigation to the bay of Mexico and Atlantic ocean, and thence to the West India islands, and other parts of the world. On this river there is a number of villages belonging to the Creek Indians.—Also, a small river, about 25 miles long, in the Genessee country, in New York, which runs N.N.E. into Canandarqua creek.—Also, a river of Jamaica, which runs into the sea, seven miles W. of Montego bay.

FLINT *Island*, an island in the gulf of St. Laurence, near the east coast of the island of Cape Breton. N. lat. 46° 10'. W. long. 59° 40'.

FLINT, *Silex cretaceus*, Linn. *Ignarius*, Carth. et Wall. *Pyromachus*, Wern. *Quartz-Azathe pyromachus*, Haüy. *Feuifstein*, Germ. *Flinta*, *Böfs flinta*, Swed. *Pierre à feu*, Fr.

The flint, one of the most remarkable of the siliceous stones, has frequently been confounded with other hard stones of the same class; the quality it possesses in an eminent degree of giving sparks with the steel, and the popular denomination it has thence derived among almost all nations, have been the principal causes of this confusion, which may easily be avoided by a proper attention to its more distinguishing characters. It must, however, be confessed, that, in some cases, its diagnosis is rendered uncertain by its too great affinity to *Horn-stone* and *Flint-stone*, (see those articles,) and by its gradual transition into these kindred stones.

Its colour is chiefly grey, of which yellowish, blueish, and smoke-grey, are the more usual shades, and these pass, the latter into greenish-black, the former into all the well known tints of yellow, red, and reddish-brown, that approach it, to the carnelian. It is sometimes found perfectly black,

and also displaying several of the just-mentioned colours in stripes, zones, and spots.

Flint occurs massive, in angular pieces of various size, in globular boulders, frequently tapering at one end, (the petrified melons of Mount Carmel, vulgarly so called, belong to this variety): also in knobbed, branching, amorphous, perforated pieces, and as hollow balls filled with various substances. (See GROUND.) Besides these forms, it sometimes adopts those of crystals, which however do not belong to it, as some writers have supposed, but are suppositions: from calcareous spar it derives the double three-sided pyramid, as also the six-sided prism acuminated by three planes; and it has been likewise observed in crystals formed after those of lamellar barytes or caulk. It is also frequently observed, (contrary to what we know of hornstone,) in extraneous external shapes, as petrifications of species of echinus, madrepora, coral, &c. Surface little glistening, and of various degrees of smoothness, often coated by, and passing into, a white or yellowish-white crust, of which we shall say more hereafter. Fracture conchoidal, never perfectly splintery; internal surface but little glistening, or dull, of an almost imperceptibly fine grain. Fragment sometimes tabular, very sharp-edged, and more or less translucent in proportion to the lighter or deeper colours of the stone. It is easily frangible. Its hardness appears to be in a ratio with the depth of its colours: in general it will scratch quartz.

Specific gravity, according to Gellert, 2.581; Blumenbach 2.594; Gmelin 2.999. To these physical characters of flint we may add the one afforded by its phosphorescence, and the peculiar smell, which are manifested when two pieces are rubbed together.

Flint is infusible before the blow-pipe without addition, but loses its colour and becomes opaque. By the intense heat excited by a stream of oxygen gas, Mr. Ehrmann found it to melt into a white glistening quartz-like globule. Its constituent parts are,

	Klaproth.	Vauquelin.	Wiegleb.
Silica - -	98.00	97.0	80
Lime - -	0.50	0	2
Alumine - -	0.25	1	18
Oxyd of iron - -	0.25		
Loss - -	1.00	2	0
	100	100	100

Flint is met with in most parts of Europe, particularly in the north of France, in England, Saxony, Tyrol, Podolia, &c. Norway seems to be destitute of flint, as it is of chalk; also in Sweden it is scarce. In Denmark it is principally at Wordenborg and Taxoë, in the island of Seeland, that some chalk-hills with imbedded flints are found; and more copiously in the remarkable Steevens-Klint. It occurs but seldom in primitive mountains, and when found there, only in veins, as, for instance, in the Saxon Erzgebirge. Its principal geognostic situation is in siletz-mountains, where it occurs chiefly in common compact lime-stone or in chalk; in the sand-stone formation, where it is also met with in the shape of those conglomerates vulgarly called *Pudding-stone*. See this article.

Though the formation of flints is a subject which has engaged the attention of many naturalists, yet but few opinions have been broached respecting it that will at all stand the test of closer investigation. The theory which explains their origin by a metamorphosis of one earth into another, though it may appear absurd to the chemist who is unable

to produce the same changes in his laboratory, has notwithstanding had its able and celebrated defenders. Some have endeavoured to prove that the argillaceous, others, that the calcareous earth, underwent this conversion into flint. Buffon was an advocate for the argillaceous origin of this stone; and the observations of Pallas appeared to corroborate the opinion of the French naturalist; for he found that the *Ephemera boravia*, which abounds in the Moskwa, had in some places perforated the clayey bottom of this river with innumerable tubes closely joined; and in the adjacent fields pieces of perfect flint frequently occurred that were pierced precisely in the same manner as the clay, from which they were not found to differ in any respect but in fracture and hardness. In the same manner he states that, in the small river Sughir, near Woldemir, black, globular, rolled masses occur, which, on being broken, exhibit, from their circumference to the central part, a gradual transition from real clay and clay-stone into what he considers as perfect flint. With all deference, however, to the great merits of this excellent observer, we cannot but see in his account one of those frequent cases in which hard stones of the siliceous class (and clay stone and jasper belong to it) have been mistaken for real flint merely by reason of their giving copious sparks with steel: for this appears to be the character on which Pallas has chiefly founded his diagnosis of the stone he describes.

According to other geologists, it is lime-stone, and principally chalk, which have undergone a transformation into flint: an opinion which Wallerius endeavoured to support both by geognostical and chemical facts, and which was followed by Linnæus himself. Also Gillet-Laumont and Girod-Chantrans, from observations they respectively made in various parts of France, were induced to consider flint as a mere modification of chalk. The principal ground on which this hypothesis appears to rest is the geognostic relationship that subsists between the strata of chalk and of flints, together with the intimate union of the boulders of flint and their white earthy crust; both these substances being to completely incorporated with one another, as to preclude the possibility of our ascertaining the line where each may be considered as perfectly distinct from the other. This latter reason, though specious, may, however, lose much of its force by future analysis of that white earthy substance. To us it appears that most of the boulders of flint, such as they are found embedded in chalk, are but seldom furnished with a coating throughout calcareous: it seems to be composed of a twofold crust, *viz.* an outer chalky one, originating from the matrix of the stone; and an inner one passing over into the outer, and, by reason of the similarity of colour, not distinguishable by the eye. This inner crust shews no effervescence with acids; it appears to be siliceous, and may perhaps be properly looked upon as the result of incipient decomposition; especially if it be considered that flints with uncoated surface, by a long exposure to the influence of moisture and other atmospheric agents, have been known to acquire another thin coating, (but not calcareous,) with loss of weight.

Many geologists of the present day, who consider the idea of a transmutation of the calcareous into siliceous earth as unworthy the advanced state of modern chemistry, at the same time that they are unwilling to have recourse to floods and other revolutionary agents for rolling fragments of flint into boulders, and disposing them in the regular manner in which they are now found, have adopted, some, the hypothesis of infiltration by means of a siliceous fluid; others, that of a forcible injection of melted flint into vacancies previously existing in the calcareous strata. But either of these theories

theories is open to objection; and, indeed, the same objections appear to apply to both. It is difficult to account for the strange predilection the stony fluid (whether its fluidity proceeded from water or fire) has manifested for stony lime-stone, particularly for chalk; while other stony and primitive rocks, several of which must be supposed to have been equally exposed to it, remained perfectly untouched. Nor is it much easier to conceive how that supposed fluid can have found its way into so many approximate, but perfectly distinct, hollows in the chalk, without more or less penetrating the intermediate parts, or leaving traces of masses that were connected with the nodules as they now appear; not to mention the improbability that so many almost contiguous vacancies (especially those that must be supposed to have been the moulds for the frequently occurring tabular expansions of flint) should not have yielded to the pressure of the superincumbent stratum. As, moreover, these hypotheses are silent respecting the origin of this stony mass, (although a substance so different in its appearance from common flint), another theory of the generation of the nodules of flint has been proposed, which, however, is not likely to meet with any followers among those geologists, whose exalted ideas of the present state of chemical knowledge lead them to suppose that the result of their analytical and synthetical processes must of necessity, in all cases, square with those great operations that, with her ample means, and assisted by a long series of ages, have been accomplished by Nature in the vast laboratory of the earth. We allude to the hypothesis, according to which all flint, whether it be found in nodules or as flat tabular plates, originates from the flesh of a stratum of marine gelatinous animals, which perished by some revolution, and were buried in their shells. The internal aspect of the nodules, and their being almost constantly found imbedded in stony lime-stone, which, by most geologists, is allowed to owe its existence to shells and other calcareous coverings of testaceous animals, seems first to have suggested this new idea; which, strange as it appears, may be allowed to have as much plausibility as any of the former; especially as it may be adapted equally well to the system of an igneous, and to that of an aquatic origin of terrestrial bodies. Mr. Patrin is of opinion, that when the chalk was deposited at the bottom of the sea, in those strata which we now see, it met, on other strata already existing, a vast number of marine bodies, shells, madrepores, &c. while others were carried along with the precipitating chalk itself, such as medusæ, &c. whose soft and gelatinous bodies, while they occupy much space, contain but little substance. When all these marine animals were buried in the chalk, and their decomposition took place, those of a consistence merely gelatinous left in their matrix an empty space, nearly equal to the space they occupied when alive: their substance, almost in a state of fluidity, was absorbed by the porous sides of the cavity; and by the combination of this animal fluid with the chalk, these sides were, by some unknown agent, converted into flint. In this manner Mr. Patrin accounts for the generation of nodules that are either hollow or filled up with chalk; which latter may have been deposited there by means of some aperture, or may have penetrated through the stony coat itself, when still in a state of softness. As to those nodules, the central part of which is of a more perfectly stony nature than that nearer the circumference, they were, according to the same author, formed of marine animals of more consistence or solidity; and it is in these particularly that vestiges of animal organization are found. The more consistent part of the body of these animals produced the

more perfect flint, such as we see it in such solid nodules; while the fluid which escaped from the body, by the effects of decomposition, formed the external layers of this nucleus, which, being mixed with the substance of the chalk, became less perfect flint the farther it removed from the central part. According to this explication, the most imperfect part of a nodule of flint would be that, which, in its original situation, occupied the lowest place, and towards which the fluid which escaped from the more solid nucleus must naturally have taken its direction. This, however, is never found to be the case; nor has Mr. Patrin endeavoured to account for that circumstance. What appears to be much in favour of this explanation is, that the whole body of echini in their shells has been found converted into flint; and Gillet-Laumont has frequently observed that those echini, which he met with in the chalk strata of Montreal-sur-Mer, were furnished with a stony appendage issuing from their mouths, and which appears to have been the animal substance converted into a fluid state by decomposition. The same circumstance is not seldom observed in bivalve shells, whose gelatinous inhabitants have been found in a perfectly silicious state; while the shells themselves had retained their original calcareous nature, and were partly converted into spar. In cases where the gelatinous marine bodies were in such abundance that no intermediate space was left for the deposition of chalk, the flint has been formed into large masses and plates of considerable extent. Dr. Darwin's ideas on this subject are nearly the same, and modified only by his adopting a different theory for explaining the conversion of the gelatinous animals into flint. He conjectures that the nodules of flint found in chalk-beds have gained their form, as well as their dark colour, from the flesh of the shell-fish from which they had their origin, but which have been so completely fused by heat, or heat and water, as to obliterate all vestiges of the shell; in the same manner as (according to the doctor's opinion) the nodules of agate and onyx were produced from parts of vegetables, but which had been so completely fused as to obliterate all marks of their organization.

A remarkable circumstance, relating to the geological history of flint, should not be passed over unnoticed in this place: it is that Sir Henry Englefield has observed in the neighbourhood of Carisbrook, and in other parts of the Isle of Wight, an immense number of nodules of flint, all of which, though not removed out of their places, and retaining perfectly their original shape, were more or less lustrous or shattered. Some few were only split into large pieces, but the greater part were broken into small fragments, and some absolutely reduced to impalpable powder. The chalk strata in which they were imbedded had an inclination of at least 67 degrees, and perpendicular fissures traversed the whole. Sir Harry conjectures, "that when the tremendous convulsion took place which sunk them to the situation in which they now appear, (at which time the channel which separates the Isle of Wight from the main land was perhaps formed) the strata of chalk, in the act of subsidence, had a tendency to slide on each other; and this would be exerted most sensibly where, from the admixture of the flints, the cohesion of the parts of the chalk was the weakest. This motion, or rather strain of so enormous a weight, might in an instant shatter the flints, though their resistance stopped the incipient motion; for the flints, though crushed to powder, are not displaced, which could have been the case had the bed slipped sensibly." This theory appears to us very unsatisfactory, though we are not prepared to give a better. The advocates for the igneous origin of flint may,

perhaps, be inclined to account for the phenomenon by an accidental sudden cooling of the flinty masses.

We conclude this article by adding a few words on the *uses* to which flint is applied, some of which are of considerable importance. The one derived from its giving copious sparks with steel is the most ancient and generally known; but the art of cutting or rather breaking this stone into regularly shaped gun-flints is of more modern date, and was not practised till a considerable time after the invention of fire-arms. The mode of making gun-flints has for a long time been involved in fable and mystery: the most absurd and contradictory accounts having been given of it by various authors; and it was not till lately that we have been made fully acquainted (by Hacquet of Vienna, and by Dolomieu) with the simple manner in which these flints are manufactured in Galicia and in France, where they constitute an important article of trade. (See GUN-FLINT.) The art of squaring and chipping flint was practised long before that of making gun-flints; and as this latter requires exactly the same management and the same tools, the former cannot properly be called a lost art, though, on account of the expensiveness of such square pieces of flint, if employed for constructing walls and covering roofs, it is not much practised. The north wall of the Bridewell at Norwich, mentioned in a letter of Mr. Baker, in the 43d volume of the Philosophical Transactions, was built of flints, "squared to such a nicety, that the thin edge of a knife could not be insinuated between the joints without a great deal of difficulty." And we learn from a note to that letter, that the gate of the Austin friars at Canterbury, the gate of St. John's abbey at Colchester, and the gate near Whitehall, Westminster, are executed in the same taste; and the platform on the top of the Royal observatory at Paris, which is paved with flint after the same manner, is adduced as a proof that the French have in some measure recovered the art. Flint is also often employed in the manufactory of glass, smalt, porcelain; and some of its lighter coloured and striped varieties are made use of for ornamental purposes. They take an excellent polish, and are not unfrequently manufactured into snuff-boxes, &c.

FLINT-Slate. The history of this fossil presents a labyrinth of blunders and confusion. On one hand it has been described under the names of well defined Wernerian species of rocks, such as horn-stone, trapp, &c.; on the other hand it has been jumbled together with various mineral substances, under the vague and unsystematic appellations of *roche corneenne*, *petrosilex*, and particularly (by German mineralogical writers) under that of "hornschiefer," or corneous slate. This latter was applied by some mineralogists to the subject of this article; but by others it was indiscriminately given to hornblend-slate, to varieties of clay-slate, to mica, and to porphyry-slate; whence professor Werner, to prevent the same confusion that has been introduced into mineralogy, by the term "shorl," expunged that of hornschiefer, (though he had made use of it himself,) applying to the fossil in question the name of *kiefschiefer*, now generally adopted in Germany, and of which "flint-slate" is a literal translation. The just mentioned author has divided this species into two sub-species, *viz.* into common flint-slate, and Lydian stone. The latter has been considered by some as a mere variety of the former; but there are good reasons for ceeping it distinct. See LYDIAN STONE.

Common flint-slate occurs generally of a dark grey colour, which has frequently an admixture of blue, of red, and of yellow; and these tints often pass over into each

other, or are seen separately in the same fragments, as spots or stripes. The blood-red and brownish-red varieties are the rarest. It is found massive and in rounded pieces, which latter have a smooth surface. Internally it is dull; now and then rather glimmering. In small fragments its fracture varies; it is sometimes splintery, and imperfectly conchoidal, and sometimes passes into even; the blackish-grey variety with the latter fracture approaches the Lydian stone. In large masses it manifests its slaty nature. Its fragments are angular and sharp, and but little translucent at the edges. It is brittle, and its hardness nearly the same as that of quartz. Another pretty constant character of flint-slate is its being traversed by veins of quartz, that are often of a greyish or reddish colour. Specific gravity, according to Gerhard, 2.860; according to Kirwan from 2.596 to 2.641. Those varieties of flint-slate that have been chemically examined are not fusible *per se*; nor do they much change their colour in the fire; the grey becomes rather lighter coloured, the black does not appear to be at all affected by the heat of the blow-pipe. Wiegleb's analysis of flint-slate from Fulda (in vol. i. of Chem. Annalen, where, however, it is called hornschiefer, and considered as of volcanic origin) has given the following result:

Silica	75.00
Lime	10.00
Magnesia	4.58
Oxyd of iron	3.54
Inflamm. particles	5.02
	<hr/>
	98.14

Flint-slate appears to pass over into Lydian stone, into horn-stone, quartz, and particularly into clay-slate; so that when seen in small fragments, it is often difficult to seize its distinguishing characters. It is found in various parts of Germany, Bohemia, Silesia, in Bareuth, the kingdom of Saxony, the Hartz, Palatinate, Salzburg, &c.; and, according to Mr. Jameson, in various parts of the great tract of transition rocks in the south of Scotland. The geognostic relations of flint-slate are not well ascertained, and indeed it is difficult to assign it a proper place among the rocks. It is generally found in huge, clifty, and craggy masses, particularly on granite and clay-slate, and more frequently as beds in transition, clay-stone, *grauwacke*, and *grauwacke-slate*. From the observations of some geologists it would appear that flint slate is, in many cases, to be referred to the transition rocks of Werner; and, according to Freiesleben, the specimens in Lefsius's collection of rocks, which by this author are described as varieties of trapp, belong to the transition flint-slate; whence its occurring as angular fragments in grey-wacke, and as rounded pieces in the old red sand-stone can be no matter of surprize. Most frequently, however, it occurs in the shape of boulders, on plains, and in the beds of rivers.

FLINT is used, in our military service, for the purpose of affixing into a *vice* made at the top of the *cock* of a musquet, or pistol lock; so that when impelled against a piece of steel, called the *hammer*, it may strike fire, and ignite the gun-powder contained in a *pan*, concealed by the *hammer*, until the latter is forced backwards on a pivot, by the great force with which the *cock* strikes against it; when it not only produces fire, but, by its peculiar form, directs the sparks towards the *priming* in the *pan*.

Flints are easily adapted to this purpose; those great masses which are found chiefly in chalky soils, being broken by hammers, yield a number of wedge-like pieces,

of which the sides are trimmed to the proper width, and the backs brought into a proper form, which should be rather concave. This concavity is, however, very little attended to, but is of great service, since it embraces the screw of the vice, and causes the flint to retain a much firmer hold than when its back is made either straight, or convex; the latter is a great fault, but is commonly overlooked.

The proper sizes for flints are as follow; for a musquet, one inch and five-eighths, for the length, with a width of an inch and a quarter; the thickness at the back one-third of an inch, and the tapering to be rather sudden than gradual, something like the end of a chisel. Such flints fit well in the *vice*, being previously laid in a bed of thin sheet-lead, or for want of it, in stout leather. The edge of a flint, thus formed, is far less subject to splinter, than where the angle is more acute. It may perhaps be objected, that a thin edge strikes fire better than a thick one; but that will be for only a few rounds; whereas the thicker edge resists better, and preserves an equable facility of scintillating for a long time. All military men must know that nothing is more adverse to the operations of a regiment, than the necessity (which too often occurs in consequence of the proper form not being sufficiently attended to) for men to quit their ranks for the purpose of either hammering, or changing their flints. To the brave man such a necessity is painful, as well as dangerous, while to the less resolute it serves at least for a pretext to pass into the rear, or eventually to relinquish his post altogether.

A carbine flint should be one inch and a quarter in length, by one inch in width; that for a pistol, such as is used among our military, ought to be rather more than an inch in length, by three quarters in width. In fixing them into the vice, great care should be taken that their left sides pass down clear of the barrel, which they would otherwise hack very much, and be themselves subject to splinter, while the cock itself might, by being unduly checked, be snapt at its neck.

When flints have a curve, they should always be so fixed in the vice, as to give the curve a downward direction; since, in that way, they act more forcibly, and offer the greatest resistance. Straight flints, after being so far rounded as to yield no sparks, when their chamfered sides may have been uppermost, may be again rendered serviceable by being reversed, so as to bring their flat sides uppermost. Soaking flints in water restores them partially, probably by supplying them with hydrogen, but in a very small degree, and that not permanently.

The best flints are such as, when acted upon by steel, produce strong lasting corruptions, which emit a sulphureous smell, and are sufficiently large to leave some little stain on tissue paper, or on fine lint. Such will not only be found to yield a certain fire, but to break up admirably under the hammer employed to reduce them to splinters, and to fit them for the soldier's use. On the contrary, however clear, black, and firm a flint may appear, if its sparks are not vivid, and highly sulphureous, it ought to be at once thrown aside.

The hardest flints being generally the best, experiments were made with agates, cornelians, &c. all of which produce beautiful sparks, but, being extremely brittle, could not be brought into general use; however, in situations where they are obtainable, and where flints are not to be had, they become valuable substitutes. Various attempts have been made to produce flints by means of composition; but such have always proved vitreous, and consequently weak both in substance, and in the production of sparks. We cannot conclude this article without strongly recommending,

that more attention be paid at our arsenals to the rejection of flints of defective form and quality.

Flints are generally packed in small casks, called half-barrels, each of which contains,

	Number	qrs.	lbs.
Musquet flints	2000	weighing	2 14
Carabine do.	3000		2 10
Pistol do.	4000		2 15

The tonnage of this article is computed at 28 kegs of musquet-flints to occupy 18 cwt. and 10 kegs of pistol-flints to occupy 3 cwt. 2 qrs. which our readers cannot fail to observe by no means corresponds with the foregoing table of contents.

FLINTS, in the *Glass-trade*. The way of preparing flints for the nicest operations in the glass-trade is this. Choose the hardest flints, such as are black and will resist the file, and will grow white when calcined in the fire. Cleanse these of the white crust that adheres to them, then calcine them in a strong fire, and throw them, while red-hot, into cold water; wash off the ashes that may adhere to them, and powder them in an iron mortar, and sift them through a very fine sieve; pour upon this powder some weak aqua fortis, or the phlegm of aqua fortis, to dissolve and take up any particles of iron it may have got from the mortar; stir this mixture several times, then let it rest, and in the morning pour off the liquor, and wash the powder several times with hot-water, and afterwards dry it for use. You will thus have a powder for making the purest glass, as perfectly fine and faultless, as if you had used rock crystal itself. Cramer's Art of Assaying Metals, p. 438.

The washing off the ferruginous particles with aqua fortis is not necessary when the glass intended to be made is to be tinged with iron afterwards; but when meant to be a pure white, this is the method that will secure success.

FLINTS, the small, sharp, hard, vitrifiable stones which often abound in soils of the more thin, poor kinds.

FLINTS, *oil or liquor of*, a name given by some to a preparation made of four ounces of flints, calcined and powdered, and mixed with twelve ounces of salt of tartar; these being melted together in a large crucible, by a strong fire, run into a glass, which quickly and strongly attracts moisture from the air, and is entirely soluble in water, except a very small portion of earthy matter; this glass, being afterwards powdered and set in a cellar, runs into an oil per deliquium; with this and the calx of any metal is prepared one of the metallic vegetations. If any acid be added to the liquor of flints, so as to saturate the alkali, the flint, which was kept dissolved in water by means of this alkali, will be now precipitated in the state of a fine earth, which earth is entirely soluble by acids.

FLINT Walls. See WALL.

FLINT Nodules, in *Geology*, are a phenomenon of a curious and important kind, when their regular dispersion through the chalk strata are taken into consideration, as well as the singular and somewhat regular shapes which they assume. The great assemblage of chalk strata which form the uppermost but two of the assemblages of strata in Britain, as far as is yet known, (*viz.* the London-clay and Bagshot-sand,) abounds with these nodules in about the upper half thereof, called the upper or stony chalk, while the under part, called the lower or hard chalk, has few if any flints occurring in it, and these, at its upper part, if such do occur. It is well ascertained, that none of the chalk strata are entirely free of minute grains of siliceous or gritty matter in them, whence the use of chalk or whitening in scouring tin, silver, and other vessels arises; and modern observations by Mr. Smith and his pupils have shewn, that where the layers of
flints

flints most abound, or are nearest together, as they are near to the top of the whole series, that there the intervening beds of chalk are most *free* or soft, as well as the whitest, and that from these situations it is, that the writing chalk used by carpenters, &c. and the best for the manufacture of whiting for lime for the plaiter's uses, or for chalking land by the husbandmen, are taken. It has further been observed, that as the flints decrease in quantity, in descending the chalk series, that more siliceous grains appear in the chalk itself, until the flints cease altogether, and the lower-chalk commences; which lower chalk is much harder, more like lime-stone, and is more siliceous, which properties seem to render it preferable for the common purpose of mortar-making, than the softer chalks. This hard or inferior chalk, used for lime-burning in Bedfordshire and the adjoining counties, is called hurlock; and it is observed, that the beds of this hard chalk become more hard and compact in descending the series, as was a few years ago visible to travellers in the cutting of the new road down Ruddle-Hill, a mile from Dunstable, and as may again be shewn, if the tunnel which has been proposed under the old road for avoiding the inconvenient bend occasioned by the new one, should be carried into effect. The hard chalk or hurlock continues to increase in its siliceous qualities until near the bottom of the series, where it becomes a free-stone, which is in great repute there, under the name of Totterhoe-stone, which has a sharp and fine grit, and instead of being lime-stone, possesses the properties of a *fire-stone*, under which denomination the stone of this stratum is brought to the metropolis from Ryegate, Godstone, and other places on the southern skirt of the North Downs of Surry. Thus it appears, that siliceous or stony matter abounds in the chalk, through the whole series, from the sand strata which lie above it (at Croydon), to the sand strata which lie below it (at Ryegate); but it is in the upper part of the chalk series collected into nodules and layers of flint, and in the lower part of the series is distributed in the mass of chalk.

It seems probable, from the observations of Mr. Parkinson, and other late observers, that the flint nodules of the chalk strata, or great part of them, owe their origin, or rather perhaps occupy the place of the *Alexonium* and others of the zoophytic tribes of the primitive creation. The vast number of hollow tubes in flint, which we meet with in the chalk pits at Harefield, near Rickmanworth, Herts, and other places, though often mistook for petrified *bones*, seem to us to be remains of the coralline tribe. *Echini* are often found among the flint nodules of the chalk strata, some of them large and rather of a rude shape, compared with the delicate workmanship observable on many of echinians; this kind are found in vast numbers in the chalk-pits about Brandon in Norfolk, and are used in building walls and houses, in a neat and very singular style.

FLINTSHIRE, in *Geography*, a county in North Wales, bounded on the south and west by Denbighshire; on the north by the Irish sea; and on the north-east is separated from Cheshire by the estuary of the Dee. At an early period this district formed a portion of the country to which the Romans gave the appellation of *Ordovicia*; the inhabitants of which so eminently distinguished themselves in their pertinacious resistance to the Roman arms. Subsequent to the Romans leaving the island, it long constituted the territory known to the Britons by the name of *Deheubarth*; and several strong castles still remaining, shew it was formerly a scene of sanguinary contention. In the time of Henry VIII, when Wales was incorporated with England, this was made one of the six counties of North

Wales. This county extends in length 33 miles, and in breadth from 8 to 9, containing about 166,000 acres of land, of which, according to the report to the Board of Agriculture, only 20,000 are in an arable state 116,000 under pasturage, and the remainder in a state of waste. The principal rivers are the Dee, which rising in Merionethshire, after running through Denbighshire, waters this county, and is navigable from Chester to the sea. The Clwydd has its source in Denbighshire, and running in a northerly direction; is joined by the Alan below St. Asaph, and falls into the Irish sea. It is also watered by the Sevon, the Wheeler, and a few smaller streams. The face of the country is much less diversified than any other Welsh county. A ridge of low hills rises abruptly on the north-eastern part of the county from the Dee, and, running parallel with that river, terminates at the sea. The vale of Mold is a rich level country, and the vale, or rather valley of Clwydd, has been long celebrated for its picturesque beauty. The northern part is champagne, and abounds with corn; the vallies consist of an argillaceous soil, and are productive in grafs. The cattle are small, but considered excellent milchers. Quantities of honey are annually produced, which the inhabitants manufacture into a kind of wine called *Metheglin*. The hills are barren, but are internally rich, containing free-stone, lime-stone, coal, lead, copper, and calamine, the ores of which are smelted, and the metals exported via the port of Chester. The county politically is divided into five hundreds, *viz.* Colehill, Maylor, Mold, Prestayn, and Rhyddlan, comprising one city, St. Asaph, one borough, Flint, and four other market towns, *viz.* Caerwys, Caergwre, Mold, and Holywell; and twenty-eight parishes, 23 of which are in the diocese of St. Asaph, and five in that of Chester. By the returns made under the population act to parliament, in 1801, the number of houses was 7585, and inhabitants 39,622; out of which number it appeared 10,332 were occupied in the labours of agriculture, and 6,89 employed in trade. Many of the latter find employment in the mines and smelting-houses, and others in the linen trade, a manufactory of which was, by the patriotic exertions of Mr. Fitzwilliams, introduced into the county, and has since spread, and is at present in a flourishing state. The county is represented by one member in the British senate.

FLINTY GRAVELS, are such gravelly soils as contain a large proportion of flints in their compositions. They are met with in many situations.

FLINTY Soils, all such as are constituted with a large proportion of stony matters. These soils are mostly thin, and of no very great fertility. They prevail in many situations. See **SOIL**.

FLIP, a sort of sailor's drink, made of malt liquor, brandy, and sugar, mixed.

FLISSINGUE, in *Geography*, a small island or fortress in the East Indian sea, a little to the west of Amboyna.

FLITTER-MOUSE, in *Zoology*, the *bat*. See **VERTEBRILIO**.

FLIX, in *Geography*, a small town of Spain, in Catalonia, formerly defended by a castle on an eminence, but now dismantled, peninsulated by the Ebro; 8 leagues above Tortosa, near the cataract of that river.

FLIX Weed, in *Botany*, a species of water-cressles, which grows in uncultivated places, and by the side of foot-ways in many parts of England: it flowers in June, and the seeds, which ripen in August, are greatly recommended by some for the gravel and retention of urine.

FLIZE, in *Geography*, a town of France, in the department of the Ardennes, and chief place of a canton in the district

district of Mézières, seated on the Meuse; 5 miles S. E. of Mézières. The place contains 92, and the canton 5362 inhabitants, on a territory of 155 kilometres, in 26 communes.

FLOAT, or FLEET. See **FLOTA**, and **FLEET**.

FLOAT of a fishing-line, &c. See **FISHING-boat**.

FLOAT, sometimes called *catamaran*, also denotes a certain quantity of pieces of timber, joined together with rafters athwart, thrown into a river to be conveyed down the stream; and even sometimes to carry burthens down a river with the stream. The invention of floats is of great use; it is said to have been first put in execution at Paris in the year 1618. (See **BOAT**.) The term also signifies to turn water upon meadow-land, with the view of dressing and improving it. And it likewise implies the paring off the surface, turf, or sward of grass lands. See **RART**.

FLOAT, in *Engineering*, signifies a low or shallow boat, often called a dirt-boat, used in the repairs of canals; which see. See **FLATTS**.

FLOAT-boards, those boards fixed to water wheels of undershot mills, serving to receive the impulse of the stream, whereby the wheel is carried round. See **Water-WHEEL**.

It is a disadvantage to have too great a number of float-boards; because, when they are all struck by the water in the best manner it can be brought to act against them, the sum of all these impulses will only be equal to the impulse made against one float board at right angles, by all the water coming out of the pen-stock, through the opening, so as to take place on the float-board. The best rule in this case is, to have just so many, that each of them may come out of the water as soon as possible, after it has received and acted with its full impulse; or, which comes to the same thing, when the succeeding one is in a perpendicular direction to the surface of the water. As to the length of these float-boards, it may be regulated according to the breadth of the stream. See *Desaguliers*, vol. ii. p. 425.

FLOAT Grass. See **FESTUCA**.

FLOAT-Ore, in *Mining*, or *shoad-ore*, signifies, in some places, the same with *stream-ore*, or that found alluvial in the bottoms of vallies, as tin often is in the valleys in Cornwall.

FLOAT-stone. See **QUARTZ**.

FLOATAGES. See **FLOTAGES**.

FLOATING BODIES. *On the Stability and Equilibrium of Floating Bodies.*—Although the general principles relating to this subject will be considered in their proper order under the articles **FLUIDS** and *Specific GRAVITY*, yet there are a few interesting theorems more particularly belonging to floating bodies, and which, forming a subject of themselves, seem to merit attention in this place.

Taking for granted the elementary principles of hydrostatics, as previously established, we shall examine the cases in which floating bodies are in equilibrium, when that equilibrium is stable, and when tottering or unstable. In every system of bodies, whether floating in fluids or acted on by the force of gravity, there are two states of equilibrium, entirely distinct. In one, if the equilibrium be ever so little deranged, the bodies which compose the system only oscillate about their primitive position, and the equilibrium is said to be firm or stable. This stability is absolute if it takes place, whatever be the nature of the oscillations; it is relative if it only takes place in oscillations of a certain kind; in the other state of equilibrium, if the system be ever so little deranged, all bodies deviate more and more, and the system, instead of having any tendency to re-establish itself in its primitive position, is overset, and assumes a new position, entirely different from the former.

We may form a just conception of these two states, by supposing an ellipse placed vertically on an horizontal plane: if the ellipse is in equilibrium on its smaller axis, it is evident that, upon a slight derangement, it will tend to regain its original position, after several small oscillations, which will soon be terminated by the friction and resistance of the air; but if the ellipse be placed in equilibrium on its greater axis, if once it deviates from this position, it will continue to deviate more and more, till it finally turns itself on its lesser axis. In the above example there is this remarkable circumstance; the four positions of equilibrium of the ellipse on the extremities of its two axes are alternately stable and unstable; and this takes place in every case. For suppose two positions of stable equilibrium to take place in any body, and such that there does not exist between them any position of the same kind, if the body is placed in one of these positions, and is made to deviate from it, and to approach the other, according as this deviation is greater or less, the body will either return to its original state, or will arrive at the other position. There will evidently, therefore, be some intermediate position in which the body will neither tend towards one or the other of the former, but will remain at rest: but this state of equilibrium will be unstable, since, if the body be made to deviate ever so little towards one of the other positions, it will necessarily arrive at it. Hence it appears, that if a body turning round a fixed axis passes through several positions of equilibrium, they will be alternately stable and unstable.

The stability of a floating body is the greater as its centre of gravity is lower than that of the displaced fluid, or as the distance between these centres is encreased; it is for this reason that ballast is put in the lower part of vessels to prevent them from being overset.

The nature of the equilibrium, as to stability, depends on the position of a certain point, called the *meta-centre*, or centre of pressure. The term was first adopted, we believe, by *Bouguer*, in his *Traité du Navire*.

When the meta-centre is above the centre of gravity, the equilibrium is stable; on the contrary, when the meta-centre is lower than the centre of gravity, the equilibrium is tottering; when the meta-centre coincides with the centre of gravity, the body will remain at rest in any position it is placed in, without any tendency to oscillate.

The determination of the meta-centre, and of the nature of the small oscillations of a floating body about its primitive position, is a problem of considerable importance.

Laplace gives the following rule for determining whether the force which solicits the system tends to restore it to the same state again, when deranged from its primitive position.

“ If, through the centre of gravity of the section of the surface of the water on which a body floats, we conceive a horizontal axis to pass, such that the sum of the products of every element of the section, multiplied by the square of its distance from this axis, be less than relatively to any other horizontal axis drawn through the same centre; the equilibrium will be stable in every direction, when this sum surpasses the product of the volume of the displaced fluid, by the height of the centre of gravity of the body above the centre of gravity of this volume.”

This rule is principally useful in the construction of vessels which require sufficient stability to enable them to resist the effects of storms, which tend to submerge them.

In a ship, the axis drawn from the stern to the prow is that relative to which the sum above-mentioned is a minimum; it is easy therefore to ascertain and measure its stability by the preceding rule.

In order that a floating body may remain in equilibrium,

it is also necessary that its centre of gravity be in the same vertical line with the centre of gravity of the displaced fluid, otherwise the weight of the solid will not be completely counteracted by the pressure of the displaced fluid.

When the lower surface of a floating body is spherical or cylindrical, the meta-centre must coincide with the centre of the figure, since the height of this point, as well as the form of the portion of the fluid displaced, must remain invariable in all circumstances. The place of the meta-centre is determined by the doctrine of Forces combined with the elementary principles of hydrostatics, by considering the form and extent of the surface of the displaced portion of the fluid compared with its bulk and with the situation of its centre of gravity. According to Dr. Young, if a rectangular beam be floating on its flat surface, the height of the meta-centre above the centre of gravity will be to the breadth of the beam as the breadth to twelve times the depth of the part immersed. Hence, if the beam be square, it will float securely when either the part immersed, or the part above the surface is less than $\frac{1}{12}$ of the whole, but when it is less unequally divided by the surface of the fluid it will overfet. If, however, the breadth be so increased as to be nearly one-fourth greater than the depth, it will possess a certain degree of stability, whatever its density may be. *Plate VIII. Hydraulics, fig. 1*, taken from Dr. Young, is intended to illustrate this.

Two square beams floating at the depths shown at A and B, will have a certain degree of stability, but if they sink, as at C, they will overfet; but a beam of the breadth shewn at D will always float securely.

Theory of the Stability and Oscillations of floating Bodies.—When a floating body is in equilibrium, if it be deranged from this state by any cause whatever, it is the object of this investigation to determine the circumstances in which it will return to this state, or continue to deviate more and more from it.

In the state of equilibrium (*fig. 2.*), the straight line G O, which joins the centre of gravity G, of the body D F E, to the centre of gravity O, of the displaced fluid A F B, is vertical. Let this line be taken as the axis of z; (see FORCE, where this method of analysis is explained). If the body be deranged, this line G O becomes inclined, and O is no longer the centre of gravity of the displaced fluid a F b; the derangement is here supposed infinitely small; the plane of x and y is taken as horizontal, and passing through G, the axis y is projected as a point in G. G x is the axis of x. A B represents the floating surface in a state of equilibrium, a b in its new position; the co-ordinates y are supposed parallel to the axes of these surfaces, which separate the immersed part of the body from that which is above the fluid; this axis may be called the axis of the floating surface: it is projected on the point C. The point O may be placed lower than G, without changing any of these considerations. The figure supposes a body not homogeneous, but having the inferior part artificially rendered specifically heavier than the fluid, as in the case of ships. The angle a C A = θ = G O V is supposed infinitely small; so that we may imagine the elementary solid A C a as formed by the revolution of the surface A C, round the axis C of the floating surface. The same may be said of B C b; q q', and p p', are the projections of the arcs described by the centres of gravity of B C, A C.

Neglecting the vertical motion of the body, we may consider a F b as equal to A F B; so that the portion A C a out of the fluid is equal to the part B C b, which is immersed in it. If it were otherwise the weight of the

body would no longer be equal to the pressure of the fluid; and these two forces acting on C would produce a vertical motion in the body; besides which it would turn round C as a fixed centre; and as this last motion is independent of the first, and the only one which we are to investigate, this hypothesis simplifies the question by confining it to the latter motion only. The expressions, therefore, for the volumes A C a, B C b, are to be made equal, that is, A C \times p p' = C B \times q q'; and since the momenta of the areas A C and B C are equal with respect to the axis C, the centre of gravity of the surface A B, or a b, is situated on this axis. The equilibrium being disturbed, we are to consider the motion which the body will take. Let G O = a, the volume A F B = a F b = S; also sine θ = θ , cos. θ = 1.

The pressure of the fluid on the immersed portion a F b is equal to the weight of the displaced fluid; this force acts on the centre of gravity of a F b, and since it is the position of this centre which is to determine the motion of the body about the point G, its position must be determined by taking the momenta relatively to the planes x z, y z.

a F b + a C A is the same as A F B + C B b; and it can be shewn, that considering the volumes a F b, a C A, as concentrated in their respective centres of gravity, as likewise those of A F B and C B b, and taking their momenta relative to any plane, their momenta will be equal. Let them be taken relatively to the plane y z, or the plane perpendicular to the figure, and then A F B \times G V = S a; sin. θ = S a θ , is the momentum of A F B, supposed concentrated in O.

C B b \times q i will be that of C B b, because q differs but an infinitely small quantity from the extremity of the vertical passing through the centre of gravity of B C b.

Likewise, a C A \times i p, will be that of a C A.

Let g n be the projection of the vertical passing through the centre of gravity of a F b, then a F b \times G n = S x will be the momentum of a F b, supposing G n = x. The momentum of a C A should be taken with a contrary sign from that of a F b, since the weight and the pressure tend to make them revolve in contrary directions round the axis y. Hence

$$S x - A C a \times i p = S a \theta + C B b \times q i,$$

and $S x = S a \theta + C B b \times p q$.

To determine the centres of gravity of the elementary portions A C a, B C b, we must divide the sum of the momenta of their elements by their volumes; let any element, ϵ , be taken of the surface A C, whose distance from the axis of the floating body C is ϵ ; then $\theta \epsilon$ is the arc of rotation of A C round this axis, or the height of the little elementary paralleloiped which it describes; $\theta \epsilon$ will equal its volume, $\theta \epsilon^3$ its momentum relatively to a vertical plane passing through C; $\theta \int (\epsilon^3)$ is the sum of these momenta, therefore, $\theta \int (\epsilon^3) = A C a \times C p$.

In the same manner will be obtained C c b \times C q; and by addition B C b \times p q = θb^3 ; b^3 expressing the momentum of inertia of the area A B relative to its axis, which momentum is positive and known, since this axis is parallel to that of y, and passing through the centre of gravity of A B; lastly, the abscissa G n of the pressure of the fluid is

$$x = \left(a + \frac{b^2}{S} \right) \theta.$$

The momentum of the volume A F B is positive, only because the centre of gravity O of the displaced fluid is more elevated than that of the body. If, on the contrary, the point O had been lowest, the perpendicular G V would have fallen on the opposite side, then the momentum of

A F B would have tended to turn in a contrary direction, and we should have had

$$x = \left(-a + \frac{b^2}{S} \right) \theta.$$

The general formula is therefore $x = \left(\frac{b^2}{S} \pm a \right) \theta$; the sign + for the case of the centre of gravity of the body being lower than that of the fluid, the sign - for the contrary.

The co-ordinate x being thus determined, it now remains to determine y .

We have already $a F b + a C A = A F B + C B b$, and taking the momenta relatively to the plane of xz , that of $a F b$ is $S y$, that of $A F B$ is zero, since the centre of gravity O is in the plane xz ; we have therefore only to estimate those of the two elementary sections.

Let us suppose that the ordinates of their respective centres of gravity in the direction of the axes of y are positive, the element ϵ taking upon $C B$ gives the elementary parallelepiped $\theta \epsilon r$, denoting its distance from the plane xz ; $\theta \epsilon r$ denotes its momentum; the sum of these momenta is therefore $\theta \int (\epsilon r)$, observing that their signs must vary with the sign of r , that is, as these elements are situated on one or the other part of the plane of xz , the momentum of $B C b$ is therefore $\theta \int (\epsilon r)$: a similar expression will be obtained for $a C A$, but with a contrary sign, since the pressure relative to $B c b$ and $a F b$ acts evidently in a contrary direction to the weight of $A C a$: this negative expression, transposed on the contrary side of the

equation, becomes positive, hence $S y = \theta \int (\epsilon r)$; and $y = \frac{\theta}{S} \int (\epsilon r)$. The symbol \int denotes the integration relatively to the whole floating surface, and of a right line which is the intersection of this surface with the plane of xz , it may therefore be considered as known, but it is not necessarily positive, like $\int (\epsilon r)$ since the elements vary with their signs; therefore the co-ordinate y of the meta-centre may become either positive, negative, or zero with $\int (\epsilon r)$. If the body is cut symmetrically in two equal parts by the plane of xz , $\int (\epsilon r) = 0$ and $y = 0$, and the co-ordinate x of the centre of gravity is given by the formula found above, $x = \left(\frac{b^2}{S} \pm a \right) \theta$.

When $x = 0$, the centres of gravity, and the displaced fluid, are in the same vertical $G z$, therefore the equilibrium subsists in the new position of the body: this happens when a , being negative, $a = \frac{b^2}{S}$, but when this is not the case, as the pressure of the fluid acts upwards, it is evident that when x is positive, the body tends to regain its former position, and the equilibrium is then stable; this happens when a is positive, or when a is negative, and at the same time less than $\frac{b^2}{S}$. Finally, if a is negative, and

less than $\frac{b^2}{S}$, x is negative, which denotes that the centre of gravity of $a F b$ is on the other side of the vertical $G z$, the pressure of the fluid then causes the body to deviate more and more from its original position, and the equilibrium is tottering or unstable. This point in the axis of z , which is met by the pressure of the fluid, is called the meta-centre, and hence is derived the theorem mentioned above. That a floating body is in a stable equilibrium when the meta-centre is above the centre of gravity of the body, that the equilibrium is unstable when the meta-centre is below, and that when the two centres coincide

the body has no tendency to oscillate. It is evident that the point g is more or less elevated than the point G , or coincides with it according as the value of $G n$ is positive, negative, or zero.

We shall conclude this article with the following theorem from Dr. Young, which will serve to illustrate the preceding theory.

If a floating body have its section made by the surface of the fluid a parallelogram, its equilibrium will be stable or tottering, accordingly as the height of its centre of gravity above that of the fluid displaced is smaller or greater than one-twelfth of the cube of the breadth, divided by the area of the transverse vertical section of the immersed part.

Let the body be inclined in a small degree from the position of equilibrium $A B C$ into the position $D E F$; then the triangles $G H I$ and $K H I$ will be equal, since the area of the section immersed must remain constant, and $G K$ and $I L$ will ultimately bisect each other in H . Now the centre of gravity of the section $I L E$ is the common centre of gravity of its parts $I H M F$ and $L H M$, making $K M = G I$; but N , the centre of gravity of $I H M F$, is in the line $H F$, bisecting it, and the common centre of gravity may be found by making $N O$ parallel to $H K$ or $H L$, in the same ratio to the distance of the centre of gravity of $L H M$ from H , that $L H M$ bears to $I F L$. Now the distance of the centre of gravity of any triangle from the vertex is two-thirds of the line which bisects the base, that is, in this case, $\frac{2}{3} H K$, and the area of the triangle $L H M$ is $H K \cdot K P$; therefore $N O : \frac{2}{3} H K :: H K :$

$K P : L F I$, $N O = \frac{\frac{2}{3} H K \cdot K P}{I F L}$; but drawing $O Q$ vertically through O , $N O : N Q :: K P : H K$, and $N Q = \frac{N O \cdot H K}{K P} = \frac{\frac{2}{3} H K \text{ cub.}}{I F L} = \frac{2}{3} \frac{I L \text{ cub.}}{I F L}$. If therefore the

centre of gravity be in Q , the body will remain in its position in any small inclination; since the result of the pressure of the fluid acts in the direction $O Q$; if the centre of gravity be below Q , it will descend towards the line $Q O$, and the body will recover its situation; if above Q , the body will overset; hence the point Q is sometimes called the centre of pressure, or the meta-centre. The theorem may be easily accommodated to bodies of other forms.

FLOATING-bridge, a bridge consisting of several boats covered with planks: which ought to be so solidly framed as to bear both horses and cannon. See **BRIDGE**.

FLOATING-islands. See **ISLANDS**.

FLOATING Meadows, in *Rural Economy*, the practice of overflowing them with water in order to the improvement of their crops. See **MEADOW**, and **Watering LAND**.

FLOATING Vessel. See **BOAT**, **VESSEL**, &c.

FLOATING Upwards, an old term used in watering lands, where large dams for keeping up the water were had recourse to.

FLOBY, in *Geography*, a town of Sweden, in the province of West Gothland; 51 miles N. E. of Gotheborg.

FLOC, a town of Norway, in the diocese of Drontheim; 48 miles E. N. E. of Ramfdal.

FLOCK, a number of sheep kept together under a shepherd. Flocks are sometimes distinguished into the pasture, and mountain kinds.

FLOCK, Setting of, the practice of calling and sorting the different kinds of sheep-flock. It is usually had recourse to annually for lambs, where sheep husbandry is extensive.

FLOCK-Papir. See **PAPER**.

FLODAY, in *Geography*, one of the smaller Western islands of Scotland. N. lat. 57° 40'. W. long. 7° 13'.

FLODDAY, another of the above-mentioned islands. N. lat. 57° 31'. W. long. 6°.

FLODOARD, or **FRODOARD**, in *Biography*, an ecclesiastic and historian, was born at Epernai, in Champagne, in 894. He was educated at Rheims, and was appointed keeper of the archives in the cathedral, and afterwards canon. He had other preferments, and in 936 was deputed to pope Leo VII. by whom he was kindly received. At length he became an abbot of a monastery in the diocese of Rheims. An attempt was made, in 951, to place him in the see of Noyon, but without success. In 963 he resigned his abbacy, and devoted himself to pious exercises. He is known as an author by "A Collection of Histories in Verse," containing the triumphs of Jesus Christ and his disciples, and the abridged history of all the popes down to Leo VII. and of the most illustrious saints, &c. He wrote also "A History of the church of Rheims," and "A Chronicle comprising the History of the Times from 919 to 966." Moreri.

FLOETZ. See **FLETZ**.

FLOGEL, CHARLES FREDERIC, in *Biography*, a learned Silesian author, was born at Jauer, in December 1729. In the year 1774 he was appointed professor of philosophy in the academy of Leignitz, and died in March 1788, at the age of 59. He left behind him many able works, among which was "A History of the Human Understanding," and "A History of the present state of Belles Lettres in Germany." He had read a great deal, and possessed an extensive knowledge of the history of literature, as well as of philosophy and other sciences. He was highly esteemed on account of his integrity and agreeable disposition, and his memory has been immortalized by his excellent works. Gen. Biog.

FLOGNY, in *Geography*, a town of France, in the department of the Yonne, and chief place of a canton, in the district of Tonnerre; six miles S.E. of St. Florentin. The place contains 333, and the canton 8367 inhabitants, on a territory of 155 kilometres, in 15 communes.

FLOHA, a town of Germany, in the circle of Erzgebürg; six miles E.N.E. of Chemnitz.

FLOHAU, a town of Bohemia, in the circle of Saatz; eight miles S. of Saatz.

FLON, a river of France, which runs into the Arly, about a mile S.W. of Flumet.

FLONE, or **FLOEN**, a town of France, in the department of the Ourthe; eight miles S.S.W. of Liege.

FLONHEIM, a town of France, in the department of the Rhine and Moselle; 12 miles E.S.E. of Crantz-nach.

FLOOD, a deluge or inundation of waters. See **DELUGE**.

FLOOD is also used in speaking of the tide. See **TIDE**.

When the water is at lowest, it is called flood; when rising, young; or old flood; when at highest, high flood; when beginning to fall, ebb-water.

FLOOD-mark, the mark which the sea makes on the shore, at flowing water, and the highest tide: it is also called high-water mark.

FLOOD Sand. See **SAND**.

FLOOD-gate, among *Engineers*, signified a gate or sluice which can be opened or shut at pleasure to retain or give passage to the water of a river liable to be swollen by floods. Flood-gates are necessary in many situations upon rivers where the water is retained for the service of mills, canals, navigations, docks, &c.; in these only a certain

quantity of the stream can be employed, and the surplus in time of a flood must be suffered to escape by another passage. For instance, in the case of mills upon a large and rapid river, the stream of water is intercepted by a weir erected across it, and penned up the proper height to obtain a sufficient fall for the mill, which is situated by the side of the river, with a channel leading from above the weir, to convey the water to the mill, whilst another conducts it into the river below the weir. In ordinary times this arrangement is sufficient, for whenever the mill is not in action, the water which would otherwise pass through it, flows over the weir, and escapes into the river below. Now if the sudden falling of rain, or melting of snow, causes a flood in the river, it often happens that the length of the weir is insufficient to vent the torrent of water coming down; and without some contrivance answering the purpose of a flood-gate, to give passage to the water, it becomes penned up many feet above the crown, or highest level of the weir, inundating the lands adjacent to the channel, above the weir. If the river is provided with a proper flood-gate, it acts, when open, in the same manner as removing a part of the weir, and allows the water to pass down quietly without rising much above the level which is common in ordinary times. From this, the use of a flood-gate will be comprehended; navigable rivers, which are penned up to form locks, require flood-gates, which are applied in the same manner as before-mentioned.

Flood-gates may be constructed in various forms; but it is indispensable that they should be capable of being opened or shut during the time when a pressure of water is acting against them. Small gates are always made to slide up and down in a groove in the manner of a sluice; some very considerable rivers are furnished with a number of such small draw-gates, which open a great extent of water, when drawn up. In the most extensive works it is necessary to make use of a different kind of gate, which can be opened or shut with greater ease than a number of shuttles, and which will lay open a more extensive passage; for in violent floods it is not uncommon for large trees, bushes, hay ricks, thatched roofs of low buildings, &c. to be brought away by the torrent; and if the flood-gates have any obstruction, these matters accumulate before the passage, and, when the flood lasts long, frequently choke up the gate, and the water overflows its banks. To avoid such accidents is the study of the engineer in constructing works of this kind; the late Mr. Smeaton designed several flood-gates, in which the pressure of the water was balanced, so that the gate at any time could be opened or shut with ease, even while the pressure of the water was acting against it on one side only. *Figures 5 and 6 of Plate XV. Miscellany*, is a plan, and *fig. 2.* an elevation of this contrivance; A A B B represents a channel made through the weir, or, if more convenient to suit the local circumstances, it is made by the side of the river, leading from above the weir to below it: this channel must be substantially built in masonry to resist the violent action of the water rushing through it when the gate is opened; in some convenient part of this passage a stout beam C is placed across the bottom, and another, D, across the top, both firmly bedded in masonry; these support the gudgeons of the vertical axis E of the gate F F. When this gate is turned so as to present its edge to the current, the water has free passage by it, and on the other hand, when it is placed perpendicularly across the channel, the whole of the water is detained: the axis of the gate is placed so as to pass very nearly through the centre of pressure of the superficies exposed to the action of the water; and as the pressure of the surfaces on each side of the

FLOOD-GATE.

axis act to turn the gate in contrary directions, they balance each other, and the gate may be turned with scarcely any other resistance than the friction of its gudgeons. The gate must necessarily be framed exceedingly strong to bear the great weight of the water acting against it, without yielding. G, H, are two ground-cills firmly bolted down upon the floor of the conduit and the piles which are beneath it; one of the arms of each of these cills support the gate when shut, and the other arms sustain it when open, as is clearly shewn by the figure; these must be very firmly fixed to avoid any danger of the gate removing them; one of the upright sides of the gate is supported by falling into a recess made in the masonry of the conduit, and to keep the other side of the gate up to its cill, a lever, called a vallet, which is in the form of a triangle I K, and moves upon a vertical axis placed in a recess in the masonry so as to be out of the way of the gate's motion, when placed in the position at *fig. 5*, leaving the gate at liberty to open; in the other position it acts as a lever to close the gate, being drawn tight by tackle, and afterwards lashed by a small line to the beam D. The gate is retained shut, but can be opened instantaneously by cutting the line; and as the gate is made rather larger on the side of the axis where the vallet is placed, that it may have a tendency to open when released by the preponderating pressure on one side. The gate in question is 15 feet in height, and the same in breadth; when open, it allows two passages of 15 feet by 6 feet 3 inches in width; the gate is to be shut by the application of a capstan and blocks, for which purpose eye-bolts are provided on the proper points of the gates and beam D.

This gate, though very proper for large rivers where a watchman must be in constant attendance to open and shut it when necessary, is not so applicable as a common sluice to a small mill-dam, where, if a sudden flood occurs in the night, the miller must rise to open the gate; and, unless he constantly attends to shut it when the flood subsides, the mill-dam may be emptied and the water lost, which he would wish to reserve for the ensuing day. Great complaints are frequently made in the country of lands being overflowed in the night when the miller is not in the way to open his flood-gate; to remedy this a self-acting flood-gate would be desirable, and we beg leave to suggest the following. Let A A, *fig. 7*, be a gate similar to the one before mentioned, but of smaller dimensions, and poised upon a horizontal axis passing rather above the centre of pressure of the gate, so as to give it a tendency to shut close: *aa* is a lever fixed perpendicular to the gate, and connected by an iron rod with a cask *b* floating upon the surface of the water, when it rises to the line B D, which is assumed as a level of the weir or mill-dam B C E F, in which the flood-gate is placed; by this arrangement it will be seen, that when the water rises above the dam, it floats the cask, opens the gate, and allowing the water to escape until its surface subsides at the proper level B D; the cask now acts by its weight, when unsupported by the water, to close the gate and prevent leakage; the gate should be fitted into a frame of timber H K, which is set in the masonry of the dam, the upper beam H of the frame being just level with the crown of the dam, so that the water runs over the top of the gate, at the same time that it passes through it; to prevent the current disturbing the cask it is connected by a small rod *c* at each end to the upper beam H of the frame, and jointed in such a manner as to admit of motion in a vertical direction.

This flood-gate would be very useful in mill-dams of small dimension, which are therefore liable to be suddenly overflowed, for being self-acting, it requires no attendance,

and from its simplicity is not very liable to be deranged, as before mentioned; for large rivers the principal object is, to open a great extent of water-way, which will admit the passage of large bodies brought down by the stream; Mr. Smeaton's gate above mentioned, as the axis is always in the channel, would be liable to be choked by trees, &c.; for this reason large sluices or shuttles are very generally adopted, though the great power and expensive machinery required to raise such gates are an objection.

A flood-gate lately erected by Mr. Bramah is the most perfect in this respect of any that we have met with; it is raised (on the hydrostatic principle which he has so successfully applied to many other useful purposes) with such facility, that a passage 19 feet wide, and 15 feet high, can be opened by one man in 15 minutes, and this when the pressure of 10 feet of water is acting on one side only. *Fig. 8* is an elevation of this gate, and *fig. 9*, an horizontal section; A, A, represent two large beams which are partly received into the masonry of the conduit; the lower ends are framed into a strong ground-cill B, and the upper ends connected by a framing; this forms a frame in which the gate rises and falls: it is guided in its motion by two iron plates *a, a*, bolted to the sides of the gate, forming a groove, as shewn in the plan. Two square pieces of cast iron, denoted by *b, b*, and the dark shading in the plan, are bolted against the inside surfaces of the beams A, A, and received into the grooves of the gate, to confine it to move in a vertical direction: these pieces of iron have cylindrical chambers through them, as shewn by the small white circles in the plan, to admit two polished iron cylinders *d, d*, attached to the end of the upper rail D D of the ornamental framing on the top of the gate; a close fitting is made round the cylinders *d, d*, by leathers confined with screws to press against them at the top of the iron barrels, so that no fluid can pass out of the chamber in the barrels *b, b*; *e, e*, in the plan, are two small pipes communicating with the chambers at the bottom of each barrel, and these pipes are united at *f*, proceeding to a pump, by which water is injected into the two chambers together; and as this fluid is incompressible, it follows that the cylinders *d, d*, must be forced out of their respective chambers raising up the gate. As the area of the pump is much less than that of the cylinders, and as it supplies two of them, it follows that the motion of the piston of the pump will inject such a quantity of water as, when distributed into the two chambers, produces a very small protrusion of the cylinders; it is on this principle of the differences of the two motions that the power is gained: the area of the pump in the present instance is .7854 of a square inch, and the cylinders about 7.07 square inches, or nine times as much; by this means a power is gained in the two cylinders equal to 18 times the force exerted upon the piston of the pump, which being moved by a lever multiplying the power ten times, the power of a man applied to the pump is increased 180 times; so that a weight of 100 lbs. applied to the lever, will raise 18,000 lbs. on the piston rods.

The pump may be placed at any convenient distance from the gate, a small copper tube only half an inch diameter conducting the water into the cylinders; in many situations this will be extremely convenient, as it obviates the necessity of an expensive scaffold or framing over the gate, which is indispensable in other sluices to support the labourers and the machinery for drawing up the gate; the pump is explained by *figs. 10*, and *11*, on a much larger scale than the other parts; *b* is a cistern containing water, and the pump-barrel fixed perpendicular in it; the plunger or piston is solid, and leather packed round it in a manner similar to

similar to the cylinder; it is confined to a rectilinear motion by sliding through a fixed socket *l* at the upper end, and in the middle it has an opening to admit of a lever *m*, by which the pump is moved; it is connected with the rod by a coupling rod within the opening, which allows its deviations from the rectilinear motion; the pump has two valves, the one is situated in the bottom of the barrel at *n*, and the other in the pipe beneath *o*; its action is similar to the ordinary force pump, inhaling the water into the barrel when the piston is lifted up, and expelling it through the pipe *f* when forced down; at *p* is a steel-yard and weight acting upon a small valve, which permits the escape of the water if the pressure should be so great as to endanger the rupture of the pipes when the gate is lifted up to the top of its frame; hence it is termed the safety-valve: it should never be loaded with a greater weight than will keep the valve shut against a sufficient pressure to elevate the gate. At *r* is a cock which discharges the water from the pipe into the cistern, and permits the descent of the gate. To resist the great pressure of the water against the gate, it is strengthened by three trussed frames, represented by *k, k, k*, in the elevation, *fig. 8.* and in the plan; each truss is an iron rod attached to the gate at each end, and supported in the middle by a block, which answers the purpose of a king-post: the rods can be drawn tight by iron wedges passing through the gate; therefore it is evident that in this state the gate cannot yield to the pressure of the water, unless one rod is shortened and the other stretched; these frames render the gate so stiff that it does not shew any signs of weakness when the pressure acts against it; the trusses are placed nearer together at the lower part of the gate, where the greatest strength is wanted.

The limits of our plate do not allow us to do justice to the precise and more minute parts of this admirable invention, but as these will again come under our notice in the article PRESS, *Hydrostatic*, we refer the more complete elucidation of the pump, mode of packing the cylinders, &c. to the plates belonging to that article. It should be noticed, that the gate represented in our figure is intended to admit the passage of loaded barges beneath it, and is therefore much higher in the frame *AA* than would be necessary for flood-gates in all situations; it would form a most excellent sluice for clearing out harbours from mud, as the torrent of water it lets out would be much more effective than three or four of the small sluices at present in use.

Flood-bridge, signifies a low bridge constructed for the towing-path of a canal, over a weir or over-fall for discharging superfluous water. See CANAL.

Flood-lock, signifies a tide lock, or that opening into the sea, or a tidal river.

FLOODING, *Profluvium Sanguinis*, in *Surgery*, may be applied to any unnatural or profuse discharge of blood, but it is usually confined to præternatural discharges of blood from the uterus. The most common of these are profluvium menium, or an increased discharge of the menstrual flux, (see MENSES), or those discharges of blood from the uterus, which precede, and not unfrequently occasion abortion. (See ABORTION.) The hæmorrhage also, which follows a partial or total separation of the placenta from the uterus, if profuse, whether it takes place before or after the birth of the child, is called a flooding. Flooding is sometimes, though rarely, occasioned by falls or blows, and sometimes by ulcers, polypi, or other diseases of the uterus. In all cases of flooding the patient should be confined, as much as conveniently may be, to a recumbent posture, the body should be kept cool and open, and a few spoonfuls of the infusion of red roses should be given two

or three times in the day, adding to the portion given at night from five to ten drops of the tincture of opium.

FLOODING Land, in *Agriculture*, is the practice of flooding, or covering grass lands with the water of rivers, &c. at particular seasons. In this mode the water is suffered to remain upon the ground for a considerable length of time, which is quite different to that of irrigation, in which it constantly runs off as fast as it is brought upon the land. This method has probably been introduced in consequence of observing the fertilizing effects that take place after pasture lands have been overflowed with water for some time in the winter season. This plan of watering is of vast importance in mossy meadows, even where the water is perfectly clear and free from any material that is capable of being deposited.

In preparing lands for being flooded, there are two circumstances that must be particularly regarded, namely, first to lay them as level as possible, either by dividing them into different levels, or any other means; and secondly, to convey the water upon them in the most safe and convenient manner for the cultivation of the surrounding grounds. In sandy or mossy lands, this is often not accomplished without considerable difficulty. See *Watering LAND*.

FLOOK of an Anchor. See ANCHOR.

FLOOKING, in *Mining*, a term used to express a peculiarity in the load of a mine. The load or quantity of ore is frequently intercepted in its course by the crossing of a vein of earth or stone, or some different metallic substance; in which case the load is moved to one side, and this transient part of the load is called a flooking. See FAULT.

FLOOR, in *Building*, the under-side of a room, or that part on which we walk, or perform different operations, such as threshing, dressing, and measuring grain, &c.

Floors are of divers sorts; some of earth, some of brick, others of stone, others of boards, &c.

Carpenters, by the word floor, understand as well the frame-work of timber, as the boarding over it. The supporting timbers are called *naked flooring*, which see. The boarding is also of different kinds, as batten floors, common boarded floors, dowed floors, and straight-jointed floors.

For brick and stone-floors, see PAVEMENT.

For boarded floors, it is observable, that the carpenters never floor their rooms with boards, till the carcass is set up, and also inclosed with walls, lest the weather should injure the flooring. Yet they generally rough-plane their boards for the flooring, before they begin any thing else about the building, that they may set them to dry and season, which is done in the most careful manner. This operation should be performed for at least one year, so that the natural sap may be thoroughly expelled. The best wood for flooring is the fine yellow deal well seasoned, which, when well laid, will keep its colour for a long while; whereas the white sort becomes black by often washing, and looks very bad. The battens used for flooring are of three kinds: the best is that free of knots, shakes, sap, and cross grained fibres, well matched. The second best is that in which only small, but sound knots are permitted, and free of shakes and sap. The third and common kind is that which remains after taking away the best and second best.

With respect to the joints of flooring boards, they are either quite square, or plowed and tongued, or rebated, or dowed. In fixing them, they are either nailed upon one or both edges. They are always necessarily nailed upon both edges when square jointed, without dowels.

When

When they are dowelled, they may be nailed on one or both edges, though one edge only is necessary; and in the best dowelled work there are no brads or nails seen whatever, the outer edge being fastened by driving the nail obliquely through the wood, without piercing the upper surface; so that the floor, when planed off, appears without blemish.

In laying boarded floors, the boards are sometimes laid one after the other; or otherwise one is first laid down, then the fourth, leaving an interval somewhat less than the breadth of the second and third together. The intermediate boards are next laid in their places, with an edge of the one upon the edge of the first board, and an edge of the third upon the inner edge of the fourth, and the two middle edges together, which will form a ridge; to level which, two or more workmen jump upon it, till they have made the under surface coincident with the joists, then they are nailed down in their places. The operation is called folding floors, and the boards are said to be folded. This mode is only taken when the boards are not sufficiently seasoned, or suspected to be so. In order to make close work, it is obvious that the two edges forming the joint of the second and third boards must make angles, with the faces, together less than two right angles, or each one of each board less than a right angle. The seventh board is fixed as the fourth, and the fifth and sixth inserted as the second and third, and so on till completed. In this kind of flooring the headings are generally square or splayed.

When floors are dowelled, the regulating line for the centre of the dowels should be drawn from the lower side, which, as has been observed, ought to be straightened on purpose. The distances to which the dowels are set, are from six to eight inches, generally one over each joist, and one over each inter-joist.

When it is necessary to have a heading joint in the length of the floor, it should always be upon a joist; one heading joint should never meet another. In dowelled floors the heading points are always plowed and tongued.

In common floors the boards are adzed on the lower side, in order to bring them to a thickness between rebated edges. In doing this, great care should be taken so as not to make them too thin, which is frequently the case; they must then be raised with chips, which is a very unstable resistance to a pressure upon the floor. The manner of measuring floors is by squares of ten feet on each side, so that taking the length and breadth, and multiplying them together, and cutting off two decimals, the content of a floor in squares will be given. Thus 18 by 16 gives 288 of 2 squares and 38 decimal parts.

FLOORS, *Earthen*, are commonly made of loam, and sometimes, especially to make malt on, of lime, and brook-sand, and gun-dust, or anvil-dust from the forge; the whole being well wrought up and blended together with blood. The siftings of lime-stone have also been found highly useful when formed into floors in this way.

Ox-blood and fine clay, tempered together, sir Hugh Plat says, make the finest floor in the world. The principal object in constructing floors of this nature is that of blending and incorporating the different substances in a full and perfect manner for some time before they are laid; and when that is done they should be repeatedly beaten down and rendered perfectly smooth and even.

The manner of making earthen floors for plain country habitations is as follows. Take two-thirds of lime, and one of coal ashes well sifted, with a small quantity of loam clay; mix the whole together, and temper it well with water, making it up into a heap: let it lie a week or ten days, and then temper it over again. After this,

heap it up for three or four days, and repeat the tempering very high, till it become smooth, yielding, tough, and gluey. The ground being then levelled, lay the floor therewith about $2\frac{1}{2}$ or 3 inches thick, making it smooth with a trowel: the hotter the season is the better; and when it is thoroughly dried, it will make the best floor for houses, especially malt-houses.

If any one would have their floors look better, let them take lime made of rag-stones, well tempered with whites of eggs, covering the floor about half an inch thick with it, before the under flooring is too dry. If this be well done, and thoroughly dried, it will look, when rubbed with a little oil, as transparent as metal or glass. In elegant houses, floors of this nature are made of stucco or of plaster of Paris beaten and sifted, and mixed with other ingredients. Well wrought coarse plaster likewise makes excellent safe upper-floors, for cottages, out-houses, &c. when neatly spread out upon good strong laths or reed. See PLASTER-Floor.

FLOOR *of a ship*, strictly taken, is only so much of her bottom which she rests on, when aground.

Such ships as have long, and withal broad floors, lie on the ground with most security, and are not apt to heel, or tilt on one side; whereas others, which are narrow in the floor, or, in the sea-phrase, *cranked by the ground*, cannot be grounded without danger of being over-turned.

FLOOR-timbers, in a *Ship*, are those parts of a ship's timbers which are placed immediately across the keel, and upon which the bottom of the ship is framed; to these the upper parts of the timbers are united, being only a continuation of floor-timbers upwards.

FLOOR, in *Mining*, or sole, thill, or pound stone, signifies the bottom of the work in a mine, or in coal-mining, the stratum immediately under the coal-seam; which if soft, the upper part of it for six or eight inches in height generally is "holed in," as the colliers call it, that is, the same is picked out in order to undermine or loosen the coal, but if the floor be hard, as clunch is, the holing or picking is then made in the bottom or some inferior bed of the coal itself, in order to under-go or give room for wedging down the blocks or webs of coal. In examining and comparing the sinkings of the numerous coal-pits in Derbyshire and Nottinghamshire, Mr. Farey lately discovered, what seems likely to prove a general and important geological fact, *viz.* that the floor of every coal is a fire-clay, more or less thick, more or less perfect in its infusible property, and more or less indurated; sometimes being in a soft or ductile state, when it is called foam, spavin, fire-clay, pipe-clay, (if white,) potter's-clay, brick-clay, &c. at others, in an indurated or almost stony state, but which it quickly loses and falls to clay, on exposure to the atmosphere, in which case it is called clunch, which is the name that the floor of coal most generally bears. This new fact appears to throw a great degree of light on the new theory of the formation of coal, near the end of our article COLLIERY, by rendering it probable that the growth of the subaqueous beds of vegetables there spoken of were produced by this peculiar substance as their soil or pabulum.

FLOOR, a superficial measure of 400 square feet or docking, is a square whose side is 20 feet, and occurs in the facing of the fen-hanks, and in other works on the fens of Cambridgeshire and Norfolk, &c.

FLOOR, a solid measure of 400 cubic feet, or a superficial floor, one foot thick, used in measuring the pits dug to obtain earth for forming the banks against the tide or rivers in the fens on the eastern coast. (Smeaton's Reports, vol. i. p. 330.)

FLOOR is a term applied to the pits, which are dug in the fens, to furnish stuff for making their banks, by the cubic measurement of which the bankers are paid.

FLOQUET, STEPHEN JOSEPH, in *Biography*, a French musical composer, whose first production for the lyric theatre was so successful as to merit a record, having supported an hundred representations always with the same applause, and crowded audience; this piece, which is called a ballet, written by Mont. le Monnier, is entitled "The Union of Love and the Arts," (*l'Union de l'Amour et des Arts*), was performed in 1773, when the music of the old school began to fade. This was the year preceding the arrival of Gluck, and a year before Piccini was invited to Paris, which divided the nation into two furious musical factions, as hostile to each other as those in England enlisted under the banners of Bononcini and Handel. Sacchini's tender and graceful strains had not yet been heard; it seems therefore as if there must have been merit of some kind or other to captivate, without cabal, a whole nation. Floquet was born at Aix in Provence, 1750; and was the first musical author that was called for by the audience to be crowned, and to receive on the stage their approbation in person. A mass of his composition was performed in the cathedral at Aix before he was eleven years old. In 1774 he set another opera, which not having the same success as the first, he determined to travel into Italy to receive instructions from the most able masters of that country, and obtained them for some time at Naples, under the celebrated Sala, the worthy successor of Durante, and master of the Conservatorio of la Pietà, which had furnished the musical art, and all Europe, with so many great masters. On quitting Naples he went to Bologna, and had the further advantage of receiving instructions from the profound father Martini, the greatest theorist that Italy has ever produced. A *Te Deum*, a *Mæ Cori*, of his composition, was performed at Naples with great success; and he was admitted of the Philharmonic Society at Bologna; it is however known, that to be received into that academy, it is necessary for a candidate to give proofs of his abilities three several nights; but M. Floquet performed all the several exercises the same evening, and composed in two hours and a half, on *canto fermo*, a *fugue* in five parts, and the *verse crucifixus* of the *credo*; so that he was immediately received unanimously. On his return to France, he composed the opera of *Hellé*, performed in 1778, but which had no success; not but that the music manifested the progress which the young Floquet had made in his art; but from the badness of the words ensued a total want of interest in the subject. This composer was ill advised by friends to attempt giving meaning to a drama so detestably dull. We advise him to be more cautious in future in the choice of his words, and will venture to answer for his success. Laborde, 1780.

FLORA, in *Mythology*. See *FLORALES Jaudi*.

FLORA, in *Botany*, is very generally applied as a title to books whose professed object is to enumerate, define, or fully describe the wild plants of any particular country or district. Publications of this kind, with which the botanical library at the present day abounds, are not less various in their scope than in their merits. Some are mere catalogues, disposed either in alphabetical or systematic order, while others are complete histories of the plants they enumerate, respecting not only their botanical characters and distinctions, but also their scientific history, and even that of animals connected with them, as well as their actual or probable uses and qualities. Of this last kind, the *Flora Lap-*

ponica of LINNÆUS, published at Amsterdam in 1737, in one volume 8vo. with 12 plates, and republished at London in 1792, is a transcendent, and hitherto unrivalled example. Of the former sort, it would be invidious to cite instances, nor ought even the most humble attempts of this nature to be discouraged, however they may have been affectedly despised by pedantic, but less practical, writers. The most essential difference in the real merits of such works consists in their degree of originality and authenticity. A small catalogue, the first attempt of its kind, such as How's *Phytologia Britannica*, printed in 1650, or Franckenius's *Speculum Botanicum*, first published at Upsal in 1638, however imperfect or incorrect, ought to rank far above compilations which only pursue a plain, well-trodden track, without affording any additional discoveries or illustrations, such as the most beaten path will yield to a real observer. Of this no more striking example can be given, in a purely botanical work, than the *Flora Germanica* of Prof. Schrader, the first volume of which, comprising the first three of the Linnæan classes, though published at Gottingen in 1806, has only just reached our country. This book, as far as we have been able to study it, is unrivalled for original and accurate descriptions, faithful well-studied synonyms, and acute as well as candid criticism. Decandolle's new edition of Lamarek's *Flore Française* is a work of similar merit. Haller's *Historia Stirpium Helveticarum*, published in three vols. folio, in 1768, with some exquisite engravings, is one of the most celebrated Floras, in which the subject is treated with that enthusiasm which gains the reader's heart; but its synonymy and references are extremely incorrect. Of the merits of Curtis's unfinished *Flora Londinensis* we have already spoken; see CURTIS. Ray's *Synopsis*, the only British Flora which ranks above it, is as far as the original author goes, a truly excellent and nearly faultless publication. His own labours we have most correct in the 2d. edition, published in 1696; the 3d., as is remarked under our biographical article DILLENIUS, being extremely faulty, though commonly used, and even the plates added by its editor, quoted as the work of Ray.

We beg leave here, being not unused to the perusal, nor indeed the composition of such works, to offer a few remarks of a practical tendency.

It is in the first place essential that the author of a local *Flora* should be responsible for the identity of the plants he enumerates, and the places in which they are said to grow, either on his own authority, or that of some person or author named. If any obscurity attends the determination of a species, it is his indispensable duty, either by a figure or minute description, to place his own plant at least out of all doubt, if he has not access to opinions or authorities which may decide his synonyms in other writers. In this particular, Relhan's *Flora Cantabrigiensis*, Sibthorp's *Flora Oxoniensis*, and Abbot's *Flora Bedfordiensis*, have their appropriate value. Nor is Lightfoot's *Flora Scotica* at all inferior as to the enumeration or determination of species, for which its author was favoured with peculiar advantages. The great fault of the last work, which ought ever to be reprobated, is the compiling descriptions from various authors, without mention of the quarters whence they are derived, which do not certainly belong to the same plant, though those authors happen to have called it by the same name. This is the fault of Withering's *Botanical Arrangement of British Plants*, where widely discordant descriptions, from foreign writers, are often brought together to determine a British species; but in this excellent writer there is no deception, all his authorities being properly acknowledged. Another very blameable practice, which we wish to expose

to just censure, is copying synonyms from Linnæus or some other author, supposed of authority, without ever turning to the books cited to see whether their figures or descriptions answer to the plant intended to be illustrated by them. This has been but too common, as a matter of course, nor are some of our best English writers exempt from it. The practice is detected by occasional errors of the press which, existing in the original, are transferred to the copy. Thus, there is hardly an error of the press in Ray's or Linnæus's citations of former authors, that is not exactly copied in the *Flora Anglica* of Hudson, who was otherwise a practical and accurate botanist. For instance, under *Alisma Damasconium* the quotation of Bauhin's *Historia* should be p. 779, but Dillenius in Ray has it 789, and so has Hudson; under *Arenaria rubra marina* the same author is erroneously cited, after Dillenius, 772, but it ought to be 720; under *Sedum rupestre* Hudson, copying Dillenius in Ray's *Synopsis*, refers to Petiver's tab. 41, whereas it ought to be 42; for *Spergula arvensis* Linnæus refers to Dodonæus p. 527, so does Hudson after him, but the right page is 537; under *Asarum europæum* Hudson quotes Gerarde as calling it *Asa. um vulgare*, an error taken from Dillenius, for Gerarde calls it only *Asarum*. Even the *Flora Londinensis* is not exempt from this fault, of which one instance will suffice. Under *Lobelia urens*, fasc. 6. t. 63, Morison p. 407 is cited, though the proper page is 467, the error being obviously copied from Hudson, who took it from Linnæus's *Species Plantarum*, in both editions of which, and in the Vienna copy of the second, the same error exists, as well as in Willdenow's *Sp. Pl. v. 1. 947*, no such mistakes being ever corrected in the last-mentioned publication. In like manner, even the great Gærtner, so professedly critical of Linnæus, under *Ægilops ovata* quotes, after the *Species Plantarum*, Dodon. Pempt. 73, whereas the proper page is 539.—The detection of only a single fault of this sort in an author, overturns our confidence in his whole system of synonymy; for how are we to know whether he has judged of a synonym for himself or not? except indeed by searching out the passages which no other writer cites.

To avoid the fault we have just been exposing is in every body's power. There is another less easy to avoid, and more common, though more excusable, that of copying generic or specific definitions, or descriptions, without acknowledgment. Since the prevalence of the system of Linnæus, and the great popularity of his works, those who have written Floras, or Catalogues of Gardens, have generally implicitly adopted his definitions, at least his generic ones, scarcely presuming to suppose they could be incorrect. Some mistakes having thence arisen, which the introduction of the Linnæan herbarium into this country first led us to correct, the author of the *Flora Britannica* judged it necessary to bring every definition to the test of examination, such being one of the few means left him, after the labours of so many able preceding botanists, to render his work importantly useful. With regard to species indeed, Mr. Hudson, when he found the Linnæan specific characters not accord with his own plants, very properly, and often advantageously, reformed them, but he by no means detected every error of this kind. On the other hand, too great a propensity to correct and reform should not lead us, in cases where one idea or expression is as good as another, and certainly preferable, from being already adopted, to make alterations merely for the sake of shewing our zeal; for it is very probable we may alter for the worse, though our self-love will make us the last to perceive it.

It leads me to consider the subject of system, or methodical arrangement, which the writer of a *Flora* should well

consider before he aims at distinction by any reformations in that department. He would be wise, in the first place, to adopt the most popular and easy system, and hence most persons have followed that of Linnæus. Some excellent and original writers in this line have chosen methods of their own, which, from their strangeness or imperfection, have depreciated their works, and rendered them far less popular than they deserved; as Villars in his *Flora* of Dauphiny, Abioni in his *Flora Pedemontana*, Gerard in his *Flora Galloprovincialis*, and Scopoli in the first edition of his *Flora Carni. lica*, though in the second he wisely adopted the Linnæan arrangement. Whether the systems of these writers possess any merit or not, nobody thinks it worth while to enquire. The reader revolts at them as a perpetual inconvenience. A *Flora* is too limited a theatre for the display of a new botanic system, and we expect a different kind of information from it, which it is the writer's duty to give us in the easiest most intelligible form, without troubling us to learn a new language on purpose. In early times indeed, before any system was regularly established, it became leading botanists, like Ray, to attempt to teach the world some scientific principles; but even this great man condescended, in his first catalogue of British plants, to use an alphabetical arrangement, as did a scarcely less excellent writer in this department, Magnol in his *Botanicon Monsp. liense*. An alphabetical arrangement is, at any rate, unexceptionable, not proving a hindrance, if it affords no scientific aid.

Some Floras, besides scientific definitions, descriptions, or synonyms, are illustrated with figures, a very useful though sometimes expensive addition; as the *Flora Londinensis* above-mentioned, the *English Botany*, Jacquin's splendid *Flora Austriaca*, to which the *Plantæ Rariores Hungariae* by Waldstein and Kitaibel are a sort of sequel, as is also the still more splendid *Flora Græca*, published according to the will of the late professor, John Sibthorp of Oxford. The *Flora Danica* consists of little else than plates, which may be had either coloured or plain. The *Flora Rossica* of Pallas, intended, by its original patroness the empress Catharine, to outshine every work of the kind, and to be bestowed gratuitously on every person worthy to possess it throughout Europe, very soon proved abortive, and became a job in the hands of those entrusted with its publication; nor is the execution of the plates to be commended, they having often been coloured from dried specimens. Of extra-european Floras illustrated with plates, though uncoloured, the *Hortus Malabaricus* of Rheede, *Herbarium Amboynense* of Rumphius, and the recent *Flora Peruviana* by Ruiz and Pavon, are the most magnificent. The performances of the Burmanns in this line are but indifferent, though much quoted by Linnæus. The *Flora Japonica* of the celebrated Thunberg is valuable for the novelty of its materials, but nothing can be more rude than his *Icones* subsequently published to illustrate it. In point of novelty nothing can exceed the *Nova Helandica Plantarum Specimen* by Labillardiere, full of useful, though not illustrious, plates, nor is its scientific merit inferior to any. The elegant *Flora Atlantica* of his countryman Desfontaines, with more beautiful plates, though less singularity of materials, deserves no less commendation. France at present teems with superb works of a similar nature.

We cannot attempt in the compass of this article to mention, still less to do justice to the merits of, every *Flora* that has appeared. We refer the reader to the article *FIGURES of Plants* for some remarks connected with the subject. More particular notice of several of the publications alluded to, as well as an account of many similar

ones here altogether omitted, may come under the Biographical articles relating to their several authors. S.

FLORAC, in *Geography*, a town of France, in the department of the Lozere, and chief place of a district, near the Tarn; 13 miles S. of Mende. N. lat. 44° 19'. E. long. 3° 40'. The place contains 1,905, and the canton 7,985 inhabitants, on an extent of territory of 305 kilometres, in 9 communes.

FLORAL LEAF, in *Botany*. See BRACTEA.

FLORALES LUDI, or FLORAL games, in *Antiquity*, were games held in honour of Flora, the goddess of flowers.

They were celebrated with shameful debaucheries. The most licentious discourses were not enough, but the courtezans were called together by the sound of a trumpet, and made their appearance naked, and entertained the people with indecent shews and postures: the comedians appeared after the same manner on the stage. Val. Maximus relates that Cato being once present in the theatre on this occasion, the people were ashamed to ask for such immodest representations in his presence; till Cato, apprised of the reservedness and respect with which he inspired them, withdrew, that the people might not be disappointed of their accustomed diversion.

There were divers other sorts of shews exhibited on this occasion; and, if we may believe Suetonius in Galba, c. vi. and Vopiscus in Carinus, these princes presented elephants dancing on ropes on these occasions.

The ludi Florales, according to Pliny, lib. xviii. cap. 29. were instituted by order of an oracle of the sibyls, on the 28th of April; not in the year of Rome 1041. as we commonly read it in the ancient edition of that author; nor in 1044. as F. Hardouin has corrected it, but as Vossius reads it, in 513; though they were not regularly held every year till after 580. The occasion is said to have been this: a famine had lasted three years, which had been introduced by cold and rainy springs; upon which the senate, to appease Flora, and obtain better crops, passed an act that year, appointing the annual celebration of these games at the end of April, in honour of that goddess; which was regularly executed for the future. They were chiefly held in the night time, in the Patrician-streets; some will have it there was a circus for the purpose, on the hill called Hortulorum.

The goddess Flora is by some held to be the same with the Chloris of the Greeks. (Ovid. Fast. l. iv.) Others maintain, (as Lactantius, Minutius Felix, Arnobius, and St. Augustin, among the fathers of the church; and Plutarch and Macrobius, among profane authors,) that this Flora was a famous courtesan at Rome, who, having enriched herself by prostitution, made the people of Rome her heirs, on condition that they should celebrate the anniversary of her birth-day by the games and feasts above mentioned. Some time afterwards the senate, judging such a foundation unworthy the majesty of the Roman people, to ennoble the ceremony, converted Flora into a goddess, whom they supposed to preside over flowers; and so made it a part of religion to render her propitious, that it might be well with their gardens, vineyards, &c. This is the common account: but Vossius (de Idolol. lib. i. cap. 12.) can by no means allow the goddess Flora to have been the courtesan above mentioned: he will rather have her a Sabine deity, and thinks her worship might have commenced under Romulus. His reason is, that Varro, (in his fourth book of the Latin tongue,) ranks Flora among the deities, to whom Tattius, king of the Sabines, offered up vows, before he joined battle with the Romans. Add, that

from another passage in Varro it appears, that there were priests of Flora with sacrifices, &c. as early as the times of Romulus and Numa. To which we may add that Pliny (l. xxxiv. c. 4.) speaks of a statue of this goddess by the hand of Praxiteles, which proves that her worship was famous in Greece, whence it was propagated to Italy, long before Romulus, who adopted it, when he entered into an association with Tattius and the Sabines. Moreover, we learn from Justin, that the Phocæans, who built Marfeilles, worshipped the same goddess.

FLORAL GAMES. There is also a kind of floral games observed at this day in France; first instituted in 1324.

The design and establishment were owing to seven persons of condition, lovers of poetry, who, about All-saints-day, in 123, sent a circular letter to all the Provençal poets, called Troubadours, to meet at Thoulouse on May-day following, there to rehearse their poems; promising a prize of a violet of gold to the person whose piece should be judged the best.

The capitouls found the design so good, that it was afterwards resolved at a council of the city, to continue it at the city-charge; and this was done in a manner that did honour to the place.

In 1325, a chancellor and secretary of the new academy were chosen: and the seven institutors took the quality of maintainers thereof. Two other prizes were afterwards added to the violet; viz. an eglantine for the second prize, and a pansy for the third. It was also decreed, that the person who bore away the first prize, might demand to be made bachelor: and that whoever bore away all three, should be created doctor in the *gay science*, that is, in poetry.

There is a register of these games kept at Thoulouse, which gives this account of their origin; though others represent the matter differently. It was an ancient custom they say, for the poets of Provence to meet yearly at Thoulouse, to confer together, rehearse their verses, and receive a prize allotted to the best performance. This held till about the year 1540, when a lady of quality left the best part of her fortune to eternize the custom, and bear the expence of prizes; the number of which she increased, ordering an eglantine, a pansy, a violet, and a pink: the three first, a cubit high; and worth fifteen pistoles a piece.

The ceremony began on May-day, with a solemn mass, music, &c. The corporation attended; and poems were rehearsed every day: the third day a magnificent treat was given by the magistracy, &c. and that day the prizes were adjudged. The three prizes were the reward of three different kinds of compositions; viz. a poem, an eclogue, and an ode.

FLORALIA, in *Antiquity*, a general name for the feasts, games, and other ceremonies, held in honour of the goddess Flora.

FLORENCE, in *Geography*, the capital city of *Etruria*, (which see), and regarded as the Athens of modern Italy, is situated on the river Arno, at the foot of the Apennines. The Arno divides it into two unequal parts, over which there are no fewer than four bridges in sight of each other. That called the Ponta della Trinita, is uncommonly elegant, being built entirely of white marble, and ornamented with four beautiful statues, representing the four seasons. The quays, the buildings on each side, and the bridges, render that part of Florence, through which the river runs, by far the finest. Florence was first founded by the soldiers of Sylla, embellished and enlarged by the triumvirs

triumvirs, destroyed by Totila, and rebuilt by Charlemagne. The environs of this city are beautiful, rich, and populous; containing, as it has been said, 6000 villas or country-houses. The habitations of the peasants likewise seem to be peculiarly neat and commodious; the country all round is divided into small farms, with a neat farm-house on each. The circumference of the city is about two leagues; the fortifications consist only of a wall and ditch, with two or three forts which defend it, and command a part of the town. This city vies, as to beauty, with Rome itself. The buildings are magnificent, most of the streets clean, paved with square stones, so as to have the appearance of a rock made level; they are generally winding, and many of them too narrow for carriages to pass each other. They reckon 17 public places, or squares; seven fountains constantly playing, six pillars or columns, two pyramids, 160 beautiful statues, placed either in the public squares, or in the streets, or in the front of some palaces; one metropolitan church; 12 collegiate, and 44 parochial; 35 convents for men, 60 for women, 37 hospitals, and about 9000 houses. The number of inhabitants is estimated at eighty thousand. Florence has been equally distinguished by a spirit of commerce, and for the fine arts; some of the Florentine merchants were formerly men of great wealth, and lived in a most magnificent manner. One of them, about the middle of the 15th century, built that noble fabric, which, from the name of its founder, is still called the Palazzo Pitti. The builder was ruined by the expense; but the palace continued to be the residence of the sovereigns. The gardens belonging to this palace are on the declivity of an eminence. On the summit there is a kind of fort, called Belvidere; from which, as well as from some of the higher walks, you have a complete view of the city, and the beautiful vale of Arno, in the middle of which it stands. The prospect is bounded on every side by an amphitheatre of fertile hills, adorned with country-houses and gardens. In this palace is a library containing about 35,000 volumes, with a great number of pictures by Raphael, Rubens, Titian, Andrea del-Sarto, Tintoret, Guercino, &c. The Palazzo Vecchio, or old palace, contains a room 172 feet long, and 70 wide, for public entertainments, in which the most celebrated actions of the republic are painted by Vasari in fresco; and in the corners are four capital historical pictures by Cigoli, Ligozzi and Passignani. These two palaces are connected by a gallery, which presents an inexhaustible fund of improving amusement in sculpture and painting, to which the public have daily access. In this place was instituted a celebrated society for the improvement of the Italian language, called "Accademia della Crusca," (see ACADEMY); and yet the Florentines are noted for bad enunciation of their language, accompanied with a guttural accent, though they write it with great elegance; whence has arisen the proverb, "Lingua Toscana, in bocca Romana." In Florence there are several theatres, all open during the carnival, which begins on the day after Christmas day, and lasts till Ash-wednesday. At other times one of them only is open, except in Lent and Advent. The two principal are the Pergola, finished in 1755, and the new Opera-house, first opened in the year 1779. The manufactures of Florence are chiefly silks and satins of excellent fabric. The woollen manufacture, to which it was indebted for its splendour and opulence, has so much declined as scarcely to suffice for the supply of the common people. At Doecia, three leagues from the city, is a manufacture of porcelain. The Florentines have been long famous for their Mosaic work, which is formed of the finer marbles, agates, jaspers, and other

hard stones, some thin, and inlaid in form of birds, flowers, &c. The wine of the adjacent country is excellent, and furnishes a considerable trade in Italy and other countries. Society is maintained with ease and freedom in this city; besides their conversaziones, many of the nobility meet every day at a house called the "Cafino;" and these meetings bear some resemblance to the clubs of London. They also pay and receive visits at the opera, where the dancing engages a much greater degree of attention than the music. The country surrounding Florence, or the Florentin, is one of the most fertile countries in Italy. Florence is situated 129 miles N.N.W. of Rome. N. lat. 43° 50'. E. long. 11° 14'.

FLORENCE-COURT, a small post-town of Ireland, in the county of Fermanagh, adjoining which the earl of Enniskillen has a beautiful seat, with very extensive plantations. It is in the western part of the county, about 74 miles N.W. from Dublin, and 6 from Enniskillen.

FLORENNES, a town of France, in the department of the Sambre and Meuse, and chief place of a canton, in the district of Dinant; 16 miles S.W. of Namur. The place contains 1,101, and the canton 6,711 inhabitants, in 22 communes, on a territory of 240 kilometres.

FLORENSAC, a town of France, in the department of the Hérault, and chief place of a canton, in the district of Beziers; 10 miles S. of Beziers. The place contains 2,740, and the canton 4,990 inhabitants, in 4 communes, on a territory of 157½ kilometres.

FLORENT, ST., a town of the department of Golo, in the island of Corsica, and in the district of Bastia; containing in its cantons 1,487 inhabitants.—Also, a town of France, in the department of the Maine and Loire, and chief place of a canton, in the district of Beaupré; 19 miles W.S.W. of Angers. The place contains 1,433, and the canton 10,101 inhabitants, on a territorial extent of 190 kilometres, in 10 communes.—Also, a town of France, in the department of the Cher, seated on the Cher; 7 miles S.W. of Bourges.

FLORENTIN, ST., a town of France, in the department of the Yonne, and principal place of a canton, in the district of Auxerre; 13 miles N.N.E. of Auxerre. The place contains 3,010, and the canton 9,740 inhabitants, on a territory of 162½ kilometres, in 12 communes.

FLORENTINE WORK. See FLORENCE and MOSAIC Work.

FLORENTINE, in the *Manufacture of Cloth*, is the term used for a species of satin or tweeled silk, which has evidently been either originally or extensively prosecuted at Florence. As from its very nature it must always prove an expensive article of dress, accessible only to the rich parts of any country or community, it must be deemed of small, or at least secondary importance in one, where the extension and success of every article of manufacture depend almost exclusively on the lowness of the price at which it can be furnished to the consumer, after frequently paying the profits of many intermediate agents. It may, however, be proper to preserve and record the manner of executing it; although it is by no means probable that it is likely to be introduced as a matter of traffic in Britain. This description of satin or tweeled silk is generally very fine and close in the fabric. It is woven with sixteen leaves of heddles, and two or three reeds placed parallel to, and at a small distance from, each other. It is the most comprehensive kind of what is called broken or alternate tweeling. Its only variety from other tweels consists in the superior richness of appearance, which this extensive apparatus gives it. Below is a plan of the draught and cording, by which it is effected.

and pistil, and fertile. These are the *semistylis* of Tournefort, and make the first section in Linnæus's *Syngenesia Polygamia equalis*, as the Dandelion, Sowthistle, Hawkweed, &c. Such flowers are generally yellow, sometimes blue, very rarely reddish. They expand in a morning, and close towards noon, or in cloudy weather. Other compound flowers are formed of tubular florets only, as the Thistle, and *Bidens*. The greater number consist partly of tubular, and partly of ligulate ones, and the latter are always marginal, or external with respect to the former. Very frequently the marginal ligulate florets, though furnished with an apparent pistil, are abortive, and sometimes they have merely so much of the rudiment of a germen, as is necessary to form a basis for the petal. It appears that some of the tubular florets, from circumstances are capable of becoming ligulate, which is analogous to the doubling, or change of the organs of impregnation into petals, in simple flowers. Witness the Chamomile. Another change happens in the *Chrysanthemum*, and *Tagetes* or African Marigold, whose ligulate florets become tubular, or, as the gardeners term it, quilled. Such quilled florets are abortive of course, being owing to preternatural luxuriance. Compound flowers entirely composed of tubular florets, all prolific, occasionally acquire neuter or abortive ones in their margin, which are likewise tubular, but greatly dilated. This happens in some species of *Carduus* and *Serratula*, and according to the Linnæan system they thus become *Centaureæ*, for no system can provide against such anomalies. In like manner some species of *Bidens* acquire a ligulate radius, and constitute the genus *Coreopsis*. Hence have arisen many spurious genera of botanical authors. In the Order *Polygamia necessaria* of Linnæus, the florets of the disk have stamens only, or at least a mere rudiment of a germen; those of the radius being furnished with perfect pistils without stamens. Thus they are both necessary to the perfection of the seeds. Linnæus, considering umbelliferous flowers as aggregate ones, uses the term *strobilus* for what we presume to call *flos*, or a simple flower. S.

FLORID STYLE, is that enriched and heightened with figures and flowers of rhetoric, in an excessive degree; or, when the ornaments, applied to style, are too rich and gaudy in proportion to the subject; when they return upon us too fast, and strike us either with a dazzling lustre, or a false brilliancy. In a young composer this is very pardonable: perhaps, indeed, it is a promising symptom in young people, that their style should incline to the florid and luxuriant. "Volo se effrat in adolescente fecunditas, &c." says Quintilian; *i. e.* "In youth, I wish to see luxuriance of fancy appear. Much of it will be diminished by years; much will be corrected by ripening judgment; some of it, by the mere practice of composition, will be worn away. Let there be only sufficient matter at first, that can bear some pruning and lopping off. At this time of life, let genius be bold and inventive, and pride itself in its efforts, though these should not, as yet, be correct. Luxuriance can be easily cured; but for barrenness there is no remedy." But a similar apology cannot be pleaded for persons of maturer years, which is admitted for young composers in their first essays. Judgment, as it ripens, should chasten imagination, and reject, as juvenile, all such ornaments as are redundant, unsuitable to the subject, or not conducive to illustrate it. Nothing can be more contemptible than that tinsel splendour of language, which some writers perpetually affect. This cannot always be ascribed to the real overflowing of a rich imagination. If this were the case, it might be in some measure excused; and we might accept amusement where we sought instruction.

But with these frothy writers, it is a luxuriance of words, not of fancy. We see a laboured attempt to rise to a splendour of composition, of which they have formed to themselves some loose idea: but having no strength of genius for attaining it, they endeavour to supply the defect by poetical words, by cold exclamations, by common-place figures, and every thing that has the appearance of power and magnificence. It has escaped these writers, that sobriety in ornament is one great secret for rendering it pleasing; and that, without a foundation of good sense and solid thought, the most florid style is but a childish imposition upon the public. The public, however, are too apt to be imposed on; at least, the mob of readers, who are very ready to be caught at first with whatever is dazzling and gaudy. Dr. Blair, after paying a deserved tribute of respect to the good qualities of Mr. Hervey, closes with observing that the perpetual glitter of expression, the swollen imagery, and strained description, which abound in his writings, are ornaments of a false kind. "I would, therefore, advise students of oratory to imitate Mr. Hervey's piety rather than his style; and in all compositions of a serious kind to turn their attention, as Mr. Pope says, from sounds to things, from fancy to the heart." Blair's Lectures, lect. 18.

Longinus uses the terms florid and affected style indifferently, and lays them down as quite contrary to the true sublime.

FLORIDA, in *Geography*, a country of North America, bounded on the North by Georgia, on the E. by the Atlantic, on the S. by the gulf of Mexico, and on the W. by the Mississippi. This country is said to have been discovered by Sebastian Cabot in the year 1496, 18 years before it was known to the Spaniards; but received its name from John Ponce, who, sailing from Porto Rico in 1513, landed here in April, when the country appeared in full verdure and bloom. Florida has frequently changed its masters; in 1564 the French took possession of some part of it, but they were driven from their settlements in the following year by the Spaniards, who then began to form establishments for themselves. In the year 1763 Florida was ceded to Great Britain in exchange for the Havana, which had been taken from the Spaniards. Whilst the English were in possession of it they divided it into two governments, *viz.* East and West Florida, separated by the Appalachicola. During the American war, both the Floridas were reduced by the Spaniards, and guaranteed to the crown of Spain by the definitive treaty of 1783.

Although this country was of little utility to Great Britain, the possession of it would be valuable to the United States, more especially since they have obtained the province of Louisiana. On the part of Spain, the cession of it would be politic, as it might serve to divert the attention of the States from the riches of the west, and as a means of amity. West Florida in particular, is chiefly useful as presenting avenues of commerce. East Florida extends much farther south than West Florida; the gulf of Mexico washing the western coast from N. lat. 25 to 30; whereas the most southern part of West Florida is in N. lat. 29° 30'. The form of East Florida is triangular, the base towards the N. being 160 miles in breadth from E. to W. near the southern extremity about 40, and about 350 from N. to S. Along the coasts the bays of small islands are numerous. The soil near the sea-coast is sandy and barren, but further inland it improves. The productions are chiefly rice and indigo. West Florida is about 320 miles from E. to W., and from 40 to 80 in width from N. to S.; on the W. it is bounded by the river Mississippi,

and on the E. by Appalachicola. The country is pleasant, and the soil is exceedingly fertile, so that the inhabitants have sometimes two or three harvests of maize in the same year. Towards the coast it is flat, but rises gradually into hills, which are covered with verdure and large trees, such as white and red oak, crab oak, mulberry, magnolia, pine, hickory, cypress, red and white cedar, &c. Orange and lemon trees grow here without cultivation, and produce better fruit than in Spain and Portugal. They have also vines, which yield grapes equal in size and flavour to the best muscadine; and they have abundance of other fruits of excellent flavour. The cabbage tree furnishes a food that is pleasant and wholesome. Cotton is produced in great plenty; as well as flax and hemp. Among the richer productions of the country we may reckon cochineal and indigo. The coasts furnish oysters and amber. The rivers abound in fish, but are molested by alligators. In the western parts are numerous herds of cattle and flocks of sheep: hogs also, whose flesh acquires an excellent flavour from the acorns and chestnuts on which they feed, are numerous. In the forests and deserts are found several species of wild beasts, and also a variety of birds. In summer the air is very hot, but in several places it is pure and wholesome; the winter is commonly temperate, though the cold sometimes destroys the orange trees. The rivers are covered with ice. The principal town in W. Florida is Pensacola, and in E. Florida St. Augustine. The population of W. Florida is very inconsiderable; Mobile and Pensacola together not containing above 1500 souls. The interior of E. Florida is little known, and only inhabited by a few Creeks or Seminoles. The town of St. Augustine in E. Florida is less healthy than some have supposed it to be; but the climate, and also the general appearance of the country, would be much improved, if industry and labour were bestowed upon it, and the inland marshes were properly drained.

FLORIDA, a post-town of America, in Orange county, New York; 50 miles N.W. of New York city.—Also, a town of Montgomery county, New York, on the S. side of Mohawk river, at the mouth of Schoharie creek. It has 1218 inhabitants.

FLORIDA, *La*, one of the Solomon islands, in the Pacific ocean, discovered by Mendana, in 1577. S. lat. 9° 30'.

FLORIDA, *Cape*, the most south-easterly point of land of East Florida. N. lat. 25° 24'. W. long. 81° 30'.

FLORIDA, *Gulf of*, or *Bahama Straits*, the narrow channel that separates the peninsula of Florida from the Bahama islands.

FLORIDA *Stream*, or *Gulf stream*, a channel which separates the island of Cuba from the coast of Florida, between the gulf of Florida and the gulf of Mexico.

FLORILEGIUM, FLORILEGE, a name the Latins have given to what the Greeks called *αὐθολογία*, *anthology*; viz. a collection of choice pieces, containing the finest and brightest things in their kind.

FLORILEGE, is also particularly used as a kind of breviary, in the Eastern church, compiled by Arcadius, for the conveniency of the Greek priests and monks, who cannot carry with them, in their travels and pilgrimages, all the volumes wherein their office is dispersed.

The florilegium contains the general rubrics, psalter, canticles, the horologium, and the office of the feria, &c.

FLORIN is sometimes used for a coin, or real money; and sometimes for any imaginary money, or money of account.

FLORIN, as a coin, is of different values, according to

the different metals, and different countries where it is struck. Pieces under this denomination were anciently very frequent in commerce; at present they are less common, though there were abundance of them struck in Holland, of English silver, during the war, which was terminated by the treaty of Ryfwick. In all appearance they took their name from the place where they were first struck, viz. the city of Florence. The era is about the year 1251; though others ascribe the name to a fleur-de-lis, which was struck on one side.

Villani observes, that there were gold florins in the year 1067, from which time the names frank or florin became applied to the gold coins, which till that time had been called *jolids*, *shillings*. See COIN and EXCHANGE.

FLORIN, as a *money of account*, is used by the Italian, Dutch, and German merchants and bankers, in keeping their books, and making up their accounts. But this florin is very various, and admits of different divisions. See COIN and EXCHANGE.

FLORIN, or *Florence*, was also a gold coin, struck in England in the eighteenth year of Edward III. of the value of six shillings.

Camden says, it was so called, because made by Florentines. Fabian observes, the florins were not of so fine gold as the nobles and half-nobles of that prince.

But what is most observable is, that Fabian calls the florin a penny, value 6s. 8d. the half-florin, a halfpenny, value 3s. 4d. the quarter-florin, a farthing, value 1s. 8d. These words were often met with in old histories and accounts, applied to several coins, as royals, angels, &c. where we are therefore only to understand by *penny* or *denarius* the whole, by *obolus* the half, and by *quadrans* the fourth part, or farthing.

By indenture of the mint, in 18 Edw. III. every pound weight of old standard gold was to be coined into fifty florences or florins, to be current at six shillings a-piece; all which made in tale fifteen pounds; or into a proportionable number of half and quarter florins.

FLORIN, in *Geography*, a town of the island of Sardinia, eight miles S. E. of Sassari.

FLORINIANI, or FLORIANI, in *Eccl'stical History*, a sect of heretics, of the second century, denominated from its author Florinus, or Florianus, a priest of the Roman church, deposed along with Blautus, for his errors.

Florinus had been a disciple of St. Polycarp, along with Irenæus. He made God the author of evil; or rather asserted, that things forbidden by God are not evil, but of his own appointing. In which he followed the errors of Valentinus, and joined himself with the Carpocratians. He seems to have maintained the doctrine of two principles, with other Gnostic errors.

They had also other names given them. Philastrius says, they were the same with the Carpocratians. He adds, that they were also called soldiers, milites, quia de militaribus fuerunt. St. Irenæus calls them Gnostics; St. Epiphanius, Phibionites; and Theodoret, Barborites, on account of the impurities of their lives. Others call them Zaccæans; others Caddians, &c. though for what particular reasons it is not easy to say, nor perhaps would it be worth while to enquire.

FLORIS, FRANCIS, in *Biography*, a painter of history, born at Antwerp in 1520. Having practised the art of sculpture till he was 20 years of age, he then indulged his partiality for painting, and changing his profession, studied the latter under the tuition of Lambert Lombard. He

afterwards went to Rome, there copying the works of the ancients; but he appears to have felt with more fervour the works of Michael Angelo Buonaroti; which he imitated with great zeal, particularly his Last Judgment; unhappily, however, attending more to the parts than the whole.

The taste which he imbibed by these studies not a little surprised his countrymen on his return to his native city; and it acquired for him the honourable appellation of the "Raphael of Flanders," though not very justly, for his style of design is more in imitation of M. Angelo than of Raphael.

He painted for the Contrafestivity Hall of St. Michael at Antwerp a large picture, which now graces the walls of the Louvre at Paris. The subject is "The fall of Lucifer and his Angels." It is highly celebrated for the goodness of the composition and handling, for the variety of attitudes in the fallen angels, and for the strong expression of the muscles in the naked figures. In fact it is a very curious picture, painted with great capacity, and exhibits a powerful, though eccentric, imagination. The fiends in M. Angelo's Last Judgment are not more horrible, or nearly so grotesque. The power of colour also is admirable, and in some parts has been rarely surpassed.

He had a strong and bold manner, and, like his great model Buonaroti, marked the muscular parts too full for a just imitation of nature. He invented and composed with ease, but in a dry and gothic manner; and though sometimes his figures have an agreeable air, yet in general they possess a reprehensible degree of the stiffness and formality peculiar to the age and country he lived in. He died in 1570, aged 50.

FLORIST, in *Gardening*, a name applied to such persons as are curious in, or have much skill in the knowledge and nature of flowers. A good florist should be perfectly acquainted with the names, characters, and kinds, or sorts of flowers; and at the same time have a thorough knowledge of their nature, habits, and methods of cultivation and management.

FLORUS, **L. ANNAEUS**, in *Biography*, a Latin historian, who wrote about 200 years after the reign of Augustus. This is his own account, though from what he says elsewhere, *viz.* that he lived under Trajan; it has been conjectured that his history was written about 150 years after Augustus. His work is "A Compendium of the Roman History," from the foundation of the city to the reign of the emperor Augustus, in four books. It is to be regarded rather as a panegyric on many of the great actions of the Romans, than a faithful and correct recital of their history. Throughout the narrative there are, unquestionably, pleasing reflections which display great animation, and strong powers of sensibility. It has obtained a sufficient share of popularity to be recommended very generally as a proper book for the learners of the Latin language; and it has employed the erudition of several critical authors. Florus was a writer of poetry as well as an historian, and has been thought to have entered the lists against the emperor Adrian. The best editions are, that by Duker, in 2 vols. 8vo. Lug. Bat. 1722, 1734; the Delphin edition; and those of Gravina, Rom. Hist. Lempiere.

FLORUS, **DREPANUS**, who was surnamed "the Master," a deacon of the church of Lyons, flourished in the ninth century. He obtained so high a reputation for learning and acuteness, that he was chosen by the church of Lyons to answer the treatise of John Scotus Erigena, on the subject of predestination. This was published in the year 852, and entitled "Liber de predestinatione, contra Johannis Scoti erroneas definitiones." It is to be found in the

8th vol. of the "Bibliotheca Patrum." It is not ascertained how long the author lived after the production of this work. Florus was the author of "Commentarius in omnes S. Pauli Epistolas," which has been falsely ascribed to the venerable Bede, and admitted into the collection of his works, and several other theological pieces. Moreri.

FLORUS, in *Ornithology*, a name by which Aldrovand and some other authors have called the bird commonly known with us by the name of whinchat, a kind of the oenanthe or fallow-lark. See *MOTACILLA Rubra*. See also *LOXIA Chlois*.

FLORY, **FLOWRY**, *Fleury*, *Floretté*, *Fleur-de-lisse*, &c. terms in *Heraldry*, used when the outlines of any ordinary are drawn as if trimmed with, or in the form of flowers, lilies, fleur-de-lis, &c. Thus, he bears a cross flory, &c.

FLOS, in *Botany*. See **FLOWER**.

FLOS Aëris. See **ÆS**.

FLOS Ambervalis, in *Botany*, a name given by some to the polygala or milkwort. See **POLYGALA**.

FLOS Argenti. See **FLORES argenti**.

FLOS Asiæ, in *Natural History*, a name given by Swenckfield and some other writers, to that salt which is found on the surface of the earth in some part of Asia, in form of an efflorescence, and is called the Smyrna soap earth.

This salt is evidently the same with the nitre of the ancients. It will ferment with any acid in the manner of our pot-ash, or other fixed salts, made by fire: and with oil or any fatty substance, boils into a soap. Euelius gives us a great many different places for its production, from which he distinguishes it into several kinds; all these lie in the eastern parts of the world; but to these Wormius adds, that it is found in New Spain. It is always easy to be known, however, in whatsoever place it is found, being a native alkali salt, perforated like a sponge, and of a lixivial taste. Its principles seem to be a marine and a urinous salt.

That it contains a marine salt seems manifest from this, that it has the same taste in solution, or nearly so, with marine salt; that the particles of it, when coagulating in the evaporated water in which they were dissolved, first rise to the top of the surface, as those of common salt do, and that it is always of a spongy texture, or full of holes, which is always the case with those things in which the common salt makes a part, its natural concretions being hollow pyramids. Its containing an urinous salt is plain, from its producing with salt of tartar the same sort of spirit that sal ammoniac does when mixed with that fixed salt.

FLOS Cæli, the *flower of the heavens*, a name given by the alchemists to the nulloch, which often appearing after rain, was supposed to fall from heaven. See **FLOS terra**.

FLOS Martialis. See **FLORES martialis**, and **IRON**.

FLOS Salicæ. The flower of salt flows down with the Nile, and is also found on the surface of some lakes. It is to be chosen of the colour of saffron, somewhat of a rank smell like garum, of a biting taste, and of a fatish substance. What is coloured with minium, or is grumous, is to be rejected: beside, what is pure and genuine is not to be dissolved but in oil; whereas what is adulterated is partly dissoluble in water.

It is effectual against malignant and phagedenic ulcers; none in the pudenda, and purulencies in the ears; it also cures dimness of sight, and removes specks and albugo from the eyes. It is mixed with plasters and ointments, as also with oil of roses, for the sake of the colour it communicates to them. Taken inwardly, in wine or water, it provokes sweat, disturbs the belly, and incommodes the stomach. It is also an ingredient in acopa and sinegmata, for extenuating the hair. In general, it is of an acrimo-

rious and pyrotic quality, as are all salts themselves. Dioscor. lib. v. cap. 129.

Flos Terræ, flower of the earth, a name given by some of the chemical authors to the nostoch, a remarkable plant, which resembles the common green cyther-weed, but that it is thicker and more like a jelly. It suddenly appears on gravel walks and gardens after rain; and the alchemists, who knew not what to think of its origin, supposed it to contain an universal spirit, capable of turning metals into gold. See NOSTOCH.

Flos Tinctorius, in Botany, a name given by Fuchsius, and many others, to the genitilla tinctoria, or dyer's-weed, called alio lutea herba, and lutum by the Latins, and al-comenium, eymene, and thapfos, by the Greeks. See GENISTA.

FLOSCOPA, from *flos*, a flower, and *scopa*, a broom, in allusion to the fasciculated form of the spikes. Lour. Cochinch. 192. Class and order, *Hexandria Monogynia*. Nat. Ord. *Enfate*, Linn. *Junci*, Juss.

Gen. Ch. Cal. Perianth inferior, funnel-shaped, hairy, coloured, permanent; its border in three ovate, curved, spreading segments. Cor. Petals three, ovate, erect, as long as the segments of the calyx. Stam. Filaments six, awl-shaped, longer than the corolla; anthers roundish, with two lobes. Pist. Germen superior, ovate, compressed, two-lobed; style awl-shaped, inflexed, longer than the stamens; stigma rather thick. Peric. Capsule nearly ovate, two-lobed, two-celled. Seeds solitary, ovate, compressed, horny, with many concentric radiating furrows.

Eff. Ch. Calyx inferior, three-cleft. Petals three, ovate. Capsule of two cells. Seeds solitary.

1. *F. scandens*. Deei hoa choi of the Cochinchinese. Native of hills in Cochinchina. Stem shrubby, climbing, without tendrils or spines, unbranched, long, round. Leaves alternate, lanceolate, entire, sheathing, many-nerved; fringed at the base; rough on the upper side; smooth beneath. Flowers small, pale violet, on very short partial stalks, in slender, rigid, clustered, level topped spikes resembling a broom. Loureiro.

By the above description of Loureiro, this plant is evidently very nearly akin to *Tradescantia* and *Commelina*, but its simple filaments, and two-celled capsule, seem to authorize its being kept distinct. We have from Sierra Leone a plant which, in the character last-mentioned and the inflorescence, how far else we cannot say, agrees with it, and is surely of the same genus, if not the very identical species.

It seems to us that *Tradescantia paniculata*. Roxb. Corom. v. 2. 6. t. 109, must be the same genus, if not the very same species, as the above. The simple filaments evidently shew it not to be a *Tradescantia*, which the inflorescence confirms. Perhaps *Floscopa* is not generically different from the *Callisia* of Jacquin and Linnæus. See CALLISIA.

FLOSCULOUS, a term used by Mr. Tournefort, and others, to express such flowers of plants, as are composed each of a great number of other small flowers placed close to one another, and inclosed in the same common cup; each of these smaller flowers consists of one petal, which is slender and hollow, and wider than the bottom, and usually divided into many segments, which sometimes are disposed in the form of a star. Each of these flowers stand upon an embryo, or young fruit, from which there grows a capillum, which reaches beyond the flowers. These embryos are lodged in the bottom of the cup, which is called by authors the thalamus of the flower, and finally become seeds winged with down, or sometimes without that, and some-

times are armed with prickles. Of this sort are the flowers of thistles, knapweed, &c.

FLOSCULUS. See FLORET.

FLOSS, in Geography, a town of Bavaria; five miles E. N. E. of Weiden.—Also, a river of Silesia, which runs into the Oder, six miles N. W. of Breslau.

FLOT HORN, a cape on the N. coast of Iceland. N. lat. 66° 6'.

FLOTA, a small western island of Scotland, near the N. W. coast of Lewis.—Also, one of the small Orkney islands, between South Ronaldsha and Hoy. N. lat. 58° 42'. W. long. 2° 59'.—Also, one of the smaller Hebrides, on the S. E. coast of North Uist. N. lat. 57° 28'. W. long. 7° 8'.

FLOTA, or *Flotta*, *Fleet*; a name the Spaniards give particularly to the ships which they send annually from Cadiz, to the port of Vera Cruz, to fetch thence the merchandizes gathered in Mexico for Spain. It consists of the captains, admiral, and patach, or pinnace, which go on the king's account; and about sixteen ships, from four hundred to a thousand tons, belonging to particular persons. They set out from Cadiz, about the month of August, and are eighteen or twenty months before they return.

These sent to fetch the commodities prepared in Peru, are called galeons. See GALEON.

The name flotilla is given to a number of ships, which get before the rest in their return, and give information of the departure and cargo of the flota and galeons.

FLOTAGES, all such things as are floating on the top of the sea, or great rivers, a word chiefly used in the commissions of water-bailiffs.

FLOTE-FESCUE Grass, a kind of natural grass which is found in watery situations, and said to be an excellent cattle grass, affording much fodder. See FESTUCA.

FLOTSON, FLOTZAM, or *Flotsam*, a term signifying any goods lost by shipwreck, and swimming on the top of the water; which, with *jetson* or *jetsam*, and *lagon* or *ligan*, and *shares*, belong to the king, if no owner appears to claim them; but if any owner appears, he is entitled to recover the possession. For even if they be cast overboard, without any mark or buoy, in order to lighten the ship, the owner is not by this act of necessity construed to have renounced his property (Lust. 2, 1. § 48); much less can things *ligan* be supposed to be abandoned, since the owner has done all in his power to assert and regain his property. Things *jetsam*, *flotsam*, and *ligan*, are accounted to far distinct from *wreck* (which see), that by the king's grant to a man of wrecks, the others will not pass. Over those the admiralty courts have jurisdiction, as they are in and upon the sea. (5 Rep. 108.)

Jetson is what is cast out of a ship, being in danger of a wreck, into the sea, and there sink and remain under water. *Lagon* or *ligan*, is that which lies in the bottom of the sea; but tied to a cork or buoy, in order to be found again (5 Rep. 106.) *Shares* are goods due to several persons by proportion.

FLOTTE, LE, in Geography, a town of France, on the N. coast of the island of Ré.

FLOTZ, a town of Germany, in the principality of Anhalt Zerbst; six miles N. W. of Zerbst.

FLOUNDER, in Ichthyology, the English name of the fish called by the generality of authors *passer fluviatilis*, and *hesus*. It is a species of the *pleuronectes*, which see.

The flounder inhabits every part of the British sea, and even frequents our rivers at a great distance from the salt-waters. It never grows large in our rivers, but is reckoned sweeter than those that live in the sea.

FLOUR, the meal of any grain, but more particularly of wheat, ground and sifted for the purpose of food.

The grain itself is not only subject to be eaten by insects in that state, but when ground into flour, it gives birth to another race of destroyers, who eat it unmercifully and increase so fast in it, that it is not long before they wholly destroy the substance. The finest flour is most liable to breed them, especially when stale or ill prepared; in this case, if it be examined in a good light, it will be perceived to be in a continual motion; and on a nicer inspection, there will be found in it a great number of little animals of the colour of the flour, and very nimble. If a little of this flour be laid on the plate of the double microscope, the insects are very distinctly seen in great numbers, very brisk and lively, continually crawling over one another's backs, and playing a thousand antic tricks together; whether for diversion or search of food, it is not easy to be determined. These animals are of an oblong slender form, their heads are furnished with a kind of trunk, or oblong hollow tube, by means of which they take in their food, and their body is composed of several rings. They do vast mischief among the magazines of flour, laid up for armies and other public uses; when they have once taken possession of a parcel of this valuable commodity, it is impossible to drive them out, and they increase so fast, that the only method of preventing the total loss of the parcel, is to make it up into bread as soon as can be. The way to prevent their breeding in the flour is, to preserve it from damp; nothing gets more injury by being put up damp than flour, and yet nothing is so often put up so. It should be always carefully and thoroughly dried before it is put up, and the barrels also dried into which it is to be put; then if they are kept in a room tolerably warm and dry, they will preserve it well. Too dry a place never does any hurt, though one too moist always spoils it. See MEAL.

FLOUR, St. in Geography, a town of France, in the department of the Cantal; before the revolution, the capital of Upper Auvergne and the see of a bishop; containing in its north and south divisions 5000 inhabitants; in the canton of the former 10,538, and in that of the latter 15,121, on a territory of 585 kilometres, in 27 communes. The inhabitants carry on a considerable trade in corn, with manufactures of cloth, carpets, and cutlery. N. lat. 45° 2'. E. long. 3° 10'.

FLOWER, in *Physiological and Systematical Botany*, comprehends all those organs of a plant which are preparatory and necessary to the impregnation and perfection of the fruit or seed. (See FECUNDATION and FRUCTIFICATION.) Of the seven parts of fructification distinguished by Linnæus, five constitute the flower. These are, first, the calyx or flower-cup; second, the corolla or petals; neither of these is indispensable, one, and sometimes both of them being occasionally wanting; (see CALYX and COROLLA;) third, the stamen or stamens, generally filamentous bodies, ranged internally with respect to the two former; these are essential, being the male organs; fourth, the pistil or pistils, in the centre of the flower, which consist of the rudiments of the fruit, and the female organs of impregnation, being therefore essential, though not always situated in the same individual flower, nor even on the same plant, with the stamens; fifth, the receptacle, or common point of connection, which must be present in some shape or other, and in compound flowers is very important; see COMPOUND.

Flowers are usually the most ornamental part of vegetables, but the most fleeting and transitory. After their production, the vegetation of the plant, however rapid and luxuriant before, is checked, at least for a time, even in

perennial plants and trees; and annual ones survive flowering only till they can ripen their seed. The same species, which will endure for several winters without blossoming, after this event loses its vigour, and yields to the first attacks of frost. Pliny observes that "blossoms are the joy of trees, in bearing which they assume a new aspect, vying with each other in the luxuriance and variety of their colours." Linnæus has adopted and exemplified this idea, so congenial with his own theory of vegetable propagation, and with the importance which he gives the flower in his principles of classification, as the sure guide to a true discrimination of the kinds of vegetables. The various modes in which flowers are situated upon, or connected with, the plant that bears them, will be explained under the article of INFLORESCENCE, an important subject in systematic botany. In position they greatly differ in different genera or species. Most generally they expand, and present themselves to the light, in a remarkable manner, closing or drooping when its stimulus is withdrawn; but some flowers always droop, shielding their internal organs, and protecting them from rain, as long as their own delicate substance endures. Flowers are eminently distinguished from the other parts of a plant by their general beauty and vivacity of colour, chiefly seated in the corolla, and likewise, in many instances, by their peculiar fragrance, the theme of poets and the admiration of all whose nerves, which is not always the case, can endure it. This fragrance is proved by experiment to depend on a volatile, essential oil, in many cases obtainable by distillation, in others by infusion in spirits, or in expressed oil, either of which inhibe or dissolve it. Flowers do not give it out alike at all times; some have no scent during the day, but become highly fragrant in the evening. These enhance the luxury of the bright moonlight nights of India, nor is our own country destitute of many such flowers. They are elegantly termed by Linnæus *flores tristes*, sad or melancholy flowers. Their colour is very frequently pale and sickly, inclining to greenish or brownish yellow, agreeing remarkably in plants of very different classes and characters, which moreover have usually the same luscious evening scent. Among these are *Hesperis matronalis*, *Pelargonium triste*, *Mesembryanthemum noctiflorum*, *Nyctanthes Arbor-tristis*, and others. Many oriental flowers have a fine lemon-like odour in an evening, which are, for that reason, assiduously cultivated by the Chinese; as the *Chloranthus inconspicuus*, whose merit in this respect was not discovered in England till it had long been cultivated, nor was the sweet and powerful scent, observable on first opening the hot-house in a morning, suspected to proceed from so minute and inconspicuous a blossom, till the late Mr. Aiton of Kew, whom no natural phenomenon could escape, first made the discovery. There seems to be an analogy between the smell and colour of flowers in other instances. The yellow variety of *Chrysanthemum indicum* differs altogether in scent from the dark-purple one, agreeing rather with the yellow wall-flower, which it also resembles in colour. The deep crimson Carnation, called the Clove Carnation, and the Clove Pink now nearly extinct, have a clove-like fragrance, richer than the paler or whitish kinds.

Ever since Botany has been cultivated on scientific principles, the flower and fruit have universally been resorted to for the leading distinctive characters of plants. (See CLASSIFICATION.) On these conjointly all natural characters of Genera, Orders and Classes are founded. The herbage of the plant is, according to the Linnæan idea, a sort of mask, which conceals its true characters till they become manifest in the flower. Artificial systems of arrange-

ment have been constructed by some authors on the fruit, by others on the flower. The former are usually considered as most according with natural affinities, the latter as the most convenient. The principal of these last are those of Rivinus and Tournefort, in which the corolla takes the lead; and the sexual system of Linnæus, founded chiefly on the stamens and pistils.

The medical properties and sensible qualities of flowers, their peculiar odours excepted, agree much more with the herbage, than with the fruit to which they are so intimately attached. Thus in the class *Icosandria*, as far at least as that class is a natural one, the flowers, as in the peach and cherry for instance, partake of the acrid, noxious, essential, oil of the leaves and bark, not at all of the sweet, acid, or aromatic qualities of the pulpy fruit. S.

FLOWERS, Colours of. It has been asserted by some chemists, that all colours arise from sulphurs, and that they differ according to the different admixtures of salts with these sulphurs. Perhaps on these principles, it may be possible to form some rational conjectures in regard to the origin of colours in the flowers of plants. We know very well that the flowers of all plants abound in an essential oil or sulphur, to which, according to this doctrine, their colours may be rationally supposed to be owing; and though this oil should be proved to be the very same substance in all, yet their variety of colours may be accounted for from it, since we find that one and the same oil, the essential oil of thyme, according to Mr. Geoffroy's experiments, may be turned to all the colours that we find in the different flowers of plants, from white to deep black, with all the shades of red, yellow, purple, blue, and green, by mixing it with different substances; and by the same laws, the essential oil of plants, while contained in their flowers, may by the different mixtures they meet with, give them all their beautiful variety of colours. See *Essential Oils*.

We know that the infusions of flowers, and of other parts of plants, become red on being mixed with acids, and green on being mixed with alkalies; and there is no reason to doubt, but that it is the sulphureous part of the vegetable in these infusions which thus changes colours on these mixtures. This, however, ought to be proved possible, before it is allowed in argument.

This proof is given in the change of colours before mentioned, which are produced in oils merely by the admixture of different salts; and as all the colours in these are the regular result of certain combinations, there is great reason to believe, that in those plants whose flowers give the same colours, there may be the same combinations.

The principal colours of plants, and their several parts, are green, yellow, red, purple, blue, white, black, and transparent whiteness; all the others are produced by different combinations of these. The green, which is the common colour of the leaves of plants, is probably the effect of an oil rarefied in that part of the plant, and there mixed with the fixed and volatile salts of the sap, which remain entangled by the earthy particles after most of the aqueous humidity is evaporated, and by that means become in a state to act upon the oil. A clear proof of this is, that if the leaves are covered up in such a manner that the aqueous humidity of the sap cannot evaporate itself, the oil and salts cannot act upon one another as they naturally would, but becoming diffused among so great a quantity of water, lose the colour they would otherwise have obtained together, and become whitish or transparent. This is seen in the obvious instance of succory and celery,

the leaves of both which plants, though naturally green, become white by being covered up with earth by the gardener.

The leaves of both plants and trees usually turn red in autumn, or on the attack of the first frost; the reason of which is, that the several canals of the sap being constricted by the cold, the juices are detained in the vessels of the leaves, or at least its circulation is greatly interrupted; and being detained there, it naturally grows sour, the acidity of this altered juice destroying the green colour, produced by the alkaline salts. The sap brings on a red colour, in the very same manner that the essential oil made green by a mixture of oil of tartar is again changed to red, by adding to it a proper quantity of distilled vinegar. Where we find in our common experiments the acids of the mineral kingdom turning the infusions of flowers red, it seems by the analogy of these experiments to be only owing to their destroying the blue, brown, or other colour, which the alkaline salts of the plant had made with its essential oil.

All the shades and degrees of yellow and saffron colour in the flowers of plants, seem wholly owing to a mixture of an acid in their juices, with their essential oil; as the oil of thyme, which itself has very little colour, is made to pass through all these shades of colours, only by digesting it with distilled vinegar. From the digesting the volatile alkalies, such as spirit of sal ammoniac and urine, with the same oil, it appears that all the shades of red, from the palest flesh-colour, to purple, and even to the violet blue, are only owing to the different admixtures of an alkaline volatile salt of the urinous kind, mixed in different manners with their essential oil.

Black, which is a very uncommon colour in flowers, and which in them ought to be regarded only as a very deep violet, seems the effect of an addition of an acid juice to their oil, already turning purple to violet colour by a volatile alkali.

All the shades of blue and purple seem also, by the analogy of the same experiments, to be only the effects of mixtures of alkalies of the fixed and volatile kind, with the oils of plants; since these colours are all produced in those experiments, by mixing the spirit of sal ammoniac, and the oil of tartar with oil of thyme.

The bright green of some flowers seems also to be produced by the same salts, only acting on oils more rarefied. For the oil of thyme of a purple violet-colour diluted with rectified spirit of wine, being diluted with oil of tartar, becomes green. Mem. Acad. Par. 1707.

Boccone is of opinion, that in many plants the colour of the flowers is wholly owing to the colour of the juices of the root. This he instances in the greater celandine, whose roots and flowers are of the same yellow colour. The barberry in like manner, he observes, has both its roots and flowers yellow. The dentillaria has its roots and flowers both of a pale red, and the acacia Indica Aldini, and many other plants, he says, are instances of this. The reason that he assigns for this is, that the more fixed parts, wherein this colour consists, preserve the same tincture, without being at all altered by so long a circulation as that from the root to the flower; and he adds another very remarkable observation, which is, that in all these plants and trees, whose roots and flowers are of the same colour, the juices are more fixed; and therefore, that these are more fit for dyeing than any other coloured wood of plants. Vide Boccone, Mus. de Plant.

Dr. Lewis, in his notes on Neumann's Chemistry, has many curious observations on the colours of flowers.

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There are few of them which are durable in themselves, or that can be made durable by art. The only permanent colour is yellow. The red, the blue, and the intermediate shades of purple, crimson, violet, &c. are very perishable. Many flowers lose their colours on being dried, and especially if they are dried in a shady and not warm place. The colours of all of them perish by keeping even in the closest vessels; the more hastily they are dried, and the more perfectly they are secured from air, so much the longer do they retain their beauty. The colouring matter of flowers extracted and applied to other bodies is still more perishable.

The colour of many blue flowers is extracted by infusion in water; but from others, water acquires only a purplish hue. Of those which have been tried, not one gives a blue colour to spirit of wine; some give no colour, and some give a reddish colour. The expressed juice of these flowers is generally blue. The blue juices and infusions are rendered red by acids; and the most florid red is given to them by marine acids. The flowers also, by maceration, impart a red colour to acid liquors. Alkalies fixed and volatile, and lime-water, change these blue colours to green. And those infusions or juices which have nothing of the colour of the flower, suffer the same changes from the addition of acid and alkaline liquors. Even when the flowers have been kept till their colours are lost, their infusions acquire a red colour from acids, and a green colour from alkalies, but in a less degree than when the flowers were fresh. The red colour produced by acids is scarcely more durable than the original blue; applied upon other bodies, and exposed to air, it gradually degenerates into a faint purple, and at last disappears, without leaving a stain behind. The green produced by alkalies changes to a yellow, which does not fade so soon. The green made by lime-water is more permanent and beautiful. Green lakes, prepared from blue flowers by means of lime-water, have been used by painters. The flowers of cyanus have been much commended for affording elegant and blue pigments. But Dr. Lewis has not been able to extract from them any blue colour. They retain their colour, when hastily dried, longer than other blue flowers, but do not communicate their original colour to any menstruum.

Red flowers readily communicate their colour to water; and those of a full red colour give to a rectified spirit also a deep red tincture, brighter, though somewhat paler, than the watery infusion. But the light red flowers, and those which are purplish, impart little colour to pure spirit. The colours of infusions of these flowers are supposed to be heightened by acids, and to be rendered green by alkalies. But this is not universal. For amongst those examined by Dr. Lewis, the rose colours and purplish red were changed by acids nearly as blue flowers are; but the full deep reds were not. The deep infusion of red poppies was turned by alkalies not to a green, but to a dusky purple.

Yellow flowers communicate to water and to spirit of wine durable yellow colours, not alterable but in degree by acids or by alkalies: the former only rendering them paler; and the latter, as also alum, rendering them deeper. Wool, or silk, impregnated with a solution of alum or tartar, receives, on being boiled with the watery infusion or decoction, a durable yellow dye. A durable yellow lake is prepared by precipitating with alum an infusion of yellow flowers made in an alkaline ley. In some of the orange-coloured flowers the yellow matter seems to be of the same kind as that of the pure yellow flowers; but the red matter seems to be different from that of the pure red flowers.

The yellow matter is extracted from these flowers by water; and the remaining red matter is extracted by spirit of wine, or by a weak solution of fixed alkali in water. Such are the saffron coloured flowers of carthamus. These flowers, after the yellow matter has been extracted by water, are said to give a red tincture to ley, from which a deep red fecula subsides, called safflower, Spanish red, and China-lake. This pigment gives a beautiful red colour to spirit of wine, but none to water. The yellow farina or fine dust, resting on the tips of the stamina of flowers, gives a fine bright yellow colour to spirit of wine, and a duller yellow colour to water. The colours of both the watery and spirituous tinctures were heightened by alkalies, rendered red by acids, and again restored to a yellow by adding an alkali. This is the only known instance of the yellow colour of a vegetable being rendered red by acids. White flowers, or their expressed juices, impart a green colour to alkaline leys, but have not been observed by Dr. Lewis to give a red colour to acids. The white flowers of the common wild convolvulus give a deep yellow or orange colour to water, which is affected by acids, by alkalies, and by alum, as the infusions of yellow flowers are. The white flowers of xeranthemum give a beautiful yellow colour to water acidulated with spirit of nitre. See Neumann's Chem. by Dr. Lewis, p. 430, 432.

FLOWERS, in *Gardening*, are distinguished into early, or spring-flowers, which flourish in the months of March, April, and May. Of this class are the anemones, daffodils, hyacinths, tulips, jonquils, cowslips, primroses, &c. Summer-flowers, which open in June, July, and August, as pinks, gilly-flowers, lilies, daisies, campanulas, poppies, sun-flowers, &c. Autumnal, or late flowers, denote those of September and October; as the oculus Christi, Indian pink and roses, pansy, flower-gentle, &c. Of these flowers, those which subsist all the year, we mean in the stem, or root at least, are called *perennials*. And those which are to be planted or sowed afresh every year, according to the season, are called *annual*.

FLOWERS, *Preservation of*. The method of preserving flowers in their beauty through the whole year has been diligently sought after by many people; some have attempted it, by gathering them when dry, and not too much opened, and burying them in dry sand; but this, though it preserves their figure well, yet takes off from the liveliness of their colour.

The primrose and cowslip kind are very eminent instances of the change of colours in the flowers of dried specimens; for those of this class of plants easily dry in their natural shape, but they not only lose their yellow, which might be expected naturally enough, but they acquire a fine deep green, much superior to that of the leaves in their most perfect state. The flowers of all the violet kind lose their noble blue, and become of a dead white, so that in dried specimens there is no difference between the blue-flowered violet and the white-flowered kinds.

Muntingius gives a method, which he says is preferable to all others; this is as follows: gather roses or other flowers when they are not yet thoroughly open, in the middle of a dry day; put them into a good earthen vessel, glazed within; fill the vessel up to the top with them; and when full, sprinkle them over with some good French wine, with a little salt in it; then set them by in a cellar, tying the mouth of the pot carefully down. After this, they may be taken out at pleasure, and on setting them in the sun, or within the reach of the fire, they will open as

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if on the tree, and not only the colour, but the smell, will be preserved.

Sir Robert Southwell has communicated to the world a method of drying plants, by which all flowers are preserved in their natural shape, and many in their proper colours. To this purpose two plates of iron are to be prepared to the size of a large half sheet of paper, or larger for particular occasions; these plates must be made so thick as not to have any power of bending, and there must be a hole made near every corner for the receiving a screw to fasten them close together.

When these plates are prepared, lay in readiness several sheets of paper, and then gather the plants with their flowers, when they are quite perfect; let this always be done in the middle of a dry day, and then lay the plant and its flower on one of the sheets of paper doubled in half, spreading out all the leaves and petals as nicely as can be. If the stalk be thick, it must be pared or cut in half so that it may lie flat; and if it be woody, it may be peeled, and only the bark left; when the plant is thus expanded, lay round about it some loose leaves and petals of the flowers, which may serve to complete any part that may prove deficient; when all is thus prepared, lay several sheets of paper over the plant, and as many under it; then put the whole into the iron plates, laying the papers smoothly on one, and laying the other evenly over them; then sew them close, and put them into an oven after the bread is drawn, and let them lie there two hours; after this make a mixture of equal parts of aquafortis and common brandy; shake these well together; and when the flowers are taken out of the pressure of the plates, rub them lightly over with a camel's hair pencil dipped in this liquor; then lay them upon fresh brown paper, and, covering them with some other sheets, press them between this and other papers with a handkerchief, till the wet of these liquors is dried wholly away. When the plant is thus far prepared, take the quantity of a nutmeg of gum dragon, put this into a pint of fair water cold, and let it stand four and twenty hours; it will in this time be wholly dissolved; then dip a fine hair pencil in this liquor, and with it daub over the back-sides of the leaves, and lay them carefully down on a half sheet of white paper fairly expanded, and press them with some more papers over these. When the gum-water is fixed, let the pressure and papers be removed, and the whole work is finished. The leaves retain their verdure in this case, and the flowers usually keep their natural colours. Some care must be taken, that the heat of the oven be not too great. When the flowers are thick and bulky, some art may be used to pare off the backs, and dispose the petals in a due order; and after this, if any of them are wanting, their places may be supplied with some of the supernumerary ones dried on purpose; and if any one of them be only faded, it will be prudent to take them away, and lay down others in their stead: the leaves may be also disposed and mended in the same manner. Another way of keeping both flowers and fruit the whole year without spoiling, is delivered by the same author in the following manner: take salt-petre, one pound; bole-armenic, two pounds; clean common sand, three pounds; mix all well together, then gather fruit of any kind, that is not full ripe, with the stalk to each; put these in one by one into a wide-mouthed glass, laying them in good order; tie over the top with an oil-cloth, and carry the glass into a dry cellar, and set the whole upon a bed of this prepared matter of four inches thick in a box; fill up the remainder of the box with the same

preparation, and let it be four inches thick over the top of the glass, and round all its sides. Flowers are to be preserved in the same sort of glasses in the same manner, and they may be taken up, after a whole year, as plump and as fair as when buried.

Flower Garden, the place where flowers are chiefly grown, cultivated and preserved. It should have a sheltered southern aspect, but which is not by any means close.

Flowers, in *Antiquity*. We find flowers in great request at the entertainments of the ancients, being provided by the master of the feast, and brought in before the second course; or, as some are of opinion, at the beginning of the entertainment. They not only adorned their heads, necks, and breasts, with flowers, but often bedrew the beds whereon they lay, and all parts of the room with them. But the head was chiefly regarded. Potter *Archæol. Græc. tom. ii. p. 383.* See *GARLAND*.

Flowers were likewise used in the bedecking of tombs. Potter *Archæol. Græc. lib. iv. cap. 7. tom. ii. p. 232, seq.* See *BURIAL*.

Flower, in *Architecture*, according to Vitruvius, is a representation of some imaginary flower, by way of crowning, or finishing, on the top of a dome, &c.

In lieu of this the moderns commonly use a vase, ball, or the like.

Flower-de-luce, *Fleur-de-lis*, in *Heraldry*, is a bearing anciently of great dignity; being reputed the noblest of all flowers, and as such having been in all ages the charge of the royal escutcheon of the kings of France, though time has made the bearing thereof more vulgar.

In some coats it is borne single; in others triple; in others it is, semée, seeded all over the escutcheon. During the exillence of monarchy in France the arms consisted of three flowers-de-lis or, in a field *azure*. These arms, however, were superseded in 1789 by the cap of liberty, and the three-coloured flag, when the bastille was taken and destroyed by the inhabitants of Paris.

Flower of the Capital is an ornament of sculpture, in form of a rose, in the middle of the sweep of the Corinthian abacus.

In that of the Composite, it is not a rose, nor any real, but an imaginary kind of flower.

Flowers, in *Chemistry*, are the finest and most subtle parts of dry bodies, raised by fire, into the vessel's head, and aludels; and adhering to them in form of a fine powder, or dust. Such are the flowers of sulphur, benjamin, &c.

Flowers of Antimony. See *ANTIMONY*.

Flowers Argentine, of *regulus of antimony*, are made by putting the regulus into an unvarnished earthen pot, placed in a furnace, so that its bottom may be red-hot, while its upper part shall be much colder. The pot is to be covered with a lid, without luting it, and heat is to be applied for an hour or more. When the pot is cold, its internal surface, and the remaining part of the regulus are found covered with white flowers, in form of beautiful, transparent, and shining needles, which are to be gathered with a feather. After this, a second sublimation may be commenced, and managed in the same manner; and the whole regulus may be changed into flowers. These flowers appear to be nothing else than the earth of regulus of antimony deprived of almost all its phlogiston. They are neither emetic nor purgative; they are soluble in aqua regia.

Flowers of Arsenic, *white*, are made, as all other flowers are, by subliming arsenic; from which they do not differ in their nature and properties.

Flowers of Benjamin, or *Benzoin*, are made by putting a quantity

quantity of this resin into a varnished earthen pan, and covering it with another inverted pan of stone-ware; and let the edges of these pans be made to fit well to each other, and to be well luted together with paper dipped in paste. Put the earthen pan containing the benzoin on a gentle fire, and with that the sublimation is performed; when the vessels are cool and unluted, the flowers are to be swept off with a feather. For the properties and medical uses of these flowers, see **BENZOIN**.

FLOWERS of Bismuth. See **BISMUTH**.

FLOWERS of Cobalt. See **COBALT**.

FLOWERS of Copper have been prepared by subliming sal-ammoniacum with the caput mortuum of blue vitriol. See **COPPER**.

FLOWERS, Martial. See **FLORES Martiales**.

FLOWERS of Sal Ammoniac are nothing more than sal ammoniac sublimed; and the sublimation is facilitated by generally mixing with it an equal part of decrepitated common salt. See **SAL AMMONIAC**.

FLOWERS of Sulphur, or Brimstone, are the vapours of melted brimstone conveyed from an iron pot (in which it is kept boiling) through a proper siew, into a close room or oven, where this vapour condenses into flowers. See **SULPHUR**.

FLOWERS of Zinc. See **CADMIUM** and **ZINC**.

FLOWERS, in the Animal Economy, denote women's monthly purgations, or *menfes*.

Nicod derives the word in this sense from *fluere*, q. d. *fluors*. Others will have the name occasioned hence, that women do not conceive till they have had their flowers; so that these are a sort of forerunners of their fruit.

FLOWERS, in Rhetoric, are figures and ornaments of discourse, by the Latins called *figurae*.

FLOWER-fence, Barbadoes. See **POINCIANA**.

FLOWER-fence, Bastard. See **ADENANTHERA**.

FLOWER of Bristol. See **LYCHNIS**.

FLOWER of Constantinople. See **LYCHNIS**.

FLOWER-de-luce, in Botany. See **IRIS**.

FLOWERS of an Hour. See **HIBISCUS**.

FLOWER, Eternal, or Everlasting. See **GNAPHALIUM**, **GOMPHRENA**, and **XERANTHEMUM**.

FLOWER, Four o'clock. See **MIRABILIS**.

FLOWER, Gentle. See **AMARANTHUS**.

FLOWER, Side Saddle. See **SARRACENA**.

FLOWER, Sky. See **CINERARIA**.

FLOWER, Sultan. See **CENTAURIA**.

FLOWER, Sun. See **HELIANTHUS**.

FLOWER, Trumpet. See **BIGNONIA**.

FLOWER, Wind. See **ANEMONE**.

FLOWER of Osteocolla, a name given by the people employed in finding the *osteocolla* to a sort of white marley matter, which they usually find on the surface of the ground in the places where the *osteocolla* lies underneath. It seems very nearly allied to the nature of the *osteocolla* itself, and usually has under it some of that blackish matter resembling rotten wood, which the *osteocolla* itself is formed upon, and which fills up those hollows we find in most of the pieces, while the whole is in the ground. This rotten vegetable matter has much the resemblance of the roots or branches of trees, and is called by the common people the root of the *osteocolla* or *hammoletti radix*. Phil. Trauf. N. 39. See **OSTEOCOLLA**.

FLOWER-root-worm, in *Natural History*, a peculiar species of fly-worm, which makes its habitation only in the bulbous roots of flowers. The roots of the narcissus, at the time they are taken up out of the earth toward the end of autumn, very frequently are found to contain each a

single worm which eats and destroys them. Sometimes, one root is found to contain two of them; but this is but rarely the case. The roots which have them may easily be known, by having each a round hole in some part, at which the destroyer has entered while it was small, and which probably serves it now in its large state for respiration of the freer air. The interior part of these bulbs is always found rotted and destroyed, and the worm is found in these, lying in a brown sort of dirt made by its own liquid excrements, mixed among the fragments of the coats of the root which it has destroyed. Reaumur's Hist. Insect. vol. iv. p. 499.

These worms undergo all their changes in a shell made of their own skin, which is of the same egg-fashioned shape with that of the blue flesh-fly, but considerably larger, and of a greyish colour. But this is not all its difference from those shells; for on its anterior and superior part it has two horns of the same kind with the four of the shells of the rat-tailed worm; and seeming to serve to the same purposes, and to convey the air necessary for the life of the creature, into its corcelet: the old stigmata, which served the creature in its worm-state, being now obliterated, and something necessarily wanted in their place. After having undergone all the necessary changes, the shells are burst open, in the month of April, and let out the fly they contained.

This has so much the appearance of a humble-bee, that at first sight it is scarce to be distinguished from it. It is covered with black, yellow, and reddish hairs, as the smaller kinds of the common humble-bees are; but its antennae, which are of the battledore fashion, prove plainly enough, that it is really no bee, even before one can determine with certainty that it has only two wings.

FLOWERAGE, a collection of flowers of several kinds set together in hulks, and hung up with strings.

FLOWERED, in the Manufactures. A stuff, or cloth, is said to be flowered, flourished, sprigged, or figured, when there are representations of flowers, either natural, or imaginary, wrought thereon.

There are stuffs flowered of almost all kinds of matter: flowers of gold, silver, silk, wool, thread, cotton, &c. Stuffs and cloths are usually denominated from the ground whereon the flowers are raised.

Thus, there are flowered velvets, taffeties, damasks, fathens, mohairs, dimities, &c.

Those flowered with gold and silver are more usually called *brocades*.

The flowers are usually wrought at the same time with the cloth, or ground. The threads of the warp are raised and lowered by means of packthreads passed through them in mounting the loom; and the manufacturer shooting his warp, or matter of the flowers, whether gold, silver, silk, or the like, between the threads thus raised, forms the *flowers*.

It is very curious to see them mount a loom; or, as they call it, *read a design*, to be represented on a stuff; but it is next to impossible to describe it; yet we have endeavoured to give some idea thereof under **DESIGNS**.

FLOWERING, Bulbous-rooted Plants, in Gardening, the art of blowing these sorts of flower-plants in the bulb. This can be easily done by proper care, as they are capable of both growing and flowering in water without any sort of earth. When well managed in this way, flowers of this kind have a beautiful and elegant appearance, at a season when they cannot be found in other situations.

It is the usual practice to blow single roots in pots or glasses made for the purpose, nothing more being requisite

than that of supplying them properly with water, so as not to rise much upon the bulbs of the roots, as they are very liable to rot when they are too much immersed in water.

Other contrivances have likewise been had recourse to in order to blow several roots of the same, or other kinds together, in which situations they have very pretty effects. Where glass or earthen-ware stands for this purpose are not at hand, the business may be easily and conveniently accomplished by means of a common garden pot, which should have the hole in the bottom perfectly closed, and two pieces of pretty strong sheet lead cut so as to exactly fit the bottom and top of the pot; proper holes should then be made in the upper piece for the reception of the root-bulbs, and small perforations formed in it, and the lower or bottom piece, for receiving suitable sticks for supporting the flowering stems of the different roots. Water must then be poured in so as to fill the pot quite up to the upper plate of lead, when the roots should be placed in the large holes made for them, so as just to touch the surface of the water. Where different kinds are used, hyacinths, narcissuses, jonquils, tulips, &c. may be put in, in a varied manner, and placed in a rather warm situation in the house. In this way the whole will be brought into flower at an early period, and continue for some time to afford a fine display of beautiful flowers. In this manner, by a careful regulation of the heat of the room, and an occasional proper supply of fresh water, they may be kept flowering from December till the beginning of the spring.

When they have done flowering, the roots should be removed and laid by in a dry, but not warm situation, until they may be wanted in the following season.

It is found by much experience that those bulbs which are kept in a dry state flower by much the best, as they gradually take in that quantity of moisture which is necessary in the process, and are not so liable to rot or sustain injury in that way.

The proper way of managing them is to let them at first only just come in contact with the surface of the water, that they may strike forth their root-fibres in a full manner, after which it may be raised a little higher to promote the full flowering of the plants. During the whole time of flowering, they should be kept quite steady by the support of proper sticks.

There is an advantage in flowering bulbous roots in glass stands, as they succeed equally well in them, by the progress of their roots being capable of being more perfectly judged of, and at the same time the supplies of water more conveniently afforded.

Such roots as have been in the ground are always improper for being employed in this way, as they never flower in any perfect manner. Before the roots are made use of, it is constantly necessary to lightly rub off all the loose old earthy matters that may hang about them. And it is a good practice to change the roots every two or three years, in order to prevent their becoming weak, and of course flowering imperfectly.

It has been suggested that the early flowering of roots of this sort may be greatly promoted by the use of weak solutions of nitre, and ammonia in its crude state. Where either of them is tried, a small portion should only be poured into the pots or glasses containing the water at a time, and not too frequently repeated. See *Root*.

FLOWING, or *FLAWS*, in *Sea Language*, denote the positions of the sheets, or lower corners of the principal sails when they are loosened to the wind, so as to receive it into their cavities in a direction more usually perpendicular than when they are close hawled, but more obliquely

than when the vessel is sailing before the wind. This position of the sheets takes place when the wind crosses the line of her course nearly at right angles.

FLOX, in the *Colour Trade*, a very well cleaned wool used to absorb the colours of cochineal, &c. It is prepared in this manner: infuse a pound of the finest shearings of woollen cloth in cold water for one day; then take them up, and press them well together, to wash off the unctuousity the wool naturally has. This is the simple flox, which, when impregnated with a solution of alum, is called alumed flox. This is done in the following manner: Take four ounces of roach-alum, and two ounces of crude tartar, both in fine powder; put them into an earthen vessel with three quarts of water, set it over the fire, and when it begins to boil, then put in the flox; let the liquor now boil half an hour over a gentle fire, then take it off, and when all is perfectly cooled, wash the flox with fair water, letting them stand in it two hours, then press them in the hand, and let them dry.

FLOYD, in *Geography*, a new township of America, and chief place of a district in Oneida Herkemer county, New York; containing 767 inhabitants.—Also, a county of Kentucky, containing 427 inhabitants, of whom 29 are slaves.

FLOYD'S Fork, a river of Kentucky, which runs into the river Salt. N. lat. 37° 48'. W. long. 85° 57'.

FLOYER, *Sir JOHN*, in *Biography*, an eminent physician, was born at Hinters, in Staffordshire, about the year 1649, and received his education at the university of Oxford, where the degree of doctor of physic was conferred upon him, on the 8th of July, 1680. He settled himself in the practice of his profession at Litchfield, in his native county; where his indefatigable attention to the sick, and the consequent practical skill which he attained, not only procured for him the confidence of the inhabitants, but gained him a reputation so extensive, that his sovereign honoured him with knighthood, as a reward for his talents. He was a great friend to the use of cold bathing, and left no means untried, by which he might disseminate the knowledge of its utility and safety, and bring the practice into general vogue: he particularly recommended it in chronic rheumatisms, and in nervous disorders, and he maintained that consumptions had prevailed extensively in England only since the practice of baptizing children by immersion had been relinquished. The following are the titles of his different publications. 1. "The Touchstone of Medicines," London, 1687, 8vo. 2. "The Preternatural state of the Animal Humours described by their sensible qualities," London, 1696, 8vo. in which he maintained the doctrine of fermentation. 3. "An Enquiry into the right use of Baths," London, 1697, 8vo. This work afterwards appeared under different titles, such as "Ancient Psychrolutry revived," London, 1702; and the subject was more amply treated in another edition; "History of hot and cold Bathing, ancient and modern, with an Appendix by Dr. Baynard," London, 1709, and again in 1715, and 1722. 4. His next work was "A Treatise on the Asthma," first published in 1698, and republished in 1717 and 1726. He was himself the subject of asthma from the age of puberty, yet lived to be an old man. 5. "The Physicians' Pulse-watch," 1707 and 1710, in two volumes, 8vo. Sir John Floyer was one of the first to count the pulsations of the arteries; for although the pulse had been the subject of observation from ancient times, the number of beats in a given time had not been attended to. 6. "Medicina Geronomica; of preserving old men's health; with an appendix concerning the use of oil and unctio, and a letter on the regimen of younger years," London,

London, 1724. Several of these treatises were translated into the continental languages.

FLUATES, in *Chemistry*, a genus of salts formed by the union of fluoric acid with any alkaline or salifiable base. Little is known of these salts, but the properties of the principal of them are enumerated in the article FLUOR, to which the reader is referred.

FLUCTUATION denotes, in *Surgery*, the motion communicated to any collection of purulent matter, or other kinds of fluid, by applying some of the fingers of each hand, at a certain distance from each other, to the surface of the tumour, and pressing with them alternately in such a manner, that the fingers of one hand are to make a little pressure, while those of the other hand remain lightly placed on another part of the swelling. When the ends of one set of fingers are thus delicately applied, and the surgeon taps, or makes gentle pressure with the fingers of the other hand, the impulse given to the fluid is immediately perceptible to those fingers which are lightly laid on the tumour, and the sensation thus received is one of the principal symptoms by which practitioners are enabled to discover the presence of fluid in a great variety of cases.

When the collection of fluid is very deeply situated, the fluctuation is frequently exceedingly obscure, and sometimes not at all distinguishable. In this circumstance, the existence of the fluid is to be ascertained by the consideration of other symptoms. For example, in cases of hydrops pectoris, and empyema, surgeons do not expect to feel the undulation of the fluid in the thorax with their fingers; they consider the patient's difficulty of breathing, the uneasiness attending his lying on one particular side, the œdema of the parietes of the chest, the dropsical affection of other parts, the more raised and arched position of the ribs on the affected side of the body, the preceding rigors, fever, and several other circumstances from which a judgment is formed, both with regard to the presence and the peculiar nature of the fluid.

FLUDD, ROBERT, or as he styled himself in Latin, *De Fluilibus*, in *Biography*, the second son of sir Thomas Fludd, treasurer of war to queen Elizabeth, was born at Milgate, in Kent, in 1574. He was educated at St. John's college, Oxford; and after taking his degree in arts, attached himself to the study of physic, and spent almost six years in his travels through the principal countries in Europe. It was probably during these peregrinations that he imbibed a taste for the Rosycrucian philosophy, of which he was ever after a most strenuous supporter, and indeed almost the only one who became eminent in it in this kingdom. He proceeded as doctor of physic in 1605, and about that time settled in London, and was made a fellow of the college of physicians. He was a very voluminous author in his sect, diving into the farthest profundities and most mysterious obscurities of the Rosicross, and blending, in a most extraordinary manner, divinity, chemistry, natural philosophy, and metaphysics. Eloy allows him some credit on the score of mathematical and mechanical knowledge, but characterizes his physic as a tissue of superstitious nonsense. Yet such a vein of warm enthusiasm runs through his works, that we may readily suppose him to have been a believer in the mystical jargon of his system. He had the faculty, at all events, of impressing his patients with an idea of his importance, and of inspiring them with great faith in his skill, by the use, it is said, of a kind of sublime unintelligible cant, whether successful or not; he was therefore at least very eminent in his medical capacity. He died at his house in Coleman-street, London, on the 8th of September,

1637, and was buried in the parish church of his native place. It is said that Dr. Fludd was in possession of the manuscripts of Simon Forman, the astrologer. Although the sect of Rosycrucians is now entirely extinct, a list of the works of Fludd, which were chiefly written in Latin, may not be uninteresting to the curious. 1. The largest, entitled, "Utriusque Cœli, majoris et minoris, Technica Historia," Oppenheim, 1617, in two volumes folio, contains some extremely singular prints, which are intelligible only to an adept. 2. "Tractatus Apologeticus integritatem societatis de Rosca cruce defendens," Leyden, 1617. 3. "Monochordum mundi symphonicum, seu Replicatio ad Apologiam Joannis Kepleri," Francfort, 1621. 4. "Anatomia Theatrum triplici effigie designatum," *ibid*, 1623. 5. "Philosophia Sacra et verè Christiana, seu Meteorologia Cosmica," *ibid*, 1626. 6. "Medicina Catholica, seu, Mylticum artis Medicandi Sacrarium," *ibid*, 1626. 7. "Integrum Morborum Mysterium," *ibid*, 1631. 8. "De Morborum Signis," *ibid*, 1631. These two treatises are a part of the *Medicina Catholica*. 9. "Clavis Philosophiæ et Alchymiaæ Fluddanae," *ibid*, 1633. 10. "Philosophia Mosaica," Gouda, 1638. 11. "Pathologia Dæmoniaca," *ibid*, 1640. Aikin *Biograph. Memoirs of Med. Eloy. Dict. Hist.*

It is true, that as the great Kepler, his contemporary, from the high respect which he bore even to the prejudices and philosophic dreams of antiquity, in his work, entitled "Harmonius Mundi," endeavours to illustrate and demonst-rate the Pythagorean harmony of the spheres, and to reconcile it to geometrical laws, and the Copernican system; but as it was in this vain attempt that he made the great discovery of the elliptic orbits of the planets, his visionary analogies between the distance of the planets, and the harmonic intervals in music, have been excused. Now Fludd, anxious for the honour which he thought Kepler had gained by the very attempt which most disgraced him with posterity, in his fanciful demonstration of the music of the spheres, opposes him and his analogy with abuse and scurrility, and sets up a system of his own still more wild and absurd; for in the third book of the first tract, entitled "De Musica Mundana," he supposes the world to be a musical instrument, resembling a monochord, extending from the summit of the empyrean heaven to the basis of the earth itself, dividing it into parts constituting consonances; so that if the half part were touched or struck, it would produce the consonant diapason, or octave, in the same manner as in the instrumental monochord. Master doctor Fludd has given us a diagram of his system, representing his mundane monochord, the finger-board of which he has graduated by flats into a scale of disdiapason, to *G sol re ut* in the treble, and placed opposite to each note of this gamut, ascending from the earth, the elements of water, air, and fire; then the celestial bodies from the moon to Saturn, assigning a place to each orb opposite to some sound of his musical scale.

After adjusting his mundane monochord, and dividing it into systems of diatessaron, diapente, and diapason, our author, chap. iv. undertakes to demonstrate his whimsical hypothesis by the figure of a pipe or flute. But if our readers have had perseverance to follow us thus far, we can hardly suppose that their patience will last one inch farther; we shall therefore only observe, that this bewildered author, in order to enable himself to put together his system of metaphorical music, must previously have studied real practical music, concerning which, in his second tract, he speaks like other *Christian* fools.

FLUDER, or Sea-FLUDDER, in *Ornithology*, the name of a water-fowl of the colymbus or diver-kind, described by Geiner, and some other authors, under the name of the colymbus

colymbus maximus, or largest diver. See COLYMEUS *Glacialis*.

FLUE, ST. NICHOLAS DE, in *Biography*, a very distinguished patriot of Switzerland, was born at Saxelen in 1417. Descended from an ancient family, he signalized himself in defence of his country, and particularly during the war which the Swiss supported against Sigismund, archduke of Austria. He was no less remarkable for humanity than valour. To his countrymen, when they were preparing to pillage and burn the convent of St. Margaret, near Dieffenhofen, he exclaimed, "If God grants you the victory over your enemies, use it with moderation, and spare those edifices which are consecrated to him." This remonstrance was effectual, and preserved the convent from destruction. To the most excellent qualities of the heart and understanding, to great political sagacity, he added the exterior graces of figure, dignity of character, and the most winning affability. Raised by his countrymen to high employments in the state, he repeatedly declined the office of landamman from motives of delicacy, because he disapproved the principles of the governing party. At length, hurried away by his detestation of evil, and a zeal for monkish devotion, he quitted his family in the 50th year of his age, and retiring from the world in a fit of gloomy superstition, turned hermit. The place of his retreat was Ransf, a few miles from Saxelen, where he built an hermitage and a small chapel, and practised all the severities required by that austere mode of life with the strictest observance. But though he withdrew from the world, the flame of patriotism was not extinct; but he was the happy instrument in rescuing Switzerland from the impending horrors of civil discord. When a quarrel took place among the cantons, and the deputies assembled, in 1481, at Stantz, in order to compromise the difference, De Flue quitted his hermitage, and in the 64th year of his age travelled during the night, and arrived at Stantz on the very morning when the deputies, having failed to terminate their dispute amicably, were preparing for their departure. He conjured them to remain; and, having by his mediation succeeded in composing the public dissensions, returned to his hermitage, where he died, in 1487, in the 70th year of his age, regretted and esteemed by all Switzerland. Such a general opinion of his extreme piety prevailed among his contemporaries, that the bigotry of these times ascribed to him an exemption from the common wants of human nature. The following epitaph was inscribed on his tomb: "Nicholas de Flue quitted his wife and children to go into the desert: he served God 19½ years without taking any sustenance. He died 1487." *Coxe's Travels in Switzerland*, vol. i.

FLUE, the long tube of a chimney, from the fire-place to the top, for giving passage to the smoke. For a more particular account, see CHIMNIES.

FLUELLIN, in *Botany*. See ANTIRRHINUM.

FLUENT, in *Analysis*. It is not easy to give such a definition of the term fluent as shall be intelligible to those not previously acquainted with the use of the word. And indeed mathematicians themselves differ in their conceptions of it according to the different points of view in which they have been accustomed to consider the principles of the fluxionary or differential calculus.

As the converse of a fluxion, a fluent is the flowing quantity, the rate of whose increase is expressed by the fluxion. According to other writers the fluent or integral is the sum of an infinite number of small factors increasing or decreasing according to some given law, each of which

may be considered as the fluxion or differential of the whole integral or fluent. See FLUXION.

According to the more accurate ideas of modern analysts, a fluent or integral is nothing more than an algebraic expression, consisting of variable quantities with or without others that are constant, which expression being expanded into a series according to certain rules, gives for the *first term* the fluxion or differential of which it is the fluent. In this view of the subject a fluent and its fluxion, or an integral and its differential, are merely certain analytical or symbolical relations, not depending on any theory relating to velocity, or indeed on any disputable hypothesis whatever, since it is founded on arbitrary definition alone: and it is presumed that this will be sufficient for all the purposes to which the application of the differential or integral calculus can possibly be applied. But the discussion of this subject will be again resumed under *Analytic Function*.

The most luminous and correct explanation of the real meaning of the term fluent is given by Mr. Woodhouse in the *Transactions* for 1802, in a paper on the independence of the analytical and geometrical methods of investigation. His object is to shew that analytical expressions, involved in geometrical language, are foreign to the subject, and tend to produce confused and erroneous notions. Such, for example, are the following: $\sin x$; $\cos. x$; $\text{hyp. log. } x$; $\sin. nx = 2 \cos. x. \sin. (n-1)x - \sin. (n-2)x$; $f \dot{x} (1-x^2)^{\frac{1}{2}} = \text{circular arc}$; $f \dot{x} \sqrt{\frac{1+n^2 x^2}{1-x^2}} = \text{elliptical arc}$, &c.

The value of $f \dot{x} (1+x)^{-1}$ is said to be a portion of the area of an hyperbola intercepted between two ordinates to its asymptotes; but as Mr. W. observes, this is a circumlocutory mode of expression, since to find the value of the area, $\dot{x} (1+x)^{-1}$ must be expanded, and the integrals of the several terms taken, which same operation must have taken place in order to approximate to the value of $f \dot{x} (1+x)^{-1}$, if no such curve as the hyperbola had ever been invented.

Mr. W. then proceeds to explain what he himself understands by an integral or fluent of an expression. We shall use his own words.

Let $\dot{\phi} x$ denote a function of x ; if x be increased by o then $\dot{\phi} x$ becomes $\dot{\phi} (x+o)$ and $\dot{\phi} (x+o)$, developed, according to the power of o , becomes $\dot{\phi} x + P o + \frac{Q}{1.2}$.

$o^2 + \frac{R}{1.2.3} o^3$, &c. where P is derived from $\dot{\phi} x$, Q from P, R from Q, &c. by the same law, so that the manner of deriving P being known, Q, R, &c. are known. The entire difference or increment of $\dot{\phi} x$ is $\dot{\phi} (x+o) - \dot{\phi} x$; but the differential or fluxion of $\dot{\phi} x$, is only a part of this difference, or P. o . If instead of o , dx or \dot{x} be put, it is P. dx or P \dot{x} ; the integral or fluent of P \dot{x} is that function from which P \dot{x} is derived; and in order to remount to it, we must observe the manner or the operation by which it was deduced, and by reverting such operation the *integral or fluent* is obtained. Now in taking the fluxion of certain functions of x , it appears that there are conditions to which the indices of x without and under the vinculum are subject. Hence, whether or not a proposed fluxion can have its fluent assigned, we must see if the fluxion has the necessary conditions.

Expressions, such as $\frac{\dot{x}}{x}$, $\frac{\dot{x}}{1+x}$, $\frac{\dot{x}}{\sqrt{1-x^2}}$, &c. have not these conditions; and consequently there is no function $\dot{\phi} x$ of

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of x , such that the second term of the development of $\phi(x + \dot{x})$ is equal either to $\frac{\dot{x}}{x}$, or $\frac{\dot{x}}{1+x}$, or $\frac{\dot{x}}{\sqrt{1-x^2}}$, &c. There are, however, integral equations from which such expressions may be derived. Thus, let $x = \epsilon^z$, then $\frac{\dot{x}}{x} = \dot{z}$; let $1+x = \epsilon^z \therefore \frac{\dot{x}}{1+x} = \dot{z}$; let $x = \frac{\epsilon^z \sqrt{-1} - \epsilon^{-z} \sqrt{-1}}{2 \sqrt{-1}} \therefore \frac{\dot{x}}{\sqrt{1-x^2}} = \dot{z}$.

Now from these equations, the differential equations $\frac{\dot{x}}{x} = \dot{z}$, $\frac{\dot{x}}{1+x} = \dot{z}$, $\frac{\dot{x}}{\sqrt{1-x^2}} = \dot{z}$, &c. may, by expunging the exponential quantities, be derived; consequently, if the symbol f is to designate a reverse operation, I can only know what that reverse operation is by attending to the manner by which the expressions affected with the symbol f were derived. Hence

$$\int \frac{\dot{x}}{x} = z, \text{ when } x = \epsilon^z,$$

$$\int \frac{\dot{x}}{1+x} = z, \text{ when } 1+x = \epsilon^z$$

$$\int \frac{\dot{x}}{\sqrt{1-x^2}} = z, \text{ when } x = (2 \sqrt{-1})^{-1} \left\{ \epsilon^z \sqrt{-1} - \epsilon^{-z} \sqrt{-1} \right\}.$$

In like manner,

$$f \dot{x} (1+x^2)^{-\frac{1}{2}} = z, x + \sqrt{1+x^2} = \epsilon^z, \text{ or } x = \frac{\epsilon^z - \epsilon^{-z}}{2}$$

$$f \dot{x} (2x+x^2)^{-\frac{1}{2}} = z, 1+x + \sqrt{2x+x^2} = \epsilon^z$$

$$\int \frac{2 \dot{x}}{1-x^2} = z, \frac{1+x}{1-x} = \epsilon^z, \text{ or } x = \frac{\epsilon^z - 1}{\epsilon^z + 1}$$

$$\int \frac{2 \dot{x}}{x \sqrt{1+x^2}} = z, \frac{\sqrt{1+x^2} - 1}{\sqrt{1+x^2} + 1} = \epsilon^z, \text{ or } \sqrt{1+x^2} = \frac{1+\epsilon^z}{1-\epsilon^z}, \text{ or } x = \frac{2}{\epsilon^{-\frac{z}{2}} - \epsilon^{\frac{z}{2}}}$$

Again, suppose $x = \left\{ 2 \sqrt{-1} \right\}^{-1} \left\{ \epsilon^z \sqrt{-1} - \epsilon^{-z} \sqrt{-1} \right\}$
 $\therefore \dot{x} = 2^{-1} \dot{z} \left\{ \epsilon^z \sqrt{-1} + \epsilon^{-z} \sqrt{-1} \right\}$; but $\sqrt{1-x^2} = 2^{-1}$,
 $\left\{ \epsilon^z \sqrt{-1} + \epsilon^{-z} \sqrt{-1} \right\}$; consequently $\dot{x} = \dot{z} \sqrt{1-x^2}$,
 or $\dot{z} = \frac{\dot{x}}{\sqrt{1-x^2}}$; hence reverfely, $\int \frac{\dot{x}}{\sqrt{1-x^2}} = z$, x
 being $= (2 \sqrt{-1})^{-1} \cdot \left\{ \epsilon^z \sqrt{-1} - \epsilon^{-z} \sqrt{-1} \right\}$.

In like manner $\int \frac{\dot{x}}{\sqrt{1-x^2}} = z, x = 2^{-1} \cdot \left\{ \epsilon^z \sqrt{-1} + \epsilon^{-z} \sqrt{-1} \right\}$.
 $\int \frac{\dot{x}}{\sqrt{2x-x^2}} = z, x = (1 - 2^{-1}) \cdot \left\{ \frac{\epsilon^z \sqrt{-1} + \epsilon^{-z} \sqrt{-1}}{\epsilon^z \sqrt{-1} - \epsilon^{-z} \sqrt{-1}} \right\}$.
 $\int \frac{\dot{x}}{x \sqrt{1-x^2}} = z, x = \frac{2}{\epsilon^z \sqrt{-1} + \epsilon^{-z} \sqrt{-1}}$.

And a variety of forms may be obtained by substituting

for x different functions of x , in the expression $\frac{\dot{x}}{\sqrt{1-x^2}}$.

Hence if the symbol f is made to denote a reverse operation, the integral equations of the preceding differential equations have been rightly assigned. All other methods of assigning the integrals by the properties of logarithms, by circular arcs, by logarithmic and hyperbolic curves, are indirect, foreign, and ambiguous. Mr. Woodhouse next proceeds, by the above method, to integrate certain differential equations which Euler and Lagrange have before treated of, and which are said to admit for their compleat integration an algebraic form, although the integration of each particular term depends on the quadrature of the circle and hyperbola.

Let $f x, f y$, denote functions of x and y . Suppose the differential equation to be $\frac{\dot{x}}{x} + \frac{\dot{y}}{y} = 0$; then $f x + f y = a$ when $x = \epsilon^{f x}, y = \epsilon^{f y}$. Hence $x y = \epsilon^{f x + f y} = \epsilon^a = A$, a constant quantity.

zdly. Let $\frac{\dot{x}}{\sqrt{1-x^2}} + \frac{\dot{y}}{\sqrt{1-y^2}} = 0$.
 $\therefore f x + f y = a, x$ being $= \left\{ 2 \sqrt{-1} \right\}^{-1} \cdot \left(\epsilon^{f x \sqrt{-1}} - \epsilon^{-f x \sqrt{-1}} \right)$; and $y = 2 \sqrt{-1} \sqrt{-1} \cdot \left(\epsilon^{f y \sqrt{-1}} - \epsilon^{-f y \sqrt{-1}} \right)$; or $\sqrt{(1-x^2)} = 2^{-1}$.
 $\left(\epsilon^{f x \sqrt{-1}} + \epsilon^{-f x \sqrt{-1}} \right)$, and $\sqrt{1-y^2} = 2^{-1}$.
 $\left(\epsilon^{f y \sqrt{-1}} + \epsilon^{-f y \sqrt{-1}} \right)$

Hence $x \cdot \sqrt{(1-y^2)} + y \cdot \sqrt{(1-x^2)} = (2 \sqrt{-1})^{-1} \cdot \left\{ \epsilon^{(f x + f y) \sqrt{-1}} - \epsilon^{-(f x + f y) \sqrt{-1}} \right\} = (2 \sqrt{-1})^{-1} \cdot \left\{ \epsilon^a \sqrt{-1} - \epsilon^{-a \sqrt{-1}} \right\} = A$, a constant quantity.

3dly. Let $\frac{\dot{x}}{\sqrt{a+bx+cx^2}} + \frac{\dot{y}}{\sqrt{a+by+cy^2}} = 0$
 $\therefore \frac{\dot{x}}{\sqrt{c} \sqrt{x^2 + \frac{bx}{c} + \frac{a}{c}}} + \frac{\dot{y}}{\sqrt{c} \sqrt{(y^2 + \frac{by}{c} + \frac{a}{c})}} = 0$.

Let $x + \frac{b}{2c} = v, y + \frac{b}{2c} = v'$, and $r^2 = \frac{a}{c} - \frac{b^2}{4c^2}$.
 $\therefore \frac{\dot{v}}{\sqrt{c} \sqrt{v^2 + r^2}} + \frac{\dot{v}'}{\sqrt{c} \sqrt{v'^2 + r^2}} = 0$.

Taking the integrals $\epsilon^{-1} \left\{ V + V' \right\} = a, v = \frac{\epsilon^v - r^2 \epsilon^{-v}}{2}, v' = \frac{\epsilon^{v'} - r^2 \epsilon^{-v'}}{2}$.

$\therefore v \sqrt{r^2 + v'^2} + v' \sqrt{(r^2 + v^2)} = \frac{\epsilon^{v-v'} - r^4}{2}$
 $\frac{\epsilon^{-(v+v')}}{2} = \frac{\epsilon^x \sqrt{c} - r^4 \epsilon^{-x} \sqrt{c}}{2} = A$, and restoring the

values of x and y ;
 $\frac{2cx + b}{c} \sqrt{(a+by+cy^2)} + \frac{2cy + b}{c} \sqrt{(a+bx+cx^2)}$

+ x^n) = A' . By the above operation it appears that certain algebraical expressions, as $x \sqrt{1-y^2} + y \sqrt{1-x^2}$, $\frac{2cx+b}{c} \sqrt{a+by+cy^2}$, &c. may be deduced, which

answer the equations $\int \frac{\dot{x}}{\sqrt{1-x^2}} + \int \frac{\dot{y}}{\sqrt{1-y^2}}$, &c.

But, strictly speaking, such algebraical expressions are not the integrals; they are rather expressions deduced from the true integral equations, from which other algebraical expressions, besides those put down, might be deduced. For the integration of this sort of differential equations, see Mem. de Turin, vol. iv. p. 98. "Sur l'integration de quelques equations differentielles, dont les indeterminées sont séparées, mais dont chaque membre en particulier n'est point integrable."

In this memoir are given three different methods of integrating $\dot{x} (1-x^2)^{-1} = y^2 (1-y^2)^{-1}$; by circular arcs and certain trigonometrical theorems, by impossible logarithms, and by partial integrations. Strictly speaking, all these methods are indirect; and the two first are only different but circuitous modes of expressing the method above described. See likewise Euler, Calc. integral, vol. ii. Novi Comm. Petrop. tom. vi. p. 37; tom. vii. p. 1. It is to be observed, that in the present state of analytic science, there is no certain and direct method of integrating differential equations, such as $\dot{x} \{a+bx+cx^2+dx^3+\epsilon x^4\}^{-1} + \dot{y} \{a+by+cy^2+dy^3+\epsilon y^4\}^{-1} = 0$; because no analytical expression or equation of a finite form has hitherto been invented, from which, according to the processes of the differential calculus, such differential equations may be deduced. To find the algebraical expressions which answer to these equations, recourse must be had to what are properly denominated artifices. For such, see Mem. de Turin, vol. iv. Comm. Petr. tom. vi. vii. Lagrange. Fonct. Analyt. p. 86. La Croix Calc. diff. p. 427, &c.

FLÜGGEEA, in Botany, so named by M. Louis Claude Richard, in honour of Mr. John Flügge, a very able German botanist of the present day, whose assistance is particularly acknowledged by professor Schrader in the first volume of his own truly excellent *Flora Germanica*, just imported into this country. Richard in Schrader's New Journal, v. 2. fasc. 1. 8. (Ophiopogon; Gawler in Curt. Mag. v. 27. 1063.) Class and order, *Hexandria Monogynia*. Nat. Ord. *Sarmentacea*, Linn. *Asparagi*, Jusl.

Gen. Ch. Cal. none, except, with Richard, we take the corolla for such. Cor. inferior, of one petal, bell-shaped, in six deep, equal, oval, spreading, permanent segments. Stam. Filaments six, very short, inserted into the base of the corolla; anthers oblong, vertical, erect, shorter than the corolla, somewhat arrow-shaped at the base. Pisl. Germen superior, in the bottom of the corolla, roundish, of three cells, with rudiments of a double row of seeds in each; style solitary, rather longer than the stamens, erect, columnar, furrowed, tapering at the summit; stigma minutely bearded, acute. Peric. Berry superior, globose, when ripe generally of one cell only. Seed solitary, large, orbicular, cartilaginous.

Eff. Ch. Corolla in six deep equal segments. Stamens inserted into the base of the corolla, very short. Stigma acute. Berry superior. Seed solitary, globose.

1. *F. japonica*. Richard. in Schrad. N. Journ. v. 2.

fasc. 1. 9. t. 1. f. A. (Ophiopogon japonicus; Gawl. in Curt. Mag. t. 1063. Convallaria japonica; Thunb. Jap. 140 E. Linn. Suppl. 204. Ait. H. Kew. v. 1. 455. Willd. Sp. Pl. v. 2. 160. Redout. Lil. v. 2. t. 80. Mondo; Kämpf. Amoen. 823. t. 824. Adanson, v. 2. 496.) Grass-leaved Flüggéea, or Japan Snakebeard Native of shady places among shrubs, near Nagafaki in Japan. Thunberg. Kept with us in greenhouses, where it flowers in June. Thunberg made it known to the Dutch, from whose gardens we obtained roots in 1784, and who treat it as a hardy plant. The root is perennial, creeping by means of fleshy horizontal shoots, which are mucilaginous and nutritive. Stem none. Leaves radical, numerous, naked, grassy, linear, recurved, bluntish, flat, rough-edged, winged at the base with a broad thin membrane. Stalk central, solitary, much shorter than the leaves, compressed, racemose. Flowers drooping, small, white, or blueish, with yellow anthers. Berry the size of a pea, of a rich deep blue. The leaves in our plants are from three inches to a foot long. Thunberg speaks of a variety in which they exceed two feet, but of this we know nothing.

This plant appears to be properly enough separated from *Convallaria*, on account of its habit, and perhaps the essential characters given above may serve to define the genus, which was published by the two writers to whom we have referred, in the same year, unknown to each other. We conceive the germen is proved by analogy to be truly superior, and the ripe fruit is altogether so; nor can we account for that part of M. Richard's description which represents it as "scarred at the top by the vestige of the flower;" this, if true, would decide the fruit and germen to be inferior. Redoute's beautiful figure faithfully represents the parts in question. Richard's plate is more minute as to the structure of the flower, and shews the germen to be in an early state attached to, and as it were imbedded in, the base of the corolla, but the more advanced state of the fruit proves that it cannot be deemed even half-inferior, nor is it, by that mark, to be discriminated from *Convallaria*.

FLUIDITY, in *Physics*, that state or affection of bodies which denominates or renders them fluid.

Fluidity stands in direct opposition to *firmness*, or *solidity*, which see.

Fluidity is distinguished from liquidity or humidity, in that the idea of the first is absolute, and the property contained in the thing itself; whereas that of the latter is relative, and implies wetting, or adhering, *i. e.* somewhat that gives us the sensation of wetness, or moisture, and which would have no existence but for our senses.

Thus melted metals, air, or ether, and even smoke, and flame itself, are fluid bodies, but not liquid ones; their parts not leaving any sense of moisture; whereas water, milk, wine, &c. are at the same time both fluids and liquids.

The nature and causes of fluidity have been variously assigned.

The Gassendists, and ancient Corpuscularians, require only three conditions as necessary to it, *viz.* a smallness and smoothness of the particles of the body; vacuities interspersed between them; and a spherical figure. Thus the Epicurean poet Lucretius:

"Illa autem debent ex lævibus atque rotundis
Esse magis, fluido quæ corpore liquida constant."

The Cartesians, and after them Dr. Hook, Mr. Boyle, &c. beside the circumstances above mentioned, require a various, perpetual, intestine motion of the particles of the bodies, as that which principally contributes to fluidity.

Fluidity

FLUIDITY.

Fluidity then, according to these philosophers, consists in this, that the parts of the body, being very fine, and small, are so disposed by motion, or figure, as that they can easily slide over one another's surfaces all manner of ways; and that they be in constant, various, separate agitation to and fro; and that they only touch one another in some few parts of their surfaces. Mr. Boyle, in his "History of Fluidity," mentions three conditions principally required to fluidity, *viz.*

1. The minuteness of parts: thus, in effect, we find that fire, by dividing metals into fine, small parts, renders them fluid; and that acid menstruums dissolve and render them fluid after the like manner; and that fire turns the hard body of common salt almost wholly into a liquor, by distillation: not but that the figure of the particles may have a considerable share in fluidity.

Thus mercury, whose parts are doubtless much grosser than those of oil and water, is yet more fluid than either of them: and thus oil, by the action of fire, may be converted into a consistent substance like butter.

2. A number of vacancies interspersed between the corpuscles, to give room for the several particles to move among themselves.

3. A motion and agitation of the corpuscles; either from some principle of mobility within themselves, or from some extraneous agent, penetrating and entering the pores, moving variously among them, and communicating to them a part of its motion.

That this last is the qualification chiefly required in fluidity, he argues from divers observations and experiments. Thus, a little dry powder of alabaster, or plaster of Paris, finely sifted, being put in a vessel over the fire, soon begins to boil like water; exhibiting all the motions and phenomena of a boiling liquor. It will tumble variously in great waves like that: it will bear stirring with a stick or ladle like that, without refilling; nay if strongly stirred near the side of the vessel, its waves will apparently dash against them; yet it is all the while a dry parched powder.

The like is observed in sand; a dish of which being set on a drum-head, briskly beaten by the sticks, or on the upper stone of a mill, it in all respects emulates the properties of a fluid body. A heavy body, *e. gr.* will immediately sink in it to the bottom, and a light one emerge to the top. Each grain of sand has a constant vibratory and dancing motion; and if a hole be made in the side of the dish, the sand will spin out like water.

That the parts of fluids are in continual motion, the Cartesians evince from divers considerations: as, 1. The transmutation of solids into fluids, *e. gr.* ice into water, and *vice versa*; the chief difference between the body in these two states, consisting in this, that the parts being fixed and at rest in the one, resist the touch; whereas in the other, being already in motion, they give way to the slightest impulse.

2. The effects of fluids, which commonly proceed from motion: such are the insinuation of fluids among the pores of bodies; the softening and dissolving of hard bodies; the actions of corrosive menstruums, &c. Add, that no solid can be brought to a state of fluidity without the intervention of some moving or moveable body, as fire, air, or water.

Air the same gentlemen hold to be the first spring of these causes of fluidity, it being this that gives motion to fire and water, though itself receives its motion and action from the ether or subtle medium.

Boerhaave, however, pleads strenuously for fire's being the first mover, and the cause of all fluidity in other

bodies, as air, water, &c. Without this, he shews that the atmosphere itself would fix into one solid mass. To the same purpose, Dr. Black maintains that fluidity is the effect of heat. The different degrees of heat which are required to reduce different bodies into a state of fluidity, he supposes, may depend on some particulars in the mixture and composition of the bodies themselves; and this is rendered further probable from considering that the natural state of bodies in this respect is changed by certain mixtures: accordingly, when two metals are compounded, the mixture is commonly more fusible than either of them separately. See FIRE and HEAT.

Sir I. Newton sets aside this theory of the cause of fluidity, and substitutes instead of it the great principle of attraction. The corpuscular system, with all the improvements of Descartes and Mr. Boyle, did not sufficiently account for the primary condition, requisite to constitute a body fluid, *viz.* the various intestine motion and agitation of its particles. But this motion is naturally enough accounted for, by supposing it a primary law of nature, that as all the particles of matter attract each other when within a certain distance; so at all greater distances they fly from, and avoid one another. For then, though their common gravity, together with the pressure of other bodies upon them, may keep them together in a mass, yet their continual endeavour to avoid one another singly, and the adventitious impulses of heat and light, or other external causes, may make the particles of fluids continually move round about one another, and so produce this quality.

There is a difficulty, indeed, in accounting why the particles of fluids always keep at such a distance from one another, as not to come within the sphere of one another's attraction. The fabric and constitution of that fluid body, water, are amazing; that a body so very rare, and which has a vast over-proportion of pores, or interspersed vacancy, to solid matter, should yet be incompressible by the greatest force, as philosophers very generally, and for a long time have imagined, (see COMPRESSION;) and yet this fluid is easily reducible into that firm, transparent, friable body, which we call ice, by being only exposed to a certain degree of cold.

One would think, that though the particles of water cannot come near enough to attract each other, yet the intervening frigorific matter doth, by being mingled per minima, strongly attract them, and is itself likewise strongly attracted by them, and so wedges or fixes all the parts into a firm solid body; which solid body loses its solidity again, when by heat the vinculum is solved, and the frigorific particles are disjoined from those of the water, and are forced to fly out of it. And thus may the fumes of lead, perhaps, fix quicksilver.

When a firm solid body, such as metal, is by heat reduced into a fluid, the particles of fire disjoin and separate its constituent parts, which their mutual attraction caused before to cohere, and keep them at such a distance from one another, as that they are out of the sphere of each other's attraction, as long as that violent motion lasts; and when by the lightness and activity they are blown off, unless they be renewed by a continual supply, the component particles of the metal finally come near enough again to feel one another's attractions.

As, therefore, the cause of cohesion of the parts of solid bodies appears to be their mutual attraction, so the chief cause of fluidity seems to be a contrary motion, impressed on the particles of fluids; by which they avoid and fly one another, as soon as they come at, and as long as they keep at such a distance from each other.

It is observed also in all fluids, that the direction of their pressure against the vessels which contain them is in lines, perpendicular to the sides of such vessels; which property, being the necessary result of the particles of any fluid's being spherical, shews that the parts of all fluids are so, or of a figure very nearly approaching to it. See FLUIDS.

FLUIDITY of the Earth, in *Geology*. It has been a favourite topic with many of the writers on the theory of the earth, to enlarge on a supposed fluidity of the materials of which the solid matters of the globe are now composed, not only progressively at the successive periods of their organic formation, but since, in consequence of the sudden and violent disintegration or demolition of the ancient mountains and strata, at the period when the organic remains of animals and plants were lodged in the present strata; and which took place, according to most of the favourers of this hypothesis, at the time of the Mosaic deluge: it is said, however, by some late writers, that the relation of that event, as given in the sacred writings, (and whence else can we gain any certain knowledge of such an event?) gives us no ground for admitting this disintegration or total destruction of the antediluvian earth, or the opinion of its having been at that time reduced to a state of fluidity. In the article ELLIPSOID *Figure of the earth*, the writer of that article has endeavoured to shew, that such fluidity of the materials of which the globe is at present constituted, is not any way necessary towards accounting fully for the present form and dimensions of the earth, as resulting from its gravitation and rotation on its axis. Those who have contended for an entire fluidity of the earth, or at least of so much of its materials as compose the crust thereof, with which alone we are acquainted, surely never turned their attention to the vast depth and quantity of water or other fluid which would be necessary for its solution, or even suspension, at one time, as seems necessary, or to the circumstances under which so perfectly heterogeneous a fluid could be supposed to deposit distinct substances, with the surprising regularity in which the strata are disposed, in orders totally distinct from that of their specific gravities. See *Order of the STRATA*.

FLUIDS are bodies, whose particles are but weakly connected, their mutual cohesion being in a great measure prevented by some interfering cause. In this sense a fluid stands opposed to a solid.

Sir I. Newton defines a fluid body, to be that whose parts yield to the smallest force impressed, and by yielding are easily moved among each other.

That the particles whereof fluids consist are of the same nature, and have the same properties, with the particles of solids, is evident, from the conversion of liquids and solids into each other, *e. gr.* of water into ice, of metals into fluors, &c. Nor can it be reasonably doubted, that the component parts of all bodies are the same, *viz.* hard, solid, impenetrable, moveable corpuseles.

We observe, therefore, with Dr. Clarke, that if the parts of a body either do not touch each other, or easily slide over one another; and are of such a magnitude, as that they may be easily agitated by heat, and the heat be sufficiently great to agitate them, though it may perhaps be less than suffices to prevent water from freezing, or, even, though the parts be not actually moved, yet, if they be small, smooth, slippery, and of such a figure and magnitude as dispose them to move, and give way, that body is fluid.

And yet the particles of such fluid bodies do, in some measure, cohere; as is evident hence, that mercury, when well purged of air, will be sustained in the barometer to

the height of 60 or 70 inches; that water will ascend in capillary tubes even in vacuo; and that the drops of liquor in vacuo run into a spherical form; as adhering by some mutual cohesion like that between polished marble planes. Add, that these fluid bodies, if they consist of particles that are easily entangled within each other, as oil, or if they be capable of being stiffened by cold, and joined by the interposition of little cunei or wedges, as water; they are easily rendered hard: but if their particles be such as can neither be entangled, as air; nor stiffened by cold, which was supposed to be the case with regard to quicksilver; then they would never grow hard and fixed. It is more probable that the primary cause of fluidity should consist in the imperfect cohesion of the constituent parts of fluids rather than in their figure. For if the particles of a body cohere strongly together, they cannot easily move amongst each other. It is also evident that the smallness of the particles of fluids will contribute to their imperfect cohesion, because the surface of a body composed of small particles must be more smooth and even, than the surface of a body composed of large particles, and two flat bodies may be conceived to consist of particles so small that their surfaces shall differ insensibly from perfect planes, so that if these bodies were placed upon one another, they would slide without the least sensible friction. Moreover, if the particles of these bodies, thus placed on each other, be by any means deprived of the whole, or the greatest part of their cohesion, the bodies will not only slide on each other in the fore-mentioned plane, but the parts of the mass would also slide on each other in any other direction whatsoever. Consequently they would readily yield to any impressed force, and in yielding be easily moved amongst each other, and thus constitute, agreeably to the definition, a fluid mass. But a perfect fluid, or that whose parts may be moved from each other by the least force, exists only in the imagination: for independently of its gravity or weight, or tendency towards the centre of the earth, every non-elastic fluid possesses the attraction of aggregation (*viz.* of the mutual attraction of its parts) in a particular degree; of the attraction of cohesion, which is likewise, in a particular degree, towards other bodies; and of the attraction of affinity. Besides, all fluids manifest more or less a sort of obstruction, or resistance to a perfectly free motion. See AFFINITY, AGGREGATION, ATTRACTION, COHESION, FRICTION and RESISTANCE.

Fluids are called either *natural*, as water and mercury; or *animal*, as blood, milk, bile, lymph, urine, &c., or *facitious*, as wines, spirits, oils, &c. See each under its proper article.

Fluids are more commonly distributed by the philosopher into *elastic* and *non-elastic*. An *elastic* fluid is that the dimensions of which are lessened by augmenting the pressure, and enlarged by diminishing the pressure upon it: of which kind are the different sorts of airs or gases. (See GAS.) A *non-elastic* fluid is that, whose dimensions are not, at least as to sense, affected by the increase of pressure, as mercury, water, &c. These latter are said to be *non-elastic*, or *incompressible*, not because they are absolutely so; but because their compressibility is so very small, as to make no sensible difference in our calculations relative to the pressures, movements, and other properties of these fluids. See COMPRESSION.

The doctrine and laws of fluids are of the greatest extent in philosophy. The pressure and gravitation of bodies in fluids, and the action of the fluids immersed in them, make the subject of *Hydrostatics*, which see.

FLUIDS, *Hydrostatical laws of*. 1. The upper parts of all

all fluids, as water, &c. do press upon the lower; or, as some philosphers state it, all fluids do gravitate in *proprio loco*.

The contrary of this was a principle in the school-philosophy; and two facts have been commonly urged in support of it. A bucket full of water is lighter in the water than out of it, nor does it weigh more when full in the water, than when empty out of it; therefore, it has been concluded, that the water in the bucket, because it is within water, its own element, does not gravitate: and divers, who descend to considerable depths, it has been said, feel no sensible pressure under water; though at the depth of thirty-two feet, the additional pressure they sustain is not less than twenty thousand avoirdupois pounds: for, supposing the surface of the body to contain only ten square feet, and a cubic foot of water to weigh one thousand avoirdupois ounces, 32×10 feet, or 16×20 feet of water will weigh $16 \times 20,000$ avoirdupois ounces, or twenty thousand pounds. However, in this case the uniformity of the pressure, the increased elasticity and resistance of the compressed internal air, and the firm texture of the membranes, &c. may prevent their complaining of any sensible pain: though there have been many instances to the contrary, in which the difference of the pressure has produced very injurious effects. See *DIVING*.

As to the former fact, it is easily explained by the theory of *specific GRAVITY*, (which see). The bucket of water weighs in water, but does not overweigh; because the surrounding parts of water endeavour to descend as well as the bucket, and with equal force, and therefore do not permit it to descend. Thus, according to an observation of Dr. Desaguliers, if two pound weights were hung at the two arms of a balance, no one will say, that neither weighs, because it does not outweigh the other. Desag. Exp. Phil. vol. ii. p. 96.

Besides, it is evident, that, in any fluid, the weight of the whole is equal to the weight of all its parts; and if any part be taken from the whole, the weight of the whole will be diminished by the weight of that part; and if any part be added to the whole, the weight of the whole will be increased by the weight of the part which was added; and, therefore, it is reasonable to conclude, that the weight of the whole is composed of the weights of the several parts, and that the parts do, therefore, gravitate in the whole, or in *proprio loco*. (Cotes's Hyd. and Pneum. Lectures, p. 7.) But the certainty of such pressure is now demonstrated by a thousand experiments: it will be sufficient to instance one or two.

Immerse a tube, open at both ends, and half filled with oil of turpentine, in a vessel of water, the upper end of the tube being stopped with the finger: if now the upper surface of the oil lie as low as that of the water, the oil, upon removing the finger, will not run out at the lower end of the tube; nay, and if the tube be thrust a little lower, the water will rise up in it, and bear the oil above it: but if the upper surface of the oil be considerably higher than that of the water, the oil will drop out of the tube. Whence it follows, that the column of oil in one case presses or gravitates less on the plane imagined to pass under its lower surface than a column of water; and in the other case more.

Or thus: a phial, with as much shot in it as will make it sink, close shut, being immersed in water, and suspended by a horse-hair to the beam of a balance, with a weight at the other end exactly counterpoising it: upon unstopping the phial, and filling it with water, it will preponderate, and

bear down the end of the balance, without having any communication with the external air. And if the phial had been first weighed in air, it will be found, that the weights necessary for restoring its equilibrium in water answer exactly to the additional weight of the phial, when it is again weighed in air with the water in it: so that water weighs in water just as much as in air.

These two experiments abundantly prove the proposition, that the upper parts of fluids do really press or gravitate on the lower. See *Specific GRAVITY*.

From this gravity it follows, that the surfaces of stagnant fluids are plain and parallel to the horizon; or rather, that they are segments of a sphere or spheroid concentrical with the earth, because they all gravitate towards the centre of the earth.

For, as the particles are supposed to yield to any force impressed, they will be moved by the action of gravity, till such time as none of them can descend any lower. And in this situation, once attained, the fluid must remain at rest, unless put in motion by some foreign cause; inasmuch as none of the particles can now move without ascending, contrary to their natural tendency.

In this case the centre of gravity of the fluid, contained in a vessel open at top, will lie as low as it possibly can. Thus, let A B D C (*Hydraulics, Plate V. fig. 1.*) represent one side of a rectangular vessel, containing water as high as E F, whose centre of gravity is G; it is easy to prove that when the surface of the water is flat and horizontal, as E F, then the centre of gravity of the water lies lowest; but that if the water be elevated on any part of that surface, and of course lowered on any other part, then the centre of gravity will be removed to some place higher than G. Imagine that the water be disposed into the situation D K B C, viz. that the portion K E H be removed to the place B H F; and in this case the centre of gravity L of the quantity of water K D H F C remains in its original situation, whilst the centre of gravity of the quantity of water K E H has been removed higher, viz. from I to S. Now, since the common centre of gravity of two bodies is in a straight line between the respective centres of gravity of those bodies; therefore, the common centre of gravity of both the quantities of water formerly stood at G, in the line I S; whereas it now stands at O in the line L S, viz. evidently higher than the level of G, which is the line *z r*. This reasoning, applied to one side of the vessel, may be easily adapted to any section of the water and vessel, as also to vessels of any shape, and to any irregularity which the surface of the water may be supposed to acquire; for in any case the conclusion is exactly the same, namely, that the centre of gravity of a given quantity of some uniform fluid, like water, which is contained in an open vessel of any shape, stands at the lowest possible situation, when the whole surface of the fluid is in the same horizontal line.

2 If a body be immersed in a fluid, either wholly, or in part, its lowest surface will be pressed upwards by the water underneath it: and the pressure of fluids upwards is equal to the pressure downwards at the same depth.

The truth of this proposition is evident from the experiment above mentioned; where the oil of turpentine was suspended and made to mount up in the tube, by the pressure of the water upward on its lower parts. Thus also, if the upper end of a narrow bored tube be dipped into quicksilver, whilst the other end is stopped with the finger, and the tube be lifted up, a short column of quicksilver will be suspended in the lower end, which column, when dipped into water deeper than about thirteen times its own length,

will be pressed upwards, after the finger is removed from the orifice.

This upward pressure of fluids may be evinced by causing a piece of lead, &c. to swim in water; which may be done by immersing it to a proper depth, and keeping the water from getting above it. Let CD, *Plate V. Hydraulics, fig. 2.* be a glass tube open at both ends, and EFG a flat piece of lead, half an inch thick, exactly fitted to the lower end of the tube, having its upper surface covered with wet leather, so as to hinder the entrance of the water contained in the outer vessel. Let this leaden plate be held close to the tube, by pulling the string or wire IHL upward at I, with one hand, whilst the tube is held in the other by the upper end C. In this situation, let the tube be immersed in water in the glass-vessel AB, to the depth of six inches below the surface of the water at K; and then the leaden plate EFG will be plunged to the depth of somewhat more than eleven times its own thickness: holding the tube at that depth, you may let go the wire or thread at L; and the lead will not fall from the tube, but will be kept to it by the upward pressure of the water below it, occasioned by the height of the water at K above the level of the lead. For, as lead is 11.33 times as heavy as its bulk of water, and in this experiment is immersed to a depth somewhat more than 11.33 times its thickness, and no water getting into the tube between it and the lead, the column of water EabcG, below the lead, is pressed upwards against it by the water KDEGL, all round the tube; which water, being a little more than 11.33 times as high as the lead is thick, is sufficient to balance and support the lead at the depth KE. If a little water be poured into the tube upon the lead, it will increase the weight upon the column of water under the lead, and cause the lead to fall from the tube to the bottom of the glass vessel, where it will lie in the situation bd: or if the tube be raised a little in the water, the lead will fall by its own weight, which will then be too great for the pressure of the water round the tube on the column of water below it. If the plate were brass instead of lead, it ought to be immersed under water at least eight times its thickness, in order to be supported by the water; because brass is about eight times specifically heavier than water. A plate of pure gold would require near twenty times its thickness of water; and this led Mr. Boyle to propose one of his hydrostatical paradoxes in these words, *viz.* That a solid body, as ponderous as any yet known, though near the top of the water it will sink by its own weight, yet immersed in water at a greater depth than that of twenty times its thickness, will not sink, if its descent be not assisted by the weight of the incumbent water. (Paradox 11. Statics. Boyle's Works, abr. by Shaw, vol. ii. p. 311.) As we have now seen that the heaviest body may be made to swim in water, the lightest wood may be made to lie at the bottom of water or mercury. Thus, let two pieces of wood be planed quite flat, so that no water may get between them when they are put together; let one of them, bd, be cemented to the bottom of the vessel AB, *fig. 2.* and the other be laid flat and close upon it, and held down with a stick, whilst water is poured into the vessel, then remove the stick, and the upper piece of wood will not rise from the lower one, for as the upper one is pressed down both by its own weight and the weight of water over it, whilst the contrary pressure of the water is kept off by the wood under it, it will lie as still as the heaviest body: but if it be raised at the edge, so that the water may get under it, it will imme-

diately be pressed upwards; and as it is lighter than its bulk of water, it will rise and float on the surface of the water. See Fergulon's Lectures, 4to. p. 68. and Cotes's Hyd. Lect. 2. See HYDROSTATIC Bellores, and Art. 11. in the sequel.

The law or quantity of this pressure in this; that a body immersed in a fluid loses just so much of the weight it would have in air, as so much of the fluid as is equal to it in bulk, if weighed in the air, would amount to.

This pressure of fluids on the lower parts of an immersed body is farther confirmed, by attending to the reason why bodies, specifically lighter than fluids, ascend therein. The effect is owing to this, that there is a greater pressure or weight on every other part of the plane or surface of the fluid imagined to pass under the lower surface of the body, than there is on that whereon the emerging body insits. Consequently, to produce an equilibrium in the fluid, the parts immediately under the rising body being pressed by the rest every way, do continually force it upwards.

In effect, the emerging body is continually pressed on by two columns of water, one bearing against its upper and the other against its lower parts: the length of both which columns being to be estimated from the top of the water, that which presses on the lower part will be the longer, by the thickness of the ascending body, and consequently will overbalance it by the weight of as much water as will fill the space that body takes up.

Hence, 1. We are furnished with one reason, why very minute corpuseles, either heavier or lighter than the liquor they are mingled with, will be sustained therein a good while, without either emerging to the top, or precipitating to the bottom; the difference between the two columns of the fluid being here inconsiderable.

Hence, 2. If a body A be specifically lighter than B, an equal portion of the fluid in which it is immersed, it will rise with a force proportionable to the excess of gravity of B above A: and if A be specifically heavier than B, it gravitates and descends with the excess only of its weight above that of B.

Hence, 3. We have, as some say, a solution of the phenomenon of two polished marbles or other planes adhering so strongly together; because the atmosphere presses or gravitates with its whole weight on the under surface and sides of the lower marble, but cannot do so at all on its upper surface, which is closely contiguous to the upper and suspended marble. See COHESION.

3. The pressure of the upper parts of a fluid on the lower exerts itself every way, and every way equally, laterally, horizontally, and obliquely, as well as perpendicularly.

For, as the parts of a fluid yield to any impression, and are easily moved, it is impossible any drop should remain in its place, if, while it is pressed by the superincumbent fluid, it be not equally pressed on every side.

The same is confirmed from experiments: for several tubes of divers forms, straight, curved, angular, &c. being immersed in the same fluid, though the apertures through which the fluid enters be differently posited to the surface or plane, some being perpendicular others parallel, and others variously declined; yet will the fluid rise to an equal height in them all. See SYMPHON.

Hence, 1. All the particles of fluids being thus equally pressed on all sides, it is argued, that they must be at rest, and not in continual motion, as has been usually supposed.

Hence, 2. Also, a body being immersed in a fluid, sustains a lateral pressure from the fluid; which is also increased as the

F L U I D S.

the body is placed deeper beneath the surface of the fluid.

4. In tubes that have a communication with each other, whatever their magnitude be, whether equal or unequal; and whatever their form, whether straight, angular, or crooked; still fluids rise in them to the same height.

5. If a fluid rise to the same altitude in two tubes that communicate with each other, the fluid in one tube is a balance, or equal in weight to that in the other.

If the tubes be of equal diameters, the columns of the fluid, having the same base and altitude, are equal, and consequently their gravities equal; so that they press and gravitate against each other with equal force.

This is demonstrated from mechanics. *E. gr.* Let the base of *GI*, *Plate V. Hydraulics, fig. 3.* be supposed quadruple the base of *HK*; and let the fluid descend in the greater tube the space of an inch, as from *L* to *O*; it will then rise in the other the space of four inches, as from *M* to *N*. Wherefore the velocity with which the fluid moves in the tube *HK*, is to that with which it moves in *GI* as the base of the tube *GI* to the base of the other, *HK*. But the altitude of the fluid being supposed the same in both tubes, the quantity of the fluid in the tube *GI* will be to that in the other tube *HK*, as the base of the tube *GI* to the base of the other *HK*.

Consequently, the momentum of the fluid in the tube *GI* is to that in the tube *HK*, as the product of the base of the tube *GI* into the base of the other *HK*, to the factum of the tube *HK* into the base of the other *GI*. Wherefore, the products being equal, the momenta must be equal.

The same is easily demonstrated where one of the tubes is inclined, and the other perpendicular, &c.

Hence in tubes that communicate, the fluid will preponderate in that where its altitude is the greatest.

6. In communicating tubes, fluids of different specific gravities will equiponderate, if their altitudes be in the ratio of their specific gravities.

Hence we have a way of finding the specific gravities of fluids, *viz.* by pouring one fluid into one of the communicating tubes, as *AB* (*fig. 4.*) and another into the other tube *CD*; and measuring the altitudes *GB* and *HD*, at which they stand when balanced.

For the specific gravity of the fluid in *AB* is to that in *DC*, as *DH* to *BG*. If the fluids employed in this experiment be apt to mix, it may be proper to fill the horizontal tube *BD* with mercury to prevent the mixture. Hence, since the densities of fluids are as their specific gravities, the densities will likewise be as the altitudes of the fluids *DH* and *BG*; so that we have hence likewise a method of determining the densities of fluids.

7. The bottoms and sides of vessels are pressed in the same manner, and by the same laws, as the liquids contained in them.

And hence, as action and re-action are equal, the fluids themselves sustain an equal pressure from the bottoms and sides. And as the pressure of fluids is equal every way, the bottoms and sides are pressed as much as the neighbouring parts of the fluids; and consequently this action increases in proportion to the height of the fluid, and is equal every way at the same depth; as depending altogether on the height, and not at all on the quantity of the fluid.

8. In perpendicular vessels of equal bases, the pressure of fluids on the bottoms is in the ratio of their altitudes. This is evident, because, the vessels being perpendicular, the bottoms are horizontal: consequently the tendency of fluids by the action of gravity will be in lines per-

pendicular to the bottoms, so that they will press with all their weight; the bottoms therefore are pressed in the ratio of the gravities. But the gravities are as the bulks, and the bulks here are as the altitudes; therefore the pressure on the bottoms are as the altitudes.

9. In perpendicular vessels of unequal bases, the pressure on the bottoms is in a ratio compounded of bases and altitudes.

From the preceding demonstration it appears, that the bottoms are pressed in the ratio of the gravities: and the gravities of fluids are as their bulks, and their bulks in a ratio compounded of the bases and altitudes. Consequently, &c.

10. If an inclined vessel *ABCD, fig. 5.* have the same base and altitude with a perpendicular one, *BEFG.* the bottoms of the one and the other will be equally pressed.

For, in the inclined vessel *ABCD*, the bottom *CD* is pressed in the direction *BD*. But the force of gravity in the direction *BD* is to the absolute gravity, as *BE* to *BD*. Consequently, the bottom *CD* is pressed in the same manner, as if it had been pressed perpendicularly by the fluid under the altitude *BE*. Therefore, the bottoms of the perpendicular and inclined vessels are equally pressed.

11. Fluids press upon subject bodies, according to their perpendicular altitude, and not according to their latitude, or breadth.

Or, as others state it, thus: If a vessel be taper, or unequally big at top and bottom, yet the bottom will be pressed after the same manner as if the vessel were cylindrical, and the top and bottom equal.

Or thus: The pressure sustained by the bottom of a vessel, whatever the figure of the vessel be, is ever equal to the weight of a column of the fluid, whose base is the bottom itself, and height, the vertical distance of the upper surface of the water from the bottom.

Or, yet more explicitly, thus: If there be two tubes or vessels, having the same heights, and bases, both filled with water; but one of them made so tapering upwards that it shall contain but twenty ounces of water; whereas the other, widening upwards, holds two hundred ounces; yet the bottoms of the two tubes shall sustain an equal pressure of water, *viz.* each of them that of the weight of two hundred ounces.

This is a noble paradox in hydrostatics, first discovered by *M. Pascal*, and which it is well worth the clearing and insinuating. It is found unexceptionably true from actual experiments; and it may even be demonstrated and accounted for on principles of mechanics.

Suppose, *e. g.* the bottom of a vessel *CD* (*fig. 6.*) less than its top *AB*; since the fluid presses the bottom *CD*, which we suppose horizontal, in a perpendicular direction *EC*, none but that part of the cylinder *E C D E* can press upon it, the natural tendency and pressure of the rest being taken off by the sides.

Again, supposing the bottom *CD* (*fig. 7.*) much bigger than the top *FG*; or even, for the easier demonstration, suppose a tube *FE* fixed in a cylinder *ABCD*; and suppose the bottom *CD* raised to *L*, that the fluid may be moved through the interval *DL*; then will it have risen through the altitude *GL*, which is to *DL* as the base *CD* is to that of *GF*. The velocity, therefore, of the fluid *FE* is to its velocity in the vessel *AD* as the base *CD* to the base *FG*.

Hence we have the momentum wherewith the fluid in the tube tends downwards, by multiplying the base of the cylinder *CD* into its altitude *CH*.

Consequently the bottom CD is pressed with the same force, as it would be pressed by the cylinder HCDI.

To confirm and illustrate this doctrine of the pressure of fluids in the ratio of the base and altitude, provide a metallic vessel ACDB (fig. 7.) so contrived, as that the bottom CD may be moveable, and to that end fitted in the cavity of the vessel with a rim of wet leather, to slide freely without letting any water pass. For this purpose it would be most advisable, that the moveable bottom should have a groove round its edge, and that it be put into a bladder, tied close round it in the groove by a strong waxen thread; and the bladder may be made to come up like a purse within the vessel, and put over the top of it at A and B all round, and then the lid of the vessel pressed on it: so that when water is poured through a hole in the lid, it would lie upon the bottom CD, and be contained within the bladder. Then, through holes in the top AB, apply successively several tubes of equal altitudes, but of different diameters. Lastly, fastening a string or wire to the beam of a balance, and fixing the other end by a little ring K to the moveable bottom, put weights in the other scale, till they be sufficient to raise the bottom CD: then will you not only find, that the same weight is required, what diameter or magnitude soever the tube be of; but even, that the weight which will raise the bottom when pressed by the smallest tube, will raise it when pressed by the whole cylinder HCDI.

Suppose the vessel ABCD to hold about a pound of water, and that the moveable bottom, wire, and hook, are of equal weight with an empty scale M. When this scale is pulled down, the bottom CD will be drawn up within the box, and that motion will cause the water to rise in the glass tube E L F G. If one pound be put into the scale, the bottom will be moved a little, and the water will just appear at the lower end of the tube at *a*. Another pound will cause it to rise from *a* to *b*, just twice as high above the bottom as it was when at *a*; the pressure on the bottom being equal to two pounds, the counterbalancing weight in the scale M. A third pound will raise it to *c*, a fourth to *d*, &c. the distances *ab*, *bc*, *cd*, &c. being taken equal to each other and to the depth of the vessel. If another tube, as *f*, be put into a hole made in the top of the vessel, and the vessel be filled with water; and, then, if water be poured in at the top of the tube F G E L, it will rise in the tube *f* to the same height as it does in the other tube: from hence it is evident, that the upward pressure of the water, rising in the tube *f*, is equal to the downward pressure in the other tube F G E L: the case would be the same, whatever be the number of tubes; and the moveable bottom would sustain the weight of the water in all the tubes, besides the weight of all the water in the vessel: and if all the holes to which these tubes (F G E L excepted) were fixed be stopped up, each part, thus stopped, will be pressed upward with a force equal to the weight of water in each tube: and consequently, the whole upward pressure against the top of the vessel, arising from the weight or downward pressure of the water in the tube F G E L, will be equal to the weight of a column of water of the same height with that in the tube, and of the same thickness as the width of the inside of the box or of the moveable bottom; and this upward pressure against the top will reach downwards with equal force against the bottom.

If the diameter of the moveable bottom be three inches, therefore, and the diameter of the bore of the tube a quarter of an inch, their squares will be nine inches and one sixteenth of an inch: and therefore the whole area of the bottom will be a hundred and forty-four times as great as that of the area of the bottom or top of the tube: so that if the

moveable bottom be raised one inch, the water would be raised to the top of a tube a hundred and forty-four inches, or twelve feet in height. The vessel must be open below the moveable bottom to let in the air; otherwise the pressure of the atmosphere upon it, supposing its diameter three inches, would require a counterbalance of a hundred and eight pounds in the scale M before the bottom would begin to move. See *HYDROSTATIC Bellows*.

12. From the preceding articles, we may easily deduce a method of estimating the quantity of pressure of fluids on any given surface. Let *abcd* (fig. 8.) represent a cubical vessel full of water; the side *ac* will therefore, represent a square; and the measure of the pressure on every physical point of *ac* will be the altitude of the water above that point; thus, the pressure on *l* is measured by *al*, on *m* by *am*, &c. and the pressure on the whole line will be measured by the sum of as many altitudes *al*, *am*, &c. as there are points in the line *ac*. Erect perpendiculars *lo*, *mp*, &c. respectively equal to *al*, *am*, &c. and the sum of these perpendiculars will be the measure of the whole pressure on the line *ac*: but the sum of these is equal to the area of the triangle *acd*; and this is as the square of its altitude *ac*. When *ac* represents a square, the triangle *acd* must represent a prism, having the said triangle for its base, and the side of the square for its altitude: the weight of that prism of water is, therefore, equal to the pressure made against the square, or side of the cube; which, as the prism is half the cube, is equal to half the weight of the whole water contained in the vessel; and as each side bears the same degree of pressure, all the four sides sustain four times half the weight, or twice the whole weight of the water: and because the bottom sustains a pressure equal to the whole weight of the water, the bottom and sides of a cubical vessel taken together sustain a pressure from the water contained in it equal to thrice its weight. The same observations may be easily applied to planes that are oblique to the horizon; and we may conclude universally, that the pressure upon any plane, of whatever figure and situation, is equivalent to the weight of a solid of water, formed by erecting perpendiculars upon every point of the plane proposed, equal to the respective distances of those points from the upper surface of the water: or, the pressure on any surface is equal to the sum of all the products which are made by multiplying every indefinitely small part of the surface into its distance from the top of the water. To find the sum of all these products, or a body of water equal to that sum, is, in most cases, a difficult problem: Stevinus has attempted the solution of it in few instances, confining himself to regular plain surfaces. Mr. Cotes has laid down the following universal and expeditious rule: the pressure on any surface is equal to the weight of a body of water whose magnitude is found by multiplying the surface proposed into the depth of its centre of gravity under water; and the pressure on any number of surfaces of different bodies, however differently situated, is equal to the weight of a body of water whose magnitude is found by multiplying the sum of all those surfaces into the depth of their common centre of gravity under water. The demonstration of this rule depends on the following theorem, *viz.* that the sum of the products, arising from multiplying every indefinitely small part of any surface, or number of surfaces, respectively, into its perpendicular distance from any proposed plane, will be equal to the product of the whole surface or number of surfaces multiplied into the perpendicular distance of the centre

of gravity of any single surface, or of the common centre of gravity of the whole number of surfaces from the same plane. Thus, let a, b, c, d , (*fig. 9.*) represent weights, hanging at their centres of gravity a, b, c, d , by the lines $a o, b o, c o, d o$, fixed to a horizontal plane $o, o; o, o$; and let z be the common centre of gravity of all the weights, and $z o$ its perpendicular distance from the said plane. Let x be the common centre of gravity of a and b , and to $x o$, drawn parallel to the rest, let $a m$ and $b n$ be perpendicular. In the similar triangles $m x a$ and $n x b$, $m x : n x :: (x a : x b ::) b : a$. (See *CENTER of Gravity.*) Therefore $a \times m x = b \times n x$, i. e. $a \times m o - x o = b \times x o - n o$, and, consequently, $a \times m o + b \times n o = a + b \times x o$. In the common centre of gravity of a and b suspend a weight $x = a + b$, and a weight $y = x + c$ in the common centre of gravity of x and c , and a weight $z = y + d$, in the common centre of gravity of y and d . Then z is the common centre of gravity of a, b, c, d . And we have (as above) $a \times a o + b \times b o = x \times x o$, and $x \times x o + c \times c o = y \times y o$, and $y \times y o + d \times d o = z \times z o$: consequently $a \times a o + b \times b o + c \times c o + d \times d o = z \times z o = a + b + c + d \times z o$. And this will be the case, if the suspended lines $a c$, &c. be perpendicular to any plane, though not parallel to the horizon. Now taking the upper surface of water for that plane to which we refer the indefinitely small parts of the surface which is exposed to the pressure we are concerned with; since it has been already shown, that the pressure upon the whole is equivalent to the weight of a body of water which is equal in magnitude to the sum of all the products, made by multiplying every little part by its distance from the upper plane of the water; and that this sum of products is exactly equal to the product of the whole surface or number of surfaces multiplied into the distance of the centre of gravity from the upper plane of the water; it will follow, that the same product is the measure of a magnitude of water, whose weight is equivalent to the pressure required. *Cotes's Hydrost. Lect. 3.* See *CENTER of Pressure*.

For the laws of the pressure and gravitation in fluids specifically heavier, or lighter, than the bodies immersed, see *GRAVITY, Specific*.

For the laws of the resistance of fluids, or the retardation of solid bodies moving in fluids, see *RESISTANCE*.

For the ascent of fluids in capillary tubes, or between glass planes, see *ASCENT and CAPILLARY Tubes*.

The motions of fluids, and particularly water, do also make the subject of *Hydraulics*, which see.

FLUIDS, Hydraulic Laws of 1. The velocity of a fluid, as water, moved by the pressure of a superincumbent fluid, as air, is equal at equal depths, and unequal at unequal ones.

For the pressure being equal at equal depths, the velocity arising thence must be so too; and *vice versa*: yet the velocity does not follow the same proportion as the depth, notwithstanding that the pressure, whence the velocity arises, does increase in the proportion of the depth. But here the quantity of the matter is concerned: and the quantity of motion, which is compounded of the ratio of the velocity and quantity of matter, is increased in equal times as the squares of the velocities.

2. The velocity of a fluid arising from the pressure of a superincumbent fluid, at any depth, is the same as that which a body would acquire in falling from a height equal to the depth: as is demonstrated both from mechanics and experiments. See *DESCENT*. See also *DISCHARGE of Fluids*.

3. If two tubes of equal diameters, full of any fluid, be placed in any position, either erect, or inclined; provided they be of the same altitude, they will discharge equal quantities of the fluid in equal times.

That tubes, every way equal, should, under the same circumstances, empty themselves equally, is evident; and that the bottom of a perpendicular tube is pressed with the same force as that of an inclined one, when their altitudes are equal, has already been shown. Whence it easily follows, that they must yield equal quantities of water, &c.

4. If two tubes of equal altitudes, but of unequal apertures, be kept constantly full of water, the quantities of water they yield in the same time will be as the diameters; and this, whether they be erect, or any way inclined.

Hence, if the apertures be circular, the quantities of water emptied in the same time, ought to be in a duplicate ratio of the diameters.

But this law, Mariotte observes, is not perfectly agreeable to experiment. If one diameter be double the other, the water flowing out of the less is found more than a fourth of what flows out of the greater. But this may have been owing to some accidental irregularities in making the experiments.

Wolffius however ascribes it principally to this, that the column of water directly over the aperture is shorter than that next the sides or parietes of the vessel: for the water, in its efflux, forms a kind of cavity over the aperture; that part immediately over it being evacuated first, and the other water not running fast enough from the sides to supply it. Now, this cavity, or diminution of altitude, being greater in the greater tube than in the less; hence the pressure, or endeavour to pass out becomes proportionably less in the greater tube than in the less.

5. If the apertures E and F of two tubes A B and C D (*Hydraulics, Plate VI. figs. 1 and 2.*) be equal, the quantities of water discharged in the same time will be as the velocities.

6. If two tubes have equal apertures E and F, and unequal altitudes A B and C D, the quantity of water discharged from the greater A B, will be to that discharged from C D, in the same time, in a subduplicate ratio of the altitudes A B and C D.

Hence, 1. The altitudes of water, A B and C D, discharged through equal apertures E and F, will be in a duplicate ratio of the water discharged in the same time. And as the quantities of water are as the velocities, the velocities are likewise in a subduplicate ratio of their altitudes.

Hence, 2. The ratio of the water discharged by two tubes A B and C D, together with the altitude of one of them, being given, we have a method of finding the altitude of the other, *viz.* by finding a fourth proportional to the three given quantities; which proportional, multiplied by itself, gives the altitudes of C D, required.

Hence, also, 3. The ratio of the altitudes of two tubes of equal apertures being given, as also the quantity of water discharged by one of them, we have a method of determining the quantity the other should discharge in the same time.

Thus, to the given altitudes, and the square of the quantity of water discharged at one aperture, find a fourth proportional. The square root of this will be the quantity of water required.

Suppos, *e. gr.* the height of the tubes as 9 to 25, and the quantity of water discharged at one of them, three inches; that discharged by the other will be $= \sqrt{\frac{9 \times 25}{9}}$
 $= \sqrt{25} = 5.$

7. If the altitude of two tubes AB and CD be unequal, and the apertures E and F be likewise unequal, the quantities of water discharged in the same time, will be in a ratio compounded of the simple ratio of the apertures, and the subduplicate one of the altitudes.

And hence, if the quantities of water discharged in the same time by two tubes, whose apertures and altitudes are unequal, be equal, the apertures are reciprocally as the roots of the altitudes, and the altitudes in a reciprocal ratio of the squares of the apertures.

8. If the altitudes of two tubes be equal, the water will flow out with equal velocity, however unequal the apertures be.

9. If the altitudes of two tubes, AB and CD, as also their apertures, E and F, be unequal, the velocities of the waters discharged are in a subduplicate ratio of their altitudes.

And hence, 1. As the velocities of waters flowing out at equal apertures, when the altitudes are unequal, are also in a subduplicate ratio of the altitudes, and as this ratio is equal if the altitudes be equal, it appears in the general, that the velocities of water flowing out of tubes, are in a subduplicate ratio of their altitudes.

Hence also, 2. The squares of the velocities are as the altitudes.

Mariotte found, from repeated experiments, that if a vessel ABCD have a tube EG fitted to it, there will more water be evacuated through the tube, than there could have been, in the same time, through the aperture of the vessel E without the tube; and that the motion of the fluid is accelerated so much the more, as the tube EG is the longer.

E. gr. The altitude of a vessel AC being one foot, that of the tube EG three feet, and the diameter of the aperture three lines, no less than $6\frac{1}{2}$ septiers of water were discharged in the space of one minute; whereas, upon taking off the tube, only four septiers were discharged. Again, when the length of the tube EG was six feet, and the diameter of the aperture G an inch, the whole quantity of water run out in thirty-seven seconds; but cutting off half the tube, the vessel was not evacuated in less than forty-five seconds; and taking it quite away in less than ninety five seconds.

10. The altitudes and apertures of two cylinders full of water being the same, one of them will discharge double the quantity of water discharged in the same time by the other, if the first be kept continually full, while the other runs itself empty; for the velocity of the full vessel will be equable, and that of the other will be continually retarded. Now it is demonstrated, that, if two bodies be impelled by the same force, and the one proceeds equally, and the second is equally retarded, by the time they have lost all their motion, the one has moved double the space of the other.

If two tubes have the same altitudes, and equal apertures, the times wherein they will empty themselves will be in the ratio of their bases.

11. Cylindric and prismatic vessels, as ABCD (*fig.* 3.) empty themselves by this law, that the quantities of water discharged in equal times decrease, according to the uneven number, 1, 3, 5, 7, 9, &c. taken backwards.

For the velocity of the descending level FG is continually decreasing in the subduplicate ratio of the decreasing altitudes; but the velocity of a heavy body descending, increases in the subduplicate ratio of the increasing altitudes. The motion, therefore, of the level FG, in its descent from G to B, is the same as if it were to descend in the inverse ratio from B to G; but if it descend from B to G, the spaces, in equal times, would increase, according to the progression of the uneven numbers; consequently the altitudes of the level FG, in equal times, would decrease, according to the same progression inversely taken.

Hence, therefore, the level of water FG descends by the same law, as, by an equal force impressed, it would ascend through an altitude equal to BG.

From this principle, many other particular laws of the motion of fluids might be demonstrated, which, for brevity sake, we here omit. See DISCHARGE of Fluids.

To divide a cylindrical vessel into parts, which shall be evacuated in certain parts or divisions of time, see CLEPSYDRA.

13. If water, descending through a tube HE (*fig.* 4.) spout up at the aperture G, whose direction is vertical, it will rise to the same altitude GI, at which the level of the water LM, in the vessel ABCD, does stand.

For since the water is driven through the aperture G by the force of gravity of the column EK, its velocity will be the same as that with which a body, by the same force impressed, would rise to the altitude FI: wherefore, since the direction of the aperture is vertical, the direction of the water spouting through it will be so too; consequently the water must rise to the height of the level of the water LM in the vessel.

Indeed, by the experiment, it appears, that the water does not rise quite so high as I: besides the aperture G should be smaller, as the height of the level of the water is less; and even smaller when mercury is to be spouted than when water. But this is no objection to the truth of the theorem; it only shews that there are certain external impediments, which diminish the ascent. Such are, the resistance of air, and the friction of the tube, &c. See JET d'Eau.

14. Water, descending through an inclined tube, or a tube bent in any manner, will spout up, through a perpendicular aperture, to the height at which the level of the water in the vessel stands.

15. The lengths or distances DE and DF, or IH and IG, (*fig.* 5.) to which water will spout either through an inclined, or an horizontal aperture D, are in a subduplicate ratio of the altitudes in the vessel or tube AB and AC.

For since water, spouted out through the aperture D, endeavours to proceed in the horizontal line DF, and, at the same time, by the power of gravity, tends downwards in lines perpendicular to the same; nor can the one power hinder the other, inasmuch as the directions are not contrary; it follows, that the water, by the direction BA will arrive at the line IG in the same time wherein it would have arrived at it, had there been no horizontal impulse at all. Now, the right lines IH and IG are the spaces which the same water would have described in the mean time by the horizontal impetus; but the spaces IH and IG, inasmuch as the motion is uniform, are as the velocities; consequently the velocities are in a subduplicate ratio of the altitudes AB and AC; and therefore the lengths or distances, to which the water will spout in apertures either horizontal or inclined, are in a subduplicate ratio of the altitudes.

That

FLUIDS.

That the velocities are in the subduplicate ratio of the altitudes may be shown by experiment: for, let two pipes, as C and g, of equal sized bores, be fixed into the side of the vessel AB, (*fig. 6.*) and let the pipe g be four times as deep below the surface of the water at b, in the vessel, as the pipe C is; and whilst these pipes run, let the water be constantly poured into the vessel, to keep the surface at the same height. Then a vessel, holding a pint, applied to the spout C, and another containing a quart at the spout g, will be filled at the same time. The horizontal distance, to which a fluid will spout from an horizontal pipe, in any part of the side of an upright vessel, below the surface of the fluid, is equal to twice the length of a perpendicular to the side of the vessel, drawn from the mouth of the pipe to a semicircle described upon the altitude of the fluid; and, therefore, the fluid will spout to the greatest distance possible from a pipe whose mouth is at the centre of the semicircle; because a perpendicular to its diameter (supposed parallel to the side of the vessel) drawn from that point, is the longest that can possibly be drawn from any part of the diameter to the circumference of the semi-circle. Thus, if the vessel AB, (*fig. 6.*) be full of water, the horizontal pipe D be in the middle of its side, and the semicircle N *edcb* be described on D as a centre, with the radius DgN, or Dfb, the perpendicular Dd to the diameter DNb is the longest that can be drawn from any part of the diameter to the circumference N *edcb*. And if the vessel be kept full, the jet G will spout from the pipe D to the horizontal distance NM, which is double the length of the perpendicular Dd. If two other pipes, as C and E, be fixed into the side of the vessel at equal distances above and below the pipe D, the perpendiculars Cc and Ee, from these pipes to the semicircle, will be equal; and the jets F and H, spouting from them, will each go to the horizontal distance NK, which is double the length of either of the equal perpendiculars Cc or Ee.

Hence, as every body, projected either horizontally or obliquely, in an unresisting medium, describes a parabola: water projected either through a vertical or inclined spout, will describe a parabola.

† Hence we have a way of making a delightful kind of water arbours, or arches, *viz.* by placing several inclined tubes in the same right line.

On these principles are formed various hydraulic engines for the raising, &c. of fluids, as pumps, syphons, fountains, or jets d'eau, &c. which see described under their proper articles PUMP, SYPHON, FOUNTAIN, SPIRAL, SCREW, &c. For other particulars relating to this subject, and the difference between the deductions of theory and the result of experiments; see DISCHARGE of Fluids. See also CONTRACTED Vein and JET.

For the laws of the motion of fluids, by their own gravity, along open channels, &c. see RIVER and WAVE, and Motion of WATER.

For the laws of pressure and motion of air, considered as a fluid, see AIR and WIND.

FLUIDS. Animalcules observed in fluids are of divers kinds; some are flat, others eel-like, but the greater part of an oval figure. Leewenhoek gives a description of a very unusual shaped creature, fixed in a little scabbard or sheath, which was fastened to some of the small green weeds found in ditches full of water. *Phil. Trans. N^o 357, p. 160.*

Waters of all kinds, that have stood a while exposed to the air, till they have grown a little putrid, or where putre-

faction has been promoted by the admixture of other matters, abound in variety of animalcules, having each their peculiar characters, sizes, figures, economy, and method of life, not to say uses. In a small drop of the discoloured surface of rain water, which had stood two months in a window, Dr. Harris observed four sorts of animalcules: the clear part of the drop presented two kinds, both very small; the first of the figure of ants-eggs: these were in a continual brisk motion. The second more oblong, three times as long as broad were exceedingly numerous, but their motion slow.

In the thick part of the drop there were also two sorts of animalcules. The first of the eel-kind, resembling these in vinegar, but much smaller, and with their extremes more sharp. These would wriggle out into the clear part, and then suddenly betake themselves back again, and hide in the thick and muddy part of the drop, much like common eels in the water. The second sort resembled a large maggot, which would contract themselves into a spherical figure, and then stretch out again. The end of the tail appeared with a forceps, like that of an ear-wig. They might be plainly perceived to open and shut their mouths, from whence air-bubbles were frequently discharged. The number of these was not above four or five. The same four kinds of animalcules he also found in many other drops of the same corrupted water. Animalcules in fluids are generally found at the top. In the lower parts of the water, Dr. Harris assures us he could never find any, unless when the liquor had been disturbed, and the surface shaken down, and mingled with the lower parts. Dr. Harris examined some rain-water that had stood uncovered a little while, but had not contracted any thick or discoloured scum. And here, where the water was clear, he could not find any animals at all: but a little thin white scum, that, like grease, began to appear in its surface, he found to be a congeries of exceeding small animals of different shapes and sizes, much like those produced by steeping barley in water. Viewing a small drop of the green surface of some puddle water, he found it altogether composed of animalcules of several shapes and magnitudes; the most remarkable were those which gave the water that green colour, and were oval creatures, whose middle part were of a gris-green, but each end clear and transparent. They could contract and dilate themselves, tumble over and over many times together, and then shoot away like fishes. *Phil. Trans. N^o 220, p. 255.*

Dr. Harris looked on the surface of some mineral chalybeate water, which stood in a viol unstopt for about three weeks. In it he saw two kinds of animals, one exceeding small, and the other very large, which latter sort had on the tail something that looked like fins. There were but very few of either sort. *Phil. Trans. N^o 220, p. 257.*

Animalcules in fluids are easily destroyed by only separating them a while from their element. Naturalists have even found shorter ways. A needle-point dipped in spirit of vitriol, and then immersed into a drop of pepper-water, readily kills all the animalcules, which, though before frisking about with great liveliness and activity, no sooner come within the influence of the acid particles, than they spread themselves, and tumble down to all appearance dead. The like may be done by a solution of salt, only with this difference; that by the application of this latter, they seem to grow vertiginous, turning round and round till they fall down. Tincture of salt of tartar used in the same manner kills them still more readily; yet not so.

but there will be apparent marks of their being sick first and convulsed. Licks destroy them as fast as spirit of vitriol, and human blood, by virtue of the salt contained in it, produces the same effect. Urine, sack, and sugar, do all destroy them, though not so fast; besides, that there is some diversity in their figures and appearances, as they receive their deaths from this poison or that. The point of a pin dipped in spittle presently killed all the kinds of animalcules in puddle-water, as Dr. Harris supposes it will other animalcules of this kind. Phil. Transf. N^o 203. p. 836, seq. and N^o 220, p. 256.

We find in the waters of our ditches many species of small animalcules, both of the crustaceous and testaceous kinds. The legs of the creatures are short, they resemble those of crabs and lobsters, but are of a much more curious structure; they are less than a small flea, but they seem all breeders, carrying spawn at their tails, or in two small bags, one hanging from each side. These bags are often seen broken, and the spawn is then found to consist of globules very large in proportion to the size of the creature. There is another sort besides these, as beautiful, but much smaller than they; this in shape more resembles the shrimp, and carries its spawn as the shrimp does. These kinds both seem only to have one eye, and that placed exactly in the middle of the fore-head, without the least trace of a dividing line; and they are often so transparent, that the motion of their bowels, and pulsation of their heart, may be seen. Baker's Microscope, p. 93.

All who are acquainted with the microscope, know very well that in water, in which the best glasses can discover no animated particle of matter, after a few grains of pepper, or a small fragment of a plant of almost any kind, has been some time in it, animals full of life and motion are produced, and those so numerous as to equal the fluid itself in quantity.

A small quantity of water taken from any ditch in the summer months, is found to be full of little worms, seeming in nothing so much as size to differ from these microscopic animalcules. Nay, water, without these, exposed in open vessels in the summer months, will be always found, after a few days, to abound with multitudes of them, visible to the naked eye, and full of life and motion.

These, we know, by their future changes, are the fly-worms of the different species of gnats, tipulæ, and multitudes of the other fly-species, and we can easily determine, that they have owed their origin only to the eggs of the parent fly there deposited. Nay, a closer observation will at any time give ocular proof of this; as the flies may be seen laying their eggs there, and those eggs may be followed in all their changes to the fly again.

Why then are we to doubt but that the air abounds with other flies and animalcules, as minute as the worms in these fluids? and that these last are only the fly-worms of the former, which, after a proper time spent in that state, will suffer changes like those of the larger kinds, and become flies like those to whose eggs they owed their origin? Vide Reaumur, Hist. Insect. vol. iv. p. 431.

The differently medicated liquors, made by the infusions of different plants, afford a proper matter for the worms of different species of these small flies; and there is no reason to doubt but among these some are viviparous, others oviparous, and to this may be in a great measure owing the different time taken up for the production of the insects in different fluids. Those which are a proper matter for the worms of the viviparous fly, may be soonest found full of them, as probably the liquor is no sooner in a

state to afford them a proper nourishment than their parents place them there: whereas those produced from the eggs of the little oviparous flies must, after the liquor is in a proper state, and they are deposited in it, in form of eggs, have a proper time to be hatched before they can appear alive.

It is easy to prove that the animals we find in these vegetable infusions were brought thither from some other place. It is not less easy to prove that they could not be in the matter infused, any more than in the fluid it is infused in.

Notwithstanding the fabulous accounts of salamanders, it is now well known, that no animal, large or small, can bear the force of fire for any considerable time; and by parity of reason we are not to believe that any insect, or embryo insect, in any state, can bear the heat of boiling water for many minutes. To proceed to enquiries on this foundation, if several tubes filled with water with a small quantity of vegetable matter, such as pepper, oak-bark, truffles, &c. in which, after a time, insects will be discovered by the microscope; and other like tubes be filled with simple water boiled, with water and pepper boiled together, and with water with the two other ingredients, all separately boiled in it; when all these liquors come to a proper time for the observation of the microscope, all, as well those which have been boiled as those which have not, will be found equally to abound with insects, and those of the same kind in the infusions of the same kind, whether boiled or not boiled.

Those in the infusions which had sustained a heat capable of destroying animal life, must therefore not have subsisted either in the water, or in the matters put into it, but must have been brought thither, after boiling, and it seems by no way so probable, as by means of some little winged inhabitants of the air depositing their eggs or worms in those fluids.

It is a natural question on this to ask, why it is, that whilst we see myriads of the progeny of these winged insects in water, we seldom see the insects themselves? The answer is equally easy, viz. because we can always place a drop of this water immediately before the focus of the microscope, and keep it there while we at leisure examine its contents; but that is not the case with regard to the air inhabited by the parent flies of these our worms, which is of immense extent in proportion to the water proper to nourish these worms, and consequently, while the latter are clustered together in heaps, the former may be dispersed and scattered. Nor do we want instances of this even in the insects of a larger kind. In many of our gardens we frequently find vessels of water filled with the grating-worms, as plentifully in proportion to their size, as these our fluids with animalcules. Every cubic inch of water in these vessels contains many hundreds of these animals; yet we see many cubic inches of the air in the garden not affording any one of the parent flies. Id. ibid. See ANIMALCULES, EEL, VINEGAR, and PEPPER-water.

FLUID, *Cautic.* See CAUSTIC-fluid.

FLUID, *Sensitive.* See SENSITIVE-fluid.

FLUKE, in *Ichthyology*, a word used in some parts of England as a name for the flounder.

FLUKE of an Anchor, that part of it which fastens in the ground. See ANCHOR.

FLUKE-worm, a sort of small flat worm, often found in the livers of sheep which have died of the rot. See ROT.

FLUMARI, in *Geography*, a town of Naples, in Principato Ultra; 9 miles S. E. of Arriano.

FLUMET, a town of France, in the department of Mont Blanc, seated on the Arly; 31 miles S. E. of Geneva.

FLUMMERY, a wholesome sort of vegetable jelly made of oatmeal.

The manner of preparing it is as follows: put in the proportion of three large handfuls of finely ground oatmeal, to steep for twenty-four hours or more, in two quarts of fair water; then pour off the clear water, and put two quarts of fresh water to it; strain it through a fine hair-sieve, and boil it till it is as thick as a hally-pudding, stirring it continually while it is boiling that it may be very smooth: some sweeten it with sugar, and add rose or orange-flower-water; and then eat it with white or Rhenish wine, cream, or milk.

FLUMS, in *Geography*, a town of Switzerland, in the county of Sargans, situated on the Mat; 5 miles W. of Sargans.

FLUOR, in *Physics*, &c. denotes a fluid; or, more properly, the state of a body, which was before hard and solid, but is now reduced, by fusion of fire, into a state of fluidity.

Gold and silver will remain a long time in fluor, maintained by the intensest heat, without losing any thing of their weight. See **GOLD**, **FIXITY**, &c.

The word fluor is applied to signify the habitual fluidity of any substance, or that property by which a substance cannot be rendered solid, and is employed as an epithet to distinguish such substances from others of the same kind, but which are habitually solid, or which may be rendered solid.

FLUOR, in *Mineralogy*, a species of the calcareous genus, being a combination of lime and fluoric acid, and known by the chemical appellation of *fluat of lime*. The more familiar names under which it passes in most countries are *flux* and *fluor*, denoting the use to which it is frequently applied as a flux of various ores. Beside these, there are a variety of other names that have originated in the similarity of its colours, (particularly those of the fluor-spar,) to the beautiful tints of several of the stones called precious; such are *false emerald*, *hyacinth*, *topazes*, *beryl*, *chrysolite*, &c. Indeed there is no mineral that may equal fluor in the varied beauty of its hues; the suite of its colours is almost sufficiently comprehensive to be formed into a chromatic scale. It is reserved for nicer chemical observation to discover the nature of this variously modified colouring principle, which is more fugacious in fluor than in most other minerals, but probably always corresponding with the nature of the metallic substances that accompany fluor in the bowels of the earth.

Fluor has been divided by Werner into three sub-species, namely, *earthy*, *compact*, and *spathose fluor*. The first, also known by the name of the phosphorecent *earth of Marmaross*, was classed with the fluates of lime on the authority of Pelletier; but the late analytical experiments of Klaproth, who found 32 parts of phosphoric to two of fluoric acid, shew the necessity of restoring it to the phosphates of limes, to which it was first referred! Mr. Jamelson appears to have had his doubts respecting this substance; he does not describe it as a sub-species of fluor, nor does he enumerate it among the phosphates of lime. See **PHOSPHORITE**.

1. *Compact fluor*. This is rather better understood; but it appears that mineralogists are very apt to confound the terms

“compact” and “massive” also in speaking of fluor: whence massive fluor spar has been described as Werner’s compact fluor. This latter occurs but rarely, having hitherto been found only at Stollberg and Strassberg in the Hartz, and at Yxhö and Norberg in Sweden, to which habitats we may perhaps add Schlackenwalde and Kriman in the Saatz circle of Bohemia, and Schwarzleogang in Salzburg. The following external characters appear the most important.

Its colour is generally light greyish-green, passing sometimes into greenish-white, sometimes into bluish-grey, approaching to verdigris green, and it is also found reddish. Not seldom several of these shades are mixed in spots in one and the same fragment, now and then with the addition of accidental yellowish and brownish spots.

It occurs massive only. Fracture more or less even, approaching sometimes to flat conchoidal, sometimes to sphaery, even to foliated. The fragments are indeterminate angular with pretty sharp edges, and more or less translucent in the same piece.

It is feebly glimmering, almost dull. Half-hard, scarcely scratched by fluor spar, brittle, easily frangible. Its specific gravity, if Kirwan’s compact fluor be the same as the one here described, is 3.120 to 3.165.

This sub-species, to a superficial observer, appears sometimes like horn-stone, sometimes like compact lime-stone; but the above external characters (to which may be added the physical one of its shewing a weak phosphorescence when laid on ignited coal) keep it sufficiently distinct. Its geographic situation has been given above. Its geognostic situation at Stollberg is in a vein, in greywacke; it is found with fluor spar (its constant companion), some copper pyrites and barytes. At Kriman in Bohemia it was found by Dr. Reufs in gneiss, in which it is sometimes seen as thin laminae between the layers of quartz and feldspar.

It is, together with fluor spar, made use of as a flux.

2. *The sparry fluor, or fluor spar*, which, besides the above-mentioned general names, is also known under those of *cubic fluor*, *glass fluor*, *phosphorescent spar*, *spath vitreux*, *spath fusible*, &c.

Its principal colours are, 1. *White*, such as greyish, greenish, yellowish, and reddish-white, passing into 2. *Red*, particularly rose red of various intensity, carmine. 3. *Grey*, greenish, yellowish, smoke, and pearl-grey. 4. *Blue*, lavender, azure, smalt, sky-blue, Prussian and violet-blue, the two latter appearing sometimes nearly black. 5. *Green*, verdigris, celadon, mountain, emerald, grass-apple, leek, pistachio, and olive green. 6. *Yellow*, wine, wax, honey yellow. 7. *Brown*, yellowish, and clove-brown. All these colours will frequently pass into each other, and even those least related to each other are sometimes seen together in the same specimens in spots and flakes, and in stripes that often appear like some kinds of alabaster, whence Romé de L’Isle called a variety of fluor, *alabâtre vitreux*. The colouring matter of some of them is very fugacious, especially that of the sky-blue variety, which is often seen to fade merely by being exposed to the atmospheric air. Of the above colours, the white and violet blue are the more common.

Fluor spar is found massive and disseminated and most commonly crystallized, but it has not been observed, except in one instance to be mentioned hereafter, in those imitative shapes, (such as dentiform, branched, stalactitic, &c.)

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&c.) in which the carbonates and sulphates of lime, and other crystallizable earthy substances so frequently occur.

Its primitive form is the octaedron. As to the determination of the integrant molecule some difficulty has arisen. The octaedron, we know, cannot be sub-divided into solids of the same form; the last term of mechanical division we arrive at is that into other octaedrons accompanied by tetraedrons; six of the former and eight of the latter being disposed in such a manner as to form in all directions acute rhomboids. If we imagine either all the octaedral or all the tetraedral particles removed, those of the same kind that remain will still be in exact connection by means of their edges. Of the latter circumstance Haüy has ingeniously availed himself to reconcile this resolution of the octaedral crystal into two kinds of solids, with that principle according to which all the integrant molecules of a crystal must be necessarily similar. He supposes that, could we cast a look into the primary construction of the octaedral crystal, and sub-divide it to the utmost limits, we should find the whole substance pervaded either by tetraedral or octaedral vacancies; if the former, the whole would be composed of octaedral elementary particles, if the latter, the tetraedron would exclusively constitute the integrant molecule. Now as, according to Haüy's doctrine, this molecule is constantly either the parallelepiped, or the triangular prism, or the tetraedron, analogy has in this case decided in favour of the tetraedron, which is now considered as the integrant molecule of fluor, instead of the octaedron. It was Werner who first observed the tetraedral and octaedral fragments which result (according to his terminology) from the fourfold cleavage presented by the foliated fracture of fluor.

The principal forms of the crystals of fluor-spar, with their modifications, considered, not according to their origin, but to the manner in which they present themselves to the eye, are the following:

1. The perfect cube (*chaux fluatée cubique*, Haüy.) It is sometimes elongated; passing from the cubic form into that of a rectangular four-sided prism, generally with two of its lateral planes narrower. We have seen specimens of the latter variety from Cumberland; it is also found at Schemnitz and Nertschink.

2. Cube with all the edges truncated (*chaux fluatée cubo-dodécèdre*, Haüy.)

3. The preceding with planes of truncation so much increased that the rhomboidal or garnet-dodécèdre is formed (*chaux fluatée dodécèdre*, Haüy.)

4. Cube with all its edges bevelled (*chaux fluatée bordée*, Haüy.)

5. The preceding, with bevelling edges so much enlarged as to convert each plane of the cube into four triangular planes (*chaux fluatée hexatétraèdre*, Haüy). What has been described as perfect cube with convex planes, we suppose to be this modification indistinctly formed.

6. Cube with all its solid angles flatly acuminated by three planes, placed on the lateral planes of the cube.

7. Cube having its angles acuminated by six planes, placed on the lateral planes. We do not know where the preceding and this variety occur; Emmerling informs us, that in the latter the six acuminating planes sometimes completely engross the planes of the cube.

8. The cube truncated at all its solid angles (*chaux fluatée cubo-octaèdre*, Haüy.) If the triangular truncating

planes do not meet, the planes of the cubes are octagons; if they meet exactly, those planes are squares; if all the truncating planes encroach on each other these become hexagons, while the planes of the cubes remain squares; when they encrease still more the

9. *Octaedron*, with six truncated angles, is formed; in which the truncating planes are the six planes of the cube; in the same manner as the truncations at the eight angles of the cube N^o 8. are the eight planes of the octaedron. When the truncating planes of the modification N^o 8. enlarge so much as to cause the faces of the cube entirely to disappear,

10. The perfect octaedron, or double four-sided pyramid, is formed (*chaux fluatée primitive*, Haüy.)

11. Octaedron with truncated edges (*chaux fluatée emarginée*, Haüy.)

12. Octaedron with both angles and edges truncated.

13. The elongated octaedron with four broader and four narrower planes, terminating in a ridge.

No. 1. is by far the most common of all the modifications of crystallized fluor spar. No. 3. is very rarely met with; it was found by M. Subrin between Breuil and Charecey on the way to Chalons. Of No. 4. the most interesting varieties occur in Cornwall. From the geometrical figure in plate 73, of that useful work "British Mineralogy," it appears, that Haüy's *chaux fl. bordée* occurs in Cornwall, with the eight angles truncated, parallel to the octaedron, by which a crystal of 38 faces is formed. Of No. 10, the perfect octaedron, the most beautiful variety is the rose-coloured one, found in the neighbourhood of Mont-Blanc. It also occurs in beautiful crystals in England, on Mount St. Gothard &c. and Mr. Sowerby is, we suppose, the first who has noticed the small violet variety of this modification found in Aberdeenshire.

To the above may perhaps in future be added the following unusual modifications. 1. The *tetraedron* with faintly truncated edges, mentioned by Mr. Mohs as existing in the collection of Mr. Vonder Null: the truncating planes are stated to correspond to those of the cube. 2. The rhomboid (one of the forms which fragments of fluor-spar frequently exhibit, and which may be considered as an octaedron, with two tetraedrons applied to two of its opposite planes) is said to have been found as crystal. The third, mentioned by Emmerling, is the double eight-sided pyramid, acuminated at both extremities by three planes placed on the alternate lateral edges. It is said to have been found in Saxony, and is in the collection of Count Wrba at Vienna.

The crystals of fluor spar are of various size; the perfect cubic is seen from five inches square to extremely minute, and scarcely distinguishable. They are found distinct and aggregated in various directions; sometimes globularly aggregated. Their surface is generally smooth and splendid; but sometimes perfectly dull. They are not seldom covered by an opaque crust of various colours, particularly blueish-green; often they are drusy, and sometimes ornamented with a beautiful golden and pavonine tarnish: of which latter we have a fine specimen before us. Internal lustre splendid, sometimes simply shining, according to the various degrees of perfection of the foliated fracture; it is vitreous, rather inclining to pearly; in some varieties even an adamantine lustre has been observed.

Fracture more or less perfectly foliated, almost always straight, seldom curved-foliated, sometimes approaching to vitreous; it presents a four-fold equiangular cleavage.

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The form of the fragments has been mentioned in speaking of the integrant molecules. The massive is generally seen in granular distinct concretions of various bigness; and sometimes it appears in columnar concretions, and radiated, intersected by curved lamellar distinct concretions.

Degree of transparency according to the differences in the colour and fracture; some varieties, particularly the white or colourless, perfectly transparent; others entirely opaque; most commonly it is semi-transparent.

Its hardness is greater than that of calcareous spar; but it is scratched by iron; it is brittle, easily frangible, and not very heavy; its specific gravity is,

3.092 (from Stollberg)	}	Gellert.
3.148 (from Freiberg)		
3.156 to 3.184. Mufchenbroeck.		
3.175 (the green var.) Blumenbach.		
3.200 to 3.700. Gerhard.		

Other physical characters are its phosphorescence when laid on ignited coal; the sky and violet blue and green varieties have been observed to emit the most vivid phosphoric light. The variety from Siberia, called chlorophane, when put on ignited coal, does not decrepitate, but emits a beautiful emerald green light, which has procured it its name. A slight phosphorescence is likewise observed when two fragments are rubbed against each other in the dark.

As chemical characters of fluor-spar, we have to mention its decrepitation before the blow-pipe, (which, however, is not the case with the Siberian chlorophane,) and subsequent loss of colour, and its melting, (particularly with addition of borax or phosphoric acid,) into a greyish white enamel; as also its emitting suffocating white vapours (fluoric acid) when acted upon by sulphuric acid.

The constituent part of fluor-spar, according to Scheele, the celebrated discoverer of a peculiar acid in this mineral, were stated to be,

Lime	57
Fluoric acid	16
Water	27

After him, Wenzel, Richter, and but lately Klaproth, have analysed this substance, and obtained the following results.

Fluoric acid	32 $\frac{3}{10}$	
Calcar. earth	56 $\frac{6}{10}$	
Iron and alum earth	10 $\frac{1}{2}$	
	100	Wenzel, 1783

Fluoric acid	35	
Calcar. earth	65	
	100	Richter, 1785.

Calcar. earth	67.75	
Fluoric acid	32.25	
	100	Klaproth, 1807.

With regard to the *geognostic situation* of fluor spar much is left to future observation. We know, however, that it does not only occur in veins, but likewise as beds principally in mountains of older formation. In Derbyshire it appears to form large irregular depositions inartz lime-stone, and also in Thuringia and at Zinnwald in Bohemia it occurs in beds. More frequently it is met with in veins of different relative ages, accompanied with several important metallic formations. The oldest, consisting principally of tin stone,

occurs at Zinnwald, and in other parts of the Bohemian and Saxon Ertzgebirge: and a vein formation, equally old, is found in Switzerland, where the veins consist of fluor spar, feldspar, rock crystal, &c. The second in antiquity appears to be that which, accompanied with lead and silver ores, and sometimes with barytes, forms the substance of veins at Freiberg and other parts of the Saxon Erzgebirge, and also partly in Derbyshire. A third vein formation, found in the lower parts of the Hartz, consists chiefly of fluor spar with copper and iron pyrites, galena, spathose iron, &c. The different ages of the venigenous fluor spar have first been examined into by Werner. We should also mention here that the variety of fluor called chlorophane is found in a granitic rock in Siberia; and Andrada speaks of a variety he saw in Sweden (in the district of Norberg) mixed in large masses with mica slate.

A list of localities of fluor spar may be found in all books on mineralogy; indeed, it is met with in most parts of Europe, though in some it is found in no considerable quantity. England and Saxony are the principal native places of this interesting mineral substance. In Scotland it is very scarce; the only localities known to Mr. Jameson are Aberdeenshire and the Shetland islands. We know of no specimens from any part of America or Africa; in the northern parts of Asia, Patrin found it in small quantities in two mines, viz. in the silver mine of Zmeof, in the Altaic mountains, where it occurs mixed with the other vein materials; and in a lead mine in Dauria, near the river Amur, where, if Patrin's observation be correct, it coats the small cavities of the vein stone, in the shape of a thick *botriol* crust.

The uses to which fluor spar is applied, though not manifold, are not unimportant. The coarser kinds are used as fluxes to metallic ores, particularly copper, iron, and silver. Chemists obtain fluoric acid from it. The use made of it in this country, (particularly of the variety called blue jack by the Derbyshire miners,) for ornamental vases, columns, &c. is generally known. Mr. Mawe, in his "Mineralogy of Derbyshire," has given an account of the mode of working it. Several attempts have been made in France to manufacture the fluor spar of Auvergne into similar articles of ornament; but it appears as if the nature of its fracture renders it less fit for the lathe.

Fluor spar is seldom seen to constitute the substance of organic remains. We find instances of this conversion mentioned in Mr. Martin's "Outlines;" the remains are chiefly those of entrochitæ. Also Dr. Kidd, in his "Outlines, &c." describes a bivalve shell in the Oxford collection, converted into fluor spar with imperfect crystals of nearly colourless fluor in the interior.

We should not omit mentioning in this place those corroded cubic crystals of fluor spar, of a yellowish-grey colour, found near the surface of the earth in some parts of Derbyshire: their texture is more or less porous throughout. Haüy, who calls this variety *chaux fluatée aluminifère*, thinks that the ferruginous clay which it is said to contain has the same relation to the fluor spar which the quartz grains have to the carbonate of lime in the crystallized limestone of Fontainebleau. But this analogy does not appear to be founded in reality (See SANDSTONE.) Dr. Kidd conjectures that the corroded appearance of these crystals may have been produced by some form of zinc.

Fluor spar sometimes exhibits traces of decomposition. The singular variety from Beerallston, Devonshire, in octahedral crystals of a pale feldspar green colour, and casé, as it were, in one another, is encrusted with a white earthy substance, which, if we may judge from the gradual transition

transition into the perfect substance observable in a specimen before us, can only be the result of a disintegration of the constituent parts. Mr. Sowerby has given a good figure of this variety. It is probable that much of the substance described as earthy fluor is nothing but fluor in a decomposed state.

FLUOR Albus, in *Medicine*, a colourless discharge from the female vagina, popularly termed *the whites*, and by the nosologists *leucorrhœa*, an appellation of the same signification, derived from the Greek. See **LEUCORRHEA**.

FLUORIC ACID, in *Chemistry*. This acid was discovered by Scheele more than thirty years ago, and the subject soon after excited the diligent attention of Dr. Priestley, whose experiments and observations are detailed at large in the second volume of his experiments methodized, p. 339, 367. For many years it was supposed to exist in the fluor spar only, but later processes have shewn that it is a constituent of some of the topazes, and of the wavelite, a newly discovered fossil. It has also been found in the animal kingdom, viz. in the enamel of the petrified teeth of an elephant: also in the enamel of the human teeth, and in ivory.

We have seen that the constituent parts of fluor spar, independently of the water in combination, are fluoric acid and lime. To obtain this acid we must put one part by weight of the spar coarsely pulverized into a leaden retort, and pour over it three parts of concentrated sulphuric acid. An effervescence is immediately excited; the sulphuric acid exerting a stronger attraction for the lime of the spar, unites with it, and the fluoric acid goes off in the form of gas, which may be collected in receivers over mercury. If water had been previously introduced into the receiver, the gas would have been absorbed, and the acid would, in that case, be exhibited in the liquid state. Hence fluoric acid can subsist in the liquid form, and likewise under that of gas, which gas has the common properties of the atmospheric air, being elastic and invisible. But it is somewhat heavier than common air; it extinguishes combustion, and is utterly incapable of supporting animal life. Exposed to the atmosphere it combines very greedily with its moisture, and appears in the form of vapour or white fumes. It has a penetrating pungent smell; reddens vegetable blues, and corrodes the skin. If a lighted candle be introduced into it, the flame becomes green, and then is extinguished. The most remarkable property of the fluoric acid gas is that of corroding glass in consequence of its strong affinity for silic. This property has rendered it extremely useful in etching or engraving on glass vessels, which operation is performed by a very simple and easy process: the glass is covered with wax, or a strong solution of isinglass, the figures are then traced with a common graver, or steel point, and then the vessel is exposed to the action of the fluoric acid in a state of gas; those parts that are exposed are soon corroded, and the impression is more or less deep, according to the time employed. This art, though adopted as new at the time of Scheele's and Priestley's discoveries, was, according to the account given by Beckmann in the second volume of his *History of Inventions*, known and practised a century before.

Light and caloric have no effect on fluoric acid; its properties are not the least altered by being passed through a red-hot porcelain tube. It will not unite with oxygen, which is the great difference that exists between this and the muriatic acid; nor has it any action on azote, hydrogen, carbon, phosphorus, or sulphur. By these, or by some of them, almost all the other acids have been decomposed, and their constituents detected, and hence its base was, till very

lately, wholly unknown; and it was, from analogy only, that chemists assumed that it must contain oxygen in combination with an unknown base. Mr. Davy has, however, thrown some light on this subject, by subjecting the fluoric acid-gas to the action of potassium, one of his newly discovered metals. In this gas potassium, when heated, burns, and there is a great absorption of the gas. Either the whole, or part of the acid, according to the quantity of the potassium used, is destroyed or absorbed, and the residual elastic fluid is found to be hydrogen, which is in less proportion as the fluoric acid gas has been more perfectly freed from water. After the combustion, a chocolate coloured mass remains at the bottom of the retort, and also a sublimate, partly chocolate coloured, and partly yellow, is found about the sides, and at the top of the retort. This substance, when examined by a magnifier, appeared to consist of different kinds of matter; and when thrown into water it effervesced very violently, and the gas evolved was inflammable. When heated in contact with air it burnt slowly, lost its brown colour, and became a white saline substance.

The water which had acted on this substance was examined, the solid particles separated by a filter, and the fluid was found to contain fluete of pot-ash, and pot-ash. The solid residuum was heated in oxygen gas, it burnt before it came to a red heat, the brown colour was changed to white; oxygen was absorbed, and acid matter was produced. The inflammable substance thus produced from the action of potassium on the fluoric acid is supposed to be the base of the acid. Perhaps the decomposition of the fluoric acid by potassium is analogous to that of the sulphuric and phosphoric acids; in which the pure bases are not evolved, nor even the bases in their common form, but new compounds formed of the base with potassium, with a smaller proportion of oxygen. This subject has engaged also the attention of the French chemists, M. M. Gay Lussac and Thenard, who employed the agency of potassium, and the results of their investigation were very similar to those of Mr. Davy. From which they infer that since little or no hydrogen gas is evolved in the combustion of potassium, the effect cannot be ascribed to the agency of water. The acid must therefore be decomposed, or it must combine undecomposed with the metallic base, which is not even oxydated. It is probable, therefore, that the acid is decomposed, and the product is a combination of the fluoric base with pot-ash, analogous in constitution to a phosphuret.

Fluoric acid combines with alkalis and earths, and the salts so formed are named fluates. They are generally deliquescent, and can be crystallized with difficulty. They are decomposed by the sulphuric or muriatic acid, which, as we have seen, disengages the fluoric. The alkaline fluates are decomposed also by lime, as is evident by the following

Table of Affinities.

Lime,
Barytes,
Strontites,
Magnesia,
Pot-ash,
Soda,
Ammonia,
Glucina,
Alamine,
Zircon,
Silica.

The saturating power of this acid exceeds that of all the others,

others, a given quantity of it saturating a larger quantity of any base. On this account, it is regarded as the most powerful of the acids, and its less energetic action must be ascribed partly to the weak state of concentration in which it can be obtained, and partly to its not affording oxygen in a direct way.

There are eight fluates known, *viz.* of pot-ash, soda, ammonia, lime, barytes, magnesia, alumine, and silica. Some of these we shall briefly notice. The fluat of *pot ash* is obtained by fusing, in a platina crucible, a mixture of fluor spar, and carbonate of pot-ash. The mass, digested in water, yields a solution, which, filtered and evaporated, leaves a fluat of pot-ash. It does not crystallize, but forms a gelatinous mass with scarcely any taste, that attracts moisture from the air. It readily dissolves in water. F. of *soda* is formed like the last; if the solution is evaporated till a pellicle rises on its surface, it yields on cooling small cubical crystals of fluat of soda. These are bitter and astringent; they do not deliquesce in the air, and are but little soluble in water. They decrepitate and melt into a transparent globe when exposed to the action of the blow-pipe. F. of ammonia is obtained by the application of heat to a mixture of sulphate of ammonia and fluor spar. The fluat sublimes; but if it is prepared by saturating the acid with ammonia, the solution, by evaporation, yields small crystals of fluat of ammonia. F. of lime, is the fluor spar on which we have already treated, as it is found in nature; this salt may be artificially prepared by adding fluat of ammonia to nitrate of lime; the fluat of lime falls to the bottom, and when properly treated is very pure. It is insoluble in water, phosphorescent when laid on a hot iron, it is insipid, unalterable by exposure to the air, and at a heat equal to 51° of Wedgwood, it melts into a colourless transparent glass. Fluoric acid obtained in glass vessels always contains a portion of silica; if this solution be allowed to remain a considerable time in a vessel not quite closed, it deposits small brilliant transparent crystals, which have been ascertained to be the fluat of silica. This salt is soluble in alkalies, and gives out fluoric acid by mere heat, or by the action of any of the strong mineral acids. Felspar, and all minerals that contain silica, are probably acted on without difficulty by the fluoric acid in a state of gas, but those that contain no alkali are less liable to its action. The following table, taken from Dr. Thomson's chemistry, vol. ii. exhibits the results of the experiments and calculations of Richter on the several fluates.

Table of the Composition of the Fluates.

Fluates of	Acid.	Base.
Alumine	100	13
Magnesia	100	14
Ammonia	100	157
Lime	100	186
Soda	100	201
Strontian	100	311
Pot-ash	100	376
Barytes	100	520

FLURRY-BRIDGE, in *Geography*, a small post-town of Ireland, in the county of Louth, on the borders of Armagh.

FLUSH, signifies to draw off, or let go a stream of water from any pound.

FLUSH Deck. See DECK.

FLUSHER, in *Ornithology*, the common name of the lesser butcher-bird, called by authors the *lanius minor*, and the *lanius tertius* of Aldrovand. See *LANIUS Collurio*.

FLUSHING, VLISSENGEN, or FLESSINGUE, in *Geography*, a sea-port town of the Dutch state of Zealand, in the isle of Walcheren, on the north side of an arm of the Scheldt. It defends the passage not only of that river, but of all the islands of Zealand, of which it is one of the most important keys: and on this account Charles V. when he abdicated his crown, enjoined his son Philip to preserve it safe; and that prince, when he left the port in 1559, in order to take possession of the kingdom of Spain, commanded a castle to be built for the defence of the town: but the order was prevented from being executed by subsequent troubles. The port lies between two moles that break the waves of the sea, which enters the town by means of two canals, forming two basons, so that loaded vessels may sail into the town, to the great convenience of the merchants. It was but a small place before the 15th century, when Adolphus de Bourgogne, the lord of the place, surrounded it with walls, since which time it has become a celebrated port; and has been reckoned next to Middleburg, the richest town in the province of Zealand. The emperor Charles V. erected it into a marquise in 1551, which the prince of Orange purchased, together with the marquise of Ter-Vere, for 146,000 florins. The stadthoufe, built according to the model of that at Amsterdam, is a superb building. The States-General seized this town on the 27th of April 1573, by means of seven boats filled with soldiers sent by the prince of Orange from the Brill. When they landed, they hanged the Spanish commander, Francis Paciotti, one of the greatest engineers of his time, and the friend of the duke of Alva: they pillaged the churches and cloisters, and took also the town of Vere, defeating a fleet of Spanish ships commanded by the duke of Medina Celi. The duke of Alva and the prince of Parma endeavoured in vain to retake it. This town was pledged with some others by the states to queen Elizabeth, as a security for her assistance, and surrendered to the earl of Leicester, who was made governor in October 1585, and arrived the same year with 600 soldiers, and more than 500 gentlemen. In 1616 it was restored, with the other towns, to the states, by the negotiation of John Olden Barneveldt, ambassador to James I. In January 1795, Flushing was taken by the French; and united by a decree of the conservatory senate in 1808 to the French empire and the department of the Scheldt or Escaut. In 1809 it was captured by the English, and soon after evacuated. N. lat. 51° 26' 37". E. long. 3° 34' 9".

FLUSHING, a town of America, in Queen's county, New York, on the N.W. part of Long island, and on the S. side of Hell-gate; seven miles E. by N. of New York city. It contains 1818 inhabitants.

FLUSTRA, in *Zoology*, a genus of Zoophytes. The animal is a polype proceeding from porous cells; stem fixed, foliaceous, membranaceous, and consisting of numerous rows of cells united together and woven, or matted together. Ovaries bulbiform?

Two or more distinct genera of zoophytes have been confounded by some naturalists under the general name of flustra. The true flustra may be readily distinguished however by the above character. It is not of a stony nature like the millepora, with which it has been sometimes arranged: neither is it so calcareous as the madrepore, though more so than the gorgonia, and by this means constitutes an intermediate link between these analogous tribes. The cells of the flustra are disposed with regularity, and always incline to the plane of their base. The animals which inhabit the cells are polypes, furnished with from six to twelve tentacula of moderate length. The colour of

these creatures is in general white, and in the night-time, or when placed in the dark, they occasionally emit a phosphorescent light.

Species.

TRUNCATA. Foliaceous, sub-divided, with linear truncated sub-divisions. Müll.

Native of the European seas, and five inches in length; cells oblong-square, and pale yellowish-brown.

FOLIACEA. Foliaceous, branched, with round cuneate sub-divisions. Fabr. Fn. Groenl. &c. *Porus cervinus Imperati*, C. Bauh.

Inhabits European and Mediterranean seas, six inches long; colour yellowish-brown.

PILOSA. Foliaceous, variously branched, with a setaceous denticle on the lower part of each pore. Müll.—*Millepora membranacea plana, punctis quincuncialibus*, Amoen. Acad.

Whitish, porous, incrusting marine plants; and inhabits European seas.

CARBASEA. Foliaceous, sub-divided, with a single layer of cells. Ellis.

Yellowish-brown. Inhabits the coast of Scotland.

CHARTACEA. Papyraceous, with cells on both sides, the tops of the branches truncated, like the edge of an axe. Ellis.

Adheres to shells, and of a pale straw colour; native of Europe.

BOMBYCINA. Frondescent, with obtuse branches, divided into two or three parts, growing together in tufts, sending forth small radical tubes, and having a single layer of cells. Soland.

Inhabits the Bahama islands.

VERTICILLATA. Parasitical, with flattish linear branches, narrower at the base, and rows of top-shaped ciliated cells disposed in whorls one above another. Soland.

Native of the Mediterranean.

DENTATA. Parasitical, foliaceous, with shining oval cells in a single layer, the mouth surrounded by sharp inflected teeth. Ellis.

On fuci, and inhabits the European seas.

BULLATA. Parasitical, with ovate projecting white cells, the mouths of which are round, and armed with small spines. Ellis.

Found in the European seas adhering to fuci.

TOMENTOSA. Parasitical, soft, woolly, with invisible cells. Müll.

Inhabits the North and Baltic seas.

DENTICULATA. Parasitical, with oval distinct cells, three-toothed at the opposite margins, and the mouth margined. Müll.

Inhabits the North seas, on fuci and shells.

TUBULOSA. Parasitical, membranaceous, with single oblong-ovate cells, and tubular erect mouths. Soland.

Deep yellowish, semi-transparent, and adheres to fuci: found in the seas of St. Domingo.

HISPIDA. Frondescent, spongy, the fronds branched and mucronated on the upper side with very rough belts. Pallas.

About an inch long, of a pale grey colour, and extremely rare. The species inhabits the Mediterranean sea.

FRONDICULOSA. Frondescent, with obtuse crowded branches thrice divided, and a single layer of cells. Seba, Pallas, &c.

Native of the Indian ocean.

PAPYRACEA. Crustaceous, frondescent, with a cuneate many-cleft singly lamellate frond; cells oblong-rhombic, and ringed at the top. Pallas

Yellowish and rough on the surface. Inhabits the Mediterranean.

HIRTA. Parasitical, flat, coriaceous, with contracted distant cells. *Flustra hippida*, Fabr. Fn. Groenl.

Fulvous with narrow cells, adhering to fuci, in the Greenland seas.

MEMBRANACEA. Parasitical, membranaceous, with oblong-quadrangular cells pointed at the upper projecting angles. Soland.

Inhabits the British and North seas.

LINEATA. Parasitical, flat, foliaceous, undivided, with oval cells in transverse rows. Fabr. Fn. Groenl.

Found on fuci in the North seas.

The flustra arenosa of Gmelin is excluded, as it cannot be considered of this genus; it is an eschara of Pallas, and millepora of Ellis.

FLUT, in *Geography*, a river of Bohemia, which runs into the Egra, opposite to Elabogen.

FLUTA, in *Ichthyology*, a name given by Gaza and some authors to the common sparus, distinguished by Artedi by the name of the plain yellow sparus, with a large annular black spot near the tail. See *SPARUS Annularis*.

FLUTA is also a name given by Columella to the murena of Aristotle and the ancient authors in general, as well Greek as Roman. It makes only one species of the murena, according to Artedi; but being with him a generical name which comprehends all the eel-kind, the serpens marinus and the like, among these. This, which was anciently called simply the murena, is distinguished by that author under the name of the murena having no pectoral fins; which being peculiar to this species, evidently and obviously distinguishes it at first sight from all the rest. See **MURÆNA**.

FLUTE, an instrument of music, the simplest of all those of the wind-kind; played, by blowing it with the mouth; and the tones or notes formed and changed by stopping or opening holes disposed for that purpose all along it. Those in common use are either the *flute a bec*, i. e. a beaked or common English flute, and the traverse, Helvetian, or German flute, the invention of which is ascribed by Galileo and Mercenne to the Helvetians; but the antique statue of the piping faun, and a tessellated pavement of Fortuna Virilis, erected by Sylla at Rome, in which is a representation of a young man playing on a traverse pipe, with an aperture to receive his breath, shew that it is of more ancient origin.

The Latins call it *flûta*, and sometimes *tibia*, pipe; from the former of which some derive the word flute; though Borel will have it derived from *fluta*, a lamprey, thus called a *fluitando in fluviiis*, in regard the flute is long, like the lamprey, and has seven holes all along it, like that fish. Grassineau.

The ancient fistule, or flutes, were made of reeds; afterwards they were of wood; and at length of metal. But how they were blown, whether as our flutes, or hautboys, does not appear.

Monf. Castillon apprehends that they were founded by means of a reed; and that there were two sorts of them, in one of which the reed was visible, as in our hautboy, but concealed in the other. (Berlin Mem. 1774. vol. v.) It is plain some had holes, which at first were but few; but afterwards were increased to a greater number; and some had none. Some were single pipes, and some a combination

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of several, particularly Pan's syringa, which consisted of seven reeds, joined together sideways.

These seven reeds had no holes, each giving but one note, in all seven distinct notes; but at what intervals is not known; perhaps they were the notes of the natural, or diatonic scale.

The German flute is different from the common one; it is not put into the mouth, by the end, as the ordinary ones are; the end is stopped up with a plug or tampon, but the lower lip is applied to a hole a little way distant from it.

It is made equally big every where, and perforated with six holes, besides that of the mouth, and that opened by the key.

The flute was of such importance in antiquity, that among the *Dii majorum gentium*, some of the female divinities laid claim to a share in musical discoveries. Of this number was Minerva, or Pallas, the daughter of Jupiter, who is sometimes called *Musica*, or the musician, a name she acquired from a statue made by Demetrius, in which, when the serpents of the Gorgon were struck, they resounded like a lute. She is also honoured with the invention of chariots, together with having first used trumpets, and invented the flute. The vouchers for her musical talents are Pausanias, Plutarch, and Fulgentius, among the prose writers; and Pindar, Nonnus, Ovid, Hyginus, Propertius, and Claudian, among the poets. The flute that she invented is said by Ovid to have been made of box, and by Hyginus of bone. *Foramina rara*, with few holes, it is natural to suppose.

Indeed the *Syrinx*, see plate IV. N^o 6, said to have been invented by Pan, was found inconvenient. It consisted of a number of pipes of different lengths, tied together, or fastened by wax, which were played on, according to Lucretius, by blowing in them one after the other, moving the instrument sideways, for the admission of wind into the several tubes; and it was by the sagacity and penetration of Minerva, that it was found practicable to produce the same variety of tones with a single pipe, by means of ventiges or holes, which had the effect of lengthening or shortening the tube, by a quick alteration of the column of air which was forced through it.

Two other circumstances are related of Minerva with respect to the flute; she is said by Hyginus to have found herself laughed at by her mother and sister, Juno and Venus, whenever she played the flute in their presence: this suggested to her the thought of examining herself in a fountain, which serving as a mirror, convinced her that she had been justly derided for the distortion of her countenance, occasioned by swelling her cheeks in the act of blowing the flute. This is one reason given for her throwing aside that instrument, and adopting the lyre. However, a better cause, and one more worthy of her wisdom, is assigned for her throwing aside the flute, upon seeing Apollo perform on the lyre; for by having his mouth at liberty, she found that it enabled him to sing at the same time as he played, which afforded an opportunity of joining instruction to pleasure.

The invention of the flute having been given by the poets to Apollo, Mercury, Minerva, and Pan, is a proof of its high antiquity as well as importance. There are nominal flutes represented in sculpture of all forms: curved, straight, small, middle-sized, single, double, right, left, equal, unequal, &c.; these instruments were made of all kinds of wood and metal. They had different names assigned them, according to the country where they were invented, or were chiefly in use; as the curved flute was called Phrygian,

or Tyrian, its name in Magna Grecia, or the Phœnition of the Egyptians, which was termed *Monaulos*. The flute had, indeed, so many different names in the Classics, and is applied to so many different purposes, that M. le Fevre, who had undertaken their explanation, ended his fruitless labours by a copy of Latin verses in praise of Minerva, for throwing the flute into the sea, and anathematizing those who should take it out. But far from imitating M. le Fevre, and without having the fear of Minerva before our eyes, we shall try if we cannot give some satisfactory explanation of the terms equal and unequal flutes, right and left flutes, *Sarrana flutes*, Phrygian, Lydian, or Tibie pares, Tibie impares, Tibie sarrana, Phrygie, Lydica, &c., of which mention is often made in comedies performed at Rome; we shall give what has been said, which seems most probable and ingenious on this curious subject of antiquity.

In the comedies of Terence the flute-players played on double flutes, or two flutes at the same time; that which they held in the right hand was called the *right* flute, and that with the left, for the same reason, the *left*. The first had but few holes, and produced the grave or lowest sounds; the left had many holes, and produced the acute or high notes. When the musician played the two flutes of different sounds, it was said that the piece was accompanied *tibiis imparibus*, with unequal flutes; or *tibiis dextris et sinistris*, with right and left flutes; and when they played on two flutes of equal sound (or in either right or left, as often happened, it was said the piece was played *tibiis paribus dextris*, with equal flutes, producing two sounds; or *tibiis paribus sinistris*, equal left-handed flutes, producing acute or high notes.

Donat pretends, that when the subject of a piece was grave and serious, the right-hand or base flutes only were used, which were called Lydian; that when the drama was gay and playful, the left-hand or high flutes were used, which were called Tyrian or Sarrana, which having high sounds were more proper for joy; and finally, when the subject was mixed, or as we should say, *tragi-comedy*, unequal flutes were employed, that is to say, right and left, which were called Phrygian.

At the Panathœnean games, instituted at Athens in honour of Minerva, the patroness of that city, premiums were given to players on the flute, an instrument then in the highest estimation throughout all Greece, but in particular request at Athens; perhaps from the legendary account of its invention by Minerva, the protectress of that city.

Aristotle tells us, (*de Laud. Sui*.) that the flute, after its first invention, was used by mean people, and thought an ignoble instrument, unworthy of a freeman, till after the invasion and defeat of the Persians, when ease, affluence, and luxury, soon rendered its use so common, that it was a disgrace to a person of birth not to know how to play upon it. Callias and Critias, celebrated Athenians, Archytas of Tarentum, Philolaus and Epaminondas, were able performers on the flute.

The Thebans in general piqued themselves much on being great performers on the flute. This is manifest from a passage in Dion Chrysostom. "The pre-eminence," says he, "which all Greece unanimously allows to the Thebans, in this particular, has been constantly regarded by them as a point of great importance, of which I shall give an instance. After the total ruin of their city, which has never yet been rebuilt, no part of it being now inhabited but the small quarter, called *Colonia*, they gave

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themselves but little trouble in restoring any of the public monuments that had been thrown down or destroyed, one statue only of Mercury excepted, which they took great pains to dig out from among the rubbish, and to erect again, on account of the following inscription; Ἑλλάς μὲν Θηβῶν νικᾷν περικρατεῖν αὐλοῦς.—“Greece has declared that Thebes wins the prize upon the flute.” So that this statue is still standing in the old public square, among the ruins.”

Pronomus, a Theban, according to Pausanias, invented a flute, upon which he could play in three different modes. Before his time, there was a particular flute for every mode or key: and so out of tune are the generality of modern flutes, it were almost to be wished that the custom had still continued. The words and music of a hymn, composed by Pronomus for the inhabitants of Chalcis, when they went to Delos, were subsisting in the time of Pausanias, as was likewise the statue of this musician, erected by the citizens of Thebes, near that of Epaminondas.

Pericles, who had invited Antigenides to Athens, and who had undertaken the superintendance of the education of Alcibiades, his nephew, appointed Antigenides for his flute master. But Aulus Gellius relates, from the History of Music, in thirty books by Pamphila, that his scholar Alcibiades, setting up for a fine gentleman, and taking the utmost care of his person, was soon disgusted with his instrument, as Minerva herself had been before; for happening to see himself in a mirror, while he was playing, he was so shocked at the distortion of his sweet countenance, that he broke his flute in a transport of passion, and threw it away, which brought this instrument into great disgrace among the young people of rank at Athens. However, this disgust did not extend to the sound of the flute itself, since we find by Plutarch, that the great performers upon it continued long after to be much followed and admired.

Horace speaks of bands of female flute players, which he calls “Ambubaiarum Collegia,” and of whom there were still colleges in his time. But the followers of this profession became so numerous and licentious, that we find their occupation prohibited in the Theodosian code; however, with little success: for Procopius tells us that in the time of Justinian, the sister of the empress Theodora, who was a Tibicina, appeared on the stage without any other dress than a slight scarf thrown loosely over her. And these performers were become so common in all private entertainments, as well as at public feasts, obtruding their company, and placing themselves at the table, frequently unmasked, that, at the latter end of this reign, their profession was regarded as infamous, and utterly abolished.

Dorion is mentioned by Plutarch as a flute player who had made several changes in the music of his time, and who was head of a sect of performers, opponents to another sect of practical musicians, of which Antigenides was the chief; a proof that these two masters were cotemporaries and rivals. Dorion, though much celebrated as a great musician and poet, by Athenæus, is better known to posterity as a voluptuary. Both his music and poetry are lost; however, many of his pleasantries are preserved. Being at Milo, a city of Egypt, and not able to procure a lodging, he enquired of a priest who was sacrificing in a chapel, to what divinity it was dedicated, who answered, to Jupiter and to Neptune. How should I be able, says Dorion, to get a lodging in a place where the gods are forced to lie double? Supping one night with Nicoereon, in the island of Cyprus, and admiring a rich gold cup that was placed

on the side-board, the gold-smith will make you just such another, says the prince, whenever you please; “he’ll obey your orders much better than mine, sir, says Dorion; so let me have that, and do you bespeak another.” The remark of Athenæus upon this reply is, that Dorion acted against the proverb, which says, that

“To flute-players, nature gave brains there is no doubt,
But alas! ’tis in vain, for they soon blow them out.”

Upon hearing the description of a tempest, in the Nauplius of Timotheus, Dorion said, he had seen a better in a boiling cauldron.

Having lost a large shoe at a banquet, which he wore on account of his foot being violently swelled by the gout, “the only harm I with the thief, said he, is, that my shoe may fit him.”

His wit and talents made amends for his gluttony, and he was a welcome guest wherever he went. Philip of Macedon, in order to enliven his parties of pleasure, used frequently to invite him with Aristonicus the citharædist.

The importance of the flute is manifested in innumerable passages in ancient authors; among which there is one in Pliny that is diverting and curious. In speaking of comets, he says that there were some in the shape of flutes, which were imagined to forebode some ill to music and musicians: (Tibiarum specie, musicæ arti portendere), and Montfaucon proves by several inscriptions from ancient marbles, that the sacrificial Tibicæ at Athens was always chosen, and his name recorded with the officers of state, (Supple. tom. ii. cap. 25.)

After speaking of so many flute players of the male sex, it is but justice to say that they did not monopolize the whole glory arising from the cultivation of that instrument; as the performing upon it was ranked, in high antiquity, among female accomplishments. Its invention was ascribed by the poets to a goddess; it was the symbol of one of the Muses; and it was never omitted in the representation of the Sirens. However, the same reason which provoked Minerva to throw it aside, has luckily inclined modern ladies to cultivate instruments, in performing upon which, their natural charms, instead of being diminished, are but rendered still more irresistible.

The most celebrated female flute-player in antiquity was Lamia; her beauty, wit, and abilities in her profession, made her regarded as a prodigy. The honours she received, which are recorded by several authors, particularly by Plutarch and Athenæus, are sufficient testimonies of her great power over the passions of her hearers. Her claim to admiration from her personal allurements does not entirely depend, at present, upon the fidelity of historians; since an exquisite engraving of her head, upon an amethyst, with the veil and bandage of her profession, is preserved in the king of France’s collection, which, in some measure, authenticates the accounts of her beauty.

As she was a great traveller, her reputation soon became very extensive. Her first journey from Athens, the place of her birth, was into Egypt, whither she was drawn by the fame of the flute-players of that country. Her person and performance were not long unnoticed at the court of Alexandria; however, in the conflict between Ptolemy Soter, and Demetrius, for the island of Cyprus, about 312 years B. C. Ptolemy being defeated in a sea engagement, his wives, domestics, and military stores fell into the hands of Demetrius.

Plutarch, in his life of this prince, tells us, that “the celebrated Lamia was among the female captives taken in this victory. She had been universally admired, at first,

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on account of her talents, for she was a wonderful performer on the flute; but afterwards her fortune became more splendid by the charms of her person, which procured her many admirers of great rank." The prince, whose captive she became, and who, though a successful warrior, was said to have vanquished as many hearts as cities, conceived so violent a passion for Lamia, that, from a sovereign and a conqueror, he was instantly transformed into a slave; and though her beauty was now on the decline, and Demetrius, the handsomest prince of his time, was much younger than herself.

At her instigation, he conferred such extraordinary benefits upon the Athenians, that they rendered him divine honours; and as an acknowledgment of the influence which she had exercised in their favour, they dedicated a temple to her, under the name of "Venus Lamia."

The flutes of the ancients alone have furnished Bartholinus with materials for a very learned and instructive work (*De Tibiis Veterum*), in which he has collected all the classic descriptions of the different instruments included in the class of flutes, and pointed out all the allusions to them in Greek and Roman authors, furnishing subsequent modern writers with a body of information on the subject, which has enabled them to appear very learned with very little trouble. So many different kinds of ancient wind instruments under the denomination of flutes are represented in sculpture, some plain without holes, some with two, some with three, and some with five holes, others with plugs, stopples, or, as Merseus calls them, *teines* (nipples) at the sides, some double, and some so large, that they must have been an octave below the others. Horace speaks of flutes with few holes, as well as lyres with few strings:

"Tibia non ut nunc orichales vineta tubæque
Æmula, sed tenuis, simplexque foramine paucis."

Ovid has the same remark:

"Prima terebrato per rara foramina buxo,
Ut daret effici, tibia longa fonos."

Sidonius gives the flute seven holes; but Avienus gives it a thousand.

"Foraminibus tibia mille sonat."

The learned are very discordant in their opinions and explanations of the flutes used in the comedies of Terence, nor does any one discover the least knowledge of modern practical music, sufficient to lead them to intelligible discoveries on the subject. Bianchini "De tribus generibus instrumentorum musicæ veterum organicæ," and Bonanni, in his "Gabinetto Armonico," have copied the antique representations of ancient musical instruments, but we have long seen that there is no dependance to be placed on their fidelity. Sometimes ignorance, and sometimes picturesque convenience, have occasioned blunders and deviations from truth in the original sculptors. In the supplement to the folio edit. of the Fr. Encyclopédie, it is supposed that all the ancient flutes had reeds; but of two kinds: one visible and the other invisible, like those in childrens' trumpets; the oblique flute, or flauto traversiere, commonly called the German flute, was unknown to the ancients. According to the author of this article, the ancients had no real flute à bec, or traversiere; but all were played with reeds, like the modern hautbois. The plugs, or stopples at the sides of ancient flutes, which served instead of keys, are imagined to have been used occasionally to stop certain holes which, in changing the mode, would not be wanted.

In this long article concerning flutes, or rather the hautbois, not a word is said of double flutes. Our belief how-

ever is, that the tibia pares were two tubes in unison with each other; and that the tibia impares were tuned all *ottava*. We can conceive no other harmonical use that could be made of them, as it is now generally believed that the ancients had never cultivated counterpoint, or figurative harmony. But something must still be said in this article, long as it is already, concerning modern flutes.

The common flute, or flute à bec, from the upper end, or mouth-piece, resembling the beak of a bird, at the beginning of the last century, till the works of Corelli came over, was in far more general use as a concert instrument than the violin. Sonatas for two flutes, and a thorough base, violone or theorbo, were innumerable; with solos, duets, and concertos for the same instrument; nor was there a ballad then printed which was not transposed for the flute at the bottom of the page; as in the middle of the same century, almost every song and tune was set for the guitar. The concert flutes for which this music was composed were generally F and C. There is an imitative stop in the organ, called the flute, composed of open wooden pipes in unison with the principal; but much more soft and tender. This stop is always in the choir organ. The flute is shown by Mr. Maxwell, in his "Essay on Tune," p. 17. to belong to the class of imperfect instruments, see PERFECT instruments.

FLUTE *Traversiere*, Fr. *Flauto traversiere*, Ital. horizontal.

FLUTE *Allemande*, or *German flute*, a wind instrument of wood or ivory, consisting of four pieces, or joints, inserted one in the other. In the Fr. Encyclopédie so minute a description is given of the several parts of this instrument, its joints, holes, or perforations, keys, tampon, or bung at the top of the mouth-piece, that an ingenious turner who never saw a German flute would find little difficulty in making one; but we shall say no more on the mechanism of the instrument, but confine our instructions to its use.

To become a good performer on this instrument, the student must begin by acquiring a good embouchure, or by procuring a clear, full, and sweet tone; a task far more difficult than is generally imagined. Every one can produce a tone on a common flute, but few are able, without teaching, to make the German flute speak. The instrument being blown at the side, whence it has its name of *traversiere*, must be held parallel to the shape of the mouth, that the stream of air issuing from the breath of the performer may enter in part at the single orifice in the upper piece. Whoever can whistle in the pipe of a key, will soon produce a tone in the German flute, which will be harsh at first, but must be smoothed and refined by degrees, never forgetting in every day's practice to make that a principal consideration. Whether sitting or standing, the performer must be erect in his carriage, the head rather above than below its usual position, and a little inclining to the left shoulder; the hands high, without raising the elbows or the shoulders; the left hand bent out, and the same arm near the body. If the player is standing, the attitude should be firm, the left foot advanced, the body resting on the right hip, and the whole person free from constraint. The greatest care should be taken not to move the head or body, as many do, in order to mark the time. The attitude should have no singularities, nothing awkward or affected to attract the attention, or prejudice the audience against the performer. With regard to the position of the hands, the left is to be at the top of the flute, which is held between the thumb of that hand, and the fore finger, which ought to stop the upper hole, marked 1 in the figure, the second hole with the middle finger, and the third by the ring finger. The right hand is to hold the lower part of the instrument; the thumb of this hand, which must be a little

bent inwards, supports the flute below, and the three fingers of this hand, the fore finger, the middle finger, and ring finger, stop the holes marked 4, 5, 6; the little finger serves to press down the key at the tail piece, or lowest joint, which key opens a hole out of the reach of the fingers. The flute must be held horizontally. No instructions for the lips in blowing the flute can suit the form of all mouths; but when the student can make the instrument speak easily and freely, he must turn it in and out, by small degrees, till he gets the best tone possible; and then, beginning with the chest well filled with wind, as soft as possible to swell by minute degrees any note to its utmost power, and then to diminish it by the same degrees to a thread. We shall give among the plates a complete scale of every sound that can be produced on the instrument. Having worked upon one and the same note till a full and clear tone can be produced on a short notice, begin on the lowest sound D, to swell and diminish each note in the same manner as the first, and let alone rapid passages and execution, till certain of the tone of the instrument: as fingers are obliged to *solfeggiar*, going no further than a hexachord for a long time; swelling each note to the utmost power of the breath and lungs, ascending and descending, to acquire steadiness in sustaining a note perfectly in tune, and free from all tremulous uncertainty during the most crude and violent accompaniment. See *Musical Flute*.

The tablature contains seven ranges of black and white indications of the seven holes that are to be occasionally stopped and opened on the flute. The black represent the fingers, and the white or open circles the holes unstoppped. The compass of the German flute at present extends to three octaves, from the lowest D in the treble, to the octave above what used to be the highest D. [A C * or D b below the D natural, has lately been acquired by blowing very softly and turning the instrument inward.] It is to be observed that the higher the notes on this instrument are, the wind must be increased, and the orifice of the lips somewhat more closed. Most of the notes are broken into octaves by a little additional force in blowing. The B, C, D, of the third octave cannot be produced upon all flutes; with middle pieces which lower the tone of the whole instrument, they are easier to be produced; the lower the better. There are sometimes seven middle pieces in use for flattening the pitch. These amount to about a tone; so that by their assistance a flute may accommodate itself to any pitch. Not only all the semitones are given in the general scale on the first plate, but the shakes on a second plate, which are indicated by the black and white ciphers. The finger over the white open cipher is to be shook; tones, semitones, shakes, beats, coup de langue, accents, flurs, &c. must be practised separately.

FLUTE stop on an Organ, is a range of pipes, constructed to imitate the notes of the common flute or flageolet: it is softer than the principal in its tone: its pitch is an octave above the notes of the diapasons, or in unison with the principal stop.

FLUTE, or *Fluyt*, is also a kind of long vessel, with flat ribs, or floor timbers, round behind, and swelled in the middle; serving chiefly for the carrying of provisions in fleets, or squadrons of ships: though it is often used in merchandize.

The word flute, taken for a sort of boat, or vessel, is derived, according to Borel, from the ancient *flotte*, a little boat. In the verbal process of the miracles of St. Catherine of Sweden, in the 12th century, we read, "Unus equum suum una cum mercibus magni ponderis introduxit super instrumentum de lignis fabricatum, vulgariter dictum fluta." Upon which the Bollandists observe, that in some copies it is read *flotta*, an instrument called by the Latins

ratis; and that the word *flutta*, or *flotta*, arose from *flotten* or *swollen*, to float.

FLUTE, in *weaving tapestry*. See *TAPESTRY*.

FLUTES, or *Flutings*, are longitudinal concavities depressed in the surface of a piece of architecture, generally of a circular or elliptic section, meeting each other in lines, or separated with a part of the surface from which the excavation is made left standing between. The surface separating every two flutes is called a fillet: if the flutes are parallel or diminish according to any law, the fillets are also made parallel or to diminish in the same law.

And if the flutes run in a straight line, or in a curve at right angles to the section, the fillets follow the same direction. When fillets separate the flutes from each other, each fillet is in breadth from one-third to one-fifth of the breadth of the flute. That species of fluting where the flutes meet each other without the intervention of fillets, is generally applied to the shaft of the Doric order, and the other with fillets to the shafts of Ionic and Corinthian. Flutes frequently terminate semicircularly on the face or with spheric heads, and sometimes their terminations are planes at right angles to their longitudinal direction. The Greeks never applied fluting to any member of the Doric order, except to the shaft, which was almost a universal practice, there only being two known examples to the contrary, nor even to the Ionic. The Romans frequently overcharged all the plain and cylindrical members. For a more particular description of fluting, see *DORIC* and *IONIC Orders*.

FLUTES, or *Flutings*, are also used, in *Botany*, to denote the stems and fruits of certain plants, which have furrows analogous to those of these columns.

FLUTTER, in *Music*, is a term applied by Dr. Robert Smith (*Harmonics*, p. 97.) to the fluttering roughness in the sound of two notes which are discords to each other: a phenomenon very distinct from the *beats* of imperfect consonances; the latter beating, because the succession of their short cycles are periodically confused and interrupted, whereas discords have this characteristic fluttering, when their ratios are quite perfect, and when concords, under the same circumstances, cease to have any beats, but produce a perfect consonance, or uniformity of sound. See *CONCORD*.

FLUVANNA, in *Geography*, a county of Virginia, bounded N. by Albemarle, N. E. by Louisa, E. by Goochland, W. by Amherst, and S. by Fluvanna or James river, which divides it from Buckingham. It is about 22 miles long and 20 broad, and contains 2703 free inhabitants, and 1920 slaves. There is great plenty of marble, both white and variegated with blue, red, and purple veins found in this county, on James river at the mouth of Rockfish; where it forms a large precipice overhanging a navigable part of the river.

FLUVIALIS, in *Botany*, Vaill. Mem. de l'Acad. des Sciences for 1719. See *NAJAS*.

FLUVIANA, in *Geography*, a river of Spain, in Catalonia, which runs into the Mediterranean, in the gulf of Roses. N. lat. 42° 10'. E. long. 2° 56'.

FLUVIATILES COCHLEÆ, fresh-water shell-fish, a term used by naturalists to express those kinds of shell-fish which never inhabit the sea, but are found in our ponds, rivers, and ditches. These, though much less numerous than the species of sea shells, are yet of a greater variety and beauty than is usually supposed. See *CONCHOLOGY*.

FLUX, in *Enamel*, is that glassy body that forms the basis of all enamels, whether transparent, semi-transparent, or opaque. Now as the painting on enamel is performed with vitreous colours, which to speak truly can be nothing more

or less than coloured enamels, it must be evident that flux likewise forms a principal part in the composition of enamel colours.

FLUX, *Enameller's*, is a sort of enamel principally used for the upper surfaces of plates intended for enamel painting. It differs from the common enamels, in being of a more mellow and rich quality, whilst its properties facilitate the fusion of those colours which are employed in painting on it. The best kinds having been generally brought from Venice, have acquired the name of *Venetian flux*, and are commonly imported in the form of small beads, hence called *bead-flux*, or short pipes about three-eighths of an inch in diameter, and from three quarters of an inch to an inch in length: the latter is called *pipe-flux*. The fluxed plates, when prepared as described under ENAMELLING, have a rich yellow hue, or cream colour; by which they are rendered of particular utility in paintings where much of the naked figure is exposed. The flux must always be laid upon *hard enamel*; as the properties of glass enamel are inimical to effective cohesion, the flux cracking in circles, or flying off in pieces as the plates cool.

In order to give a clear idea of the nature of fluxes, it will not be improper previously to inquire more particularly into the nature of the ingredients, their operations on each other in a state of composition, as well as the power which each exerts in producing a proper effect; since by this means such an initiative knowledge may be obtained, as will enable persons unacquainted with the art to conduct their experiments with more certainty, than they possibly could by any particular recipes, however good they might be.

There are two kinds of substances which enter into the composition of enamel fluxes; the one, the proper matter of the flux, being principally such bodies as are by their nature endued with a strong propensity to run into the vitreous fusion, and be converted into glass, at the same time that they assimilate and change other bodies in combination with them into their own vitreous nature. This kind consists principally of salts, lead, and arsenic. The other kind consists of the correctives of these proper fluxings, which without their admixture would be found to have quantities that would deprave them for enamels or the fluxes for paintings. For all kinds of salts, when vitrified by themselves, or with a small proportion of other bodies, are still liable to be dissolved by aqueous moisture; and flux, made of such ingredients only, would be corroded even by the common air, and turn black and dull on its surface; hence it becomes necessary to add some other bodies as correctives to prevent these bad tendencies, and render the flux more durable. Lead and arsenic, when formed into glass, of which they compose the principal ingredients, are particularly liable to be thus corroded; to prevent which, when using these substances, it is necessary to add considerable proportions of the corrective matter. The truth of these remarks may be readily ascertained by the appearance of the enamel door-plates about this town, in many of which the lead, having been used in too great a proportion as a flux for the black colour, has been so far corroded as to have admitted the air to come in contact with the colouring matter, in which case the whole writing is almost obliterated.

The most common of these corrective bodies of the proper matter of the flux, and which therefore make the second kind of substances of which enamel fluxes are composed, are calcined flints, and Lynn sand, or what is generally known by the name of silver sand, which being perfectly white, and resisting when vitrified the corrosive and

decomposing action of all menstrua, give body and hardness to the fluxes, without any other disadvantage than that of diminishing, in a certain degree, their inclination to vitrify, and on that account rendering them somewhat weaker as fluxes than they would be if used alone.

The most active kind of salt as a general flux is borax, which possesses the greatest power of any simple body hitherto known. Lead, which is the next, vitrifies with a very slight heat, and at the same time assimilates other bodies to its own nature, such as earths, stones, the oxyds of metals, &c. Arsenic is likewise a powerful fluxing substance; but whenever this is used it should be, with bodies that have been previously vitrified and ground tolerably fine, otherwise it is apt to sublime and fly off from the composition with which it is mixed, and which of course must render any recipe, where a certain proportion of this is to be used, very liable to error without such precautions. Several kinds of salts possess the next degree of fluxing power, the principal of which is sea salt; but it must be evident from what has been mentioned, that they are not sufficiently strong to form an enamel flux by themselves, yet as they are perfectly colourless when vitrified, which is not the case with lead, they will be found very useful in composition with lead, or when used in place of that substance, assisted by borax, especially where any tinge of yellow would be detrimental to the colouring matter that is to be used with the flux.

Having endeavoured to give the reader an idea of the nature of the substances that are used in the formation of fluxes, we shall next endeavour to explain the method of compounding them before they are fused, and also some observations upon that part of the process.

When the materials are procured, taking care that they are of the best quality, each should be separately levigated either in an agate mortar, or one made of the same kind of glass as the common wine bottles are made of: the pestle in either case should be of flint or agate. The proportions of each substance, having first been thoroughly mixed, the whole must be put into crucibles of a proper size, and placed in an air furnace, or what is more commonly called a wind hole, where the heat should be increased till the matter is perfectly vitrified, which may be known by its becoming clear and transparent. The heat must be sufficiently powerful, yet not too violent, for though a great heat may accelerate the vitrification, yet it at all times hardens the composition, and greatly reduces the fluxing power. The simple method of dipping the end of a tobacco pipe in the flux while in a state of fusion, and examining the small quantity that adheres to it, will enable a person to form an accurate judgment of the whole; for if it appears clear and transparent it may be concluded that the vitrification is complete, but if any cloudy parts appear inclosing opaque specks, it is evident that a longer continuation of heat is necessary. When the quantity is small it becomes very difficult to get the whole out of the pot; the best method perhaps is to hold the edge of the pot with a convenient pair of tongs, and at the same time scrape the matter out with a small piece of iron, the edge of which should be previously made to sit the bottom of the crucible. Whoever would have flux in the greatest degree of purity, must previously prepare the glass of lead to be ready at all times for use, for although lead might be mixed with the other ingredients for common purposes, yet it will be better in all cases to prepare it previously by the following means.

Take of the best minium, or, as it is commonly called, red lead, four pounds; of Lynn sand, or calcined flints, two pounds and a quarter: these two substances should be
thoroughly

thoroughly mixed, and be put into a very sound crucible. One that has had flux or a little flint glass melted in it before would be preferable, for when a new pot is used, the lead is very liable to strain through the pores, and thus occasion an uncertain result, although the quantities should have been ever so nicely adjusted. This is to be vitrified in the same manner as directed for flux, and when perfect will be of a beautiful topaz or transparent gold colour. When the matter is cold, it should be ground in the mortar before described, and then kept perfectly free from dust.

In most large concerns in the glass business sand is greatly preferable to flints, as the trouble of calcining and grinding the latter, where large quantities are wanted, is a serious objection to their use. But in the case of flux, where quality is of more consequence than quantity, flints are certainly preferable.

The method of preparing the flints for use, is to place them in a clear fire, in which they should continue two or three hours; the fire should be then increased till they attain a white heat, at which time they should be taken very quickly from the fire and plunged into cold water, which will cause them to crack and shew in innumerable parts; they must then be broken into pieces, and if they are of an uniform whiteness throughout, they may be considered as fit for grinding; but if any black and discoloured places appear, they must be again submitted to the fire, and the immersion in water repeated; the calcination being then completed, they must be broken as small as possible with a steel-faced hammer, and ground very fine in the glass or agate mortar.

A very important advantage attending this preparation of the glass of lead, is the ease with which a very perfect vitrification of the sand or flints is effected without the aid of intense heat; at the same time the mixture is rendered more capable of assimilating with a larger proportion of salts, which will in all cases add greatly to the softness of the flux.

Very little hope is entertained that any more of the Venetian hard enamel or flux for grounds will be imported into this country, as we are assured that Bertolini, the celebrated maker of those substances, perished in the hands of the French at Naples, on account of his political opinions. We feel much pleasure in being able to state, however, that Mr. Griffiths of Broad Court, Long Acre, London, after many years spent in making enamel colours, has succeeded in making flux for grounds equal to any of the Venetian, which he has constantly for sale. He has likewise, within the last three years, brought to perfection a beautiful white, hard enamel, which is so nearly equal to the Venetian, that the one might be mistaken for the other, the colour and fracture being so much alike.

The first recipe for the formation of a flux, and which we shall call N^o 1, is the white glass enamel, which, containing a large proportion of arsenic in a semi-vitrified state, requires to be broken into small pieces, and fused till the matter becomes quite clear and transparent; the arsenic will by this means be completely vitrified, and convert the glass into a soft and useful flux, fit to be mixed with most of the earths that may be used as colours, and likewise with the oxyds of all the metals, gold and silver excepted; for it must be remembered, that lead and arsenic are both apt to injure the beauty of the colours that are produced by gold and silver: therefore, whenever these are used, it must be with a flux that is composed without either of these ingredients; or if they do enter the composition, it must be in very small proportions.

Composition of a softer flux for common purposes, where

the glass may be found too hard, N^o 2.—Take of the glass of lead one pound; of pearl ashes, five ounces; of borax, five ounces; and of arsenic, half an ounce. This flux is suited, by its softness, to be mixed with colours that are to be used in glazing over others, where a harder flux has been used, and in most cases, where burning the colours with a slight heat is advantageous.

Composition of a flux perfectly pellucid and very soft, N^o 3.—Take of common flint glass, powdered very fine, seven ounces; of borax, one ounce and a half; of pearl ashes, two ounces; and of sea-salt, one ounce. This flux, by its softness and clearness, will be found very useful for the oxyds of gold and silver; likewise in all cases where a tinge in the flux might be detrimental to the colouring substance that is to be used.

These fluxes, in the proportion here given, have been found to answer the purposes for which they are intended extremely well; but as the ingredients sometimes vary in their quality, it is evident that much must at all times be left for the ingenuity of the operator to supply. Indeed, when the difficulties that every person must meet with in attempts of this nature, without a previous knowledge of chemistry, are considered, we cannot do better than advise a study of that science as an introduction to the art of enamelling and enamel painting, by which means a complete theory of the various substances may be obtained, which, in the course of practice, may lead to useful discoveries; or, to say the least, will many times prevent useless experiments being made.

We must not omit noticing in this place, that dial-plate enamellers found great inconvenience in the loss of the Venetian white hard enamel, as that substance was principally used for the bottoms or backs of dial-plates manufactured of the English glass enamel; for the expansion of these two substances so exactly suited each other, that it was very rare that any of them cracked in the fire. This, however, was not the case with all the kinds that were brought from Venice, and particularly a blue sort, stamped on the cakes with the figure of a monkey, and commonly called monkey-enamel. This sort was very apt to crack the plates in circles, after they had been made a few weeks, unless it was used in composition with other substances, whose fluxes, being softer, contributed to counteract this disagreeable property.

These observations tend to confirm what we have before stated respecting the necessity of laying flux for grounds on hard enamel, because the English glass enamel, being much harder from the nature of its composition, does not run into fusion with the same heat as the flux; consequently a perfect adhesion cannot take place between these two substances. For a further account of the proportions of flux used in enamel colours, see *PAINTING on Enamel*. Handmaid to the Arts, vol. i. and ii.

FLUX, in *Hydrography*, a regular, periodical motion of the sea, happening twice in twenty-four hours; wherein the water is raised, and driven violently against the shores.

The flux, or flow, is one of the motions of the tide, (see *TIDE*); the other, whereby the water sinks and retires, is called the reflux, or ebb.

There is also a kind of rest, or cessation of about half an hour, between the flux and reflux; during which time the water is at its greatest height, called *high-water*.

The flux is made by the motion of the water of the sea, from the equator towards the poles; which, in its progress, striking against the coasts in its way, and meeting with opposition from them, swells, and where it can find passage, as in flats, rivers, &c. rises up, and runs into the land.

This motion follows, in some measure, the course of

the moon; as it rises or comes later every day by about three quarters of an hour; or, more precisely, by forty-eight minutes: and by so much is the motion of the moon slower than that of the sun. It is always highest and greatest in full moons, particularly those of the equinoxes. In some parts, as at mount St. Michael, it rises eighty or ninety feet, though in the open sea it never rises above a foot or two; and in some places, as about the Morea, there is no flux at all. It runs up some rivers above a hundred and twenty miles. Up the river Thames it only goes eighty, viz. near to Kingston in Surry.

Above London-bridge, the water flows four hours, and ebbs eight; and below the bridge, flows five hours, and ebbs seven. See TIDES.

FLUX, in *Medicine*, often called also *bloody flux*, the popular appellation of *Dysentery*, which see.

FLUX, in *Metallurgy*. All those substances which have been employed to facilitate the separation of metals from their ores, or to give greater fluidity in the fusing or foldering of metals, have by manufacturers been denominated fluxes.

Fluxes employed in separating metals from their ores have the effect of rendering the substances with which the metal is combined, capable of fusion. The whole is, by this addition of the flux, rendered fluid; the metal, being the heaviest fluid, sinks to the bottom; while the fluid mass, arising from the earthy matters of the ore, combined with the flux, floats on the surface: the latter, on cooling, puts on a vitreous appearance, and is, by manufacturers, called *scoria*. Hence it will appear, that the flux employed must be such a substance as may be best calculated to render those substances more fusible with which the metal is combined.

If the ore abounds with siliceous matter, potash or soda is best calculated to separate it from the metal. Tartar, which consists of the tartaric acid united with the potash, and frequently abounds with much vegetable matter, is employed to great advantage in the small way. The hydrogen and carbon present, take the oxygen from the metal; while the potash combines with the siliceous matter, forming a fluid vitreous mass, more or less coloured by the oxyd of the metal.

The substances known by the names of black flux and white flux are generally used in the smaller experiments. The former is made by detonating one part of nitre with three of tartar, so that it contains at least an excess of carbonaceous matter, which is fitted for the reduction of the metallic oxyd, while the potash, derived from the nitre and tartar, combines with the earthy products.

That called white flux, is formed by detonating equal parts of nitre and tartar, by projecting the mixture, by a small quantity at a time, into a red-hot crucible. In these proportions the whole of the carbonaceous matter of the tartar is destroyed by the oxygen of the nitre, and nothing more is obtained than a sub-carbonat of potash.

It will appear evident to every chemist, that common tartar, or for nice experiments, that super-tartaret of potash, will answer all the purpose of the black flux, and the sub-carbonat of potash be equally well taken for the latter. Some have recommended the nitre and tartar to be used together; but this will always be improper where the oxydation of a substance is intended. Nitre possesses a power so much the contrary, that it is capable of oxydating gold.

In the large way, on account of cheapness, lime is employed to separate the siliceous matter. Barytes, if it could be found more plentifully, might be used to more advantage for separating siliceous matter, particularly from iron ore.

Lime is found to be the best flux for smelting the alumi-

nous iron ores, from the great fusibility of due proportions of those two earths. Should the ore abound with siliceous matter, its reduction is found more difficult. It might be an advantage, where ores of this kind occur, to use some cheap compound of barytes, such as the sulphat of that earth.

From what has been observed, it will appear that it is of the greatest importance to be acquainted with the nature of the earthy matter in the different ores. Whether the ore contain alumine, lime, or both these substances, such a quantity of one of them should be added, as will make the most fusible compound of the two. If the alumine be in excess, lime must be added, but if the ore be calcareous, which is sometimes the case, it is found necessary to add clay. In the smelting of iron ores, however, the fusibility of the earths is much increased by the oxyd of iron, which always, more or less, colours the scoria. The oxyd of iron is found to exert a much stronger affinity upon siliceous matter upon any of the other earths, and hence those iron ores abounding with siliceous matter, when smelted, afford more coloured scoria, and in consequence are less productive.

In the smelting of copper ores, which contain siliceous matter, it is common to add some substance which contains oxyd of iron; pyrites is generally used to afford this substance. But many copper ores contain iron, and need not the addition of this substance as a flux. The oxyd of iron combines with the siliceous matter, forming a dark coloured fusible compound, which floats on the surface, leaving the copper free from both those substances.

Most of the fluxes used in fusing or foldering those metals liable to oxydate by the presence of the oxygen of the atmosphere are such, as by fusing, when the metal would begin to oxydate, envelope the metallic surface, and prevent the combination of the oxygen. Of this class are many saline bodies, such as borax, pot-ash, soda, tartar, muriat of soda, &c. In short it should be such a substance as may fuse before the body becomes very hot. It should have no action upon the metal itself, and it should possess so much fixity as not to be volatilized by the heat required for the fusion of the metal. If the flux be at all liable to fly off, a fresh quantity should be frequently added.

Another species of fluxes act by reducing the oxyd as fast as it may be formed. The fusible metals are generally treated with those inflammable bodies, which combine with oxygen, with great facility, and at the same time involve the metallic surface. Resin and fatty substances are mostly employed for lead, tin, antimony, and bismuth, or their alloys. Zinc requires to be treated in a close vessel with charcoal powder, or pounded pit-coal.

The vitreous and saline fluxes which act by preventing oxydation, are employed for cast iron, copper, brass, &c.

Pounded glass, or a mixture of lime and clay, may be employed for cast iron; pot-ash or tartar for copper and brass.

The scoria of blast furnaces is generally used in the fusion of steel which is to be cast into ingots. If too much of these fluxes be used, the firmness of the crucible will be endangered. Muriat of ammonia has a very peculiar property of freeing the surfaces of metals from oxygen. This has been explained, by supposing that the ammonia is decomposed; the hydrogen of which combines with the oxygen. This does not, however, clearly explain the fact, for the muriat of ammonia is not decomposed by this process, and much less by the ammonia. It is well known to those who manufacture this muriat, that if any metallic oxyd be present when this salt is sublimed, the oxyd rises with it, forming a triple salt. Indeed the substance, known in medi-

cine by the name of *floria martialis*, is formed in this way, and is a triple muriat of iron and ammonia.

The great utility of this salt in the folding of metals, therefore, consists in carrying off the oxyd from the surface, at the time it sublimes.

Resin and fat substances used in folderings give great fluidity and brightness to the folder, and clear the surfaces to be united, by their carbon and hydrogen taking the oxygen which may be present.

The flux employed for foldering iron, brass, and copper, are generally borax, (sub-borat of soda.) After the folder and the surfaces are once made clean, this borax acts, by preventing oxydation, till the folder fuses, and unites the two surfaces.

That this is the true explanation of the action of a flux, in foldering, we have abundant proof, in foldering one noble metal with another. When fine gold is employed for foldering platina, the gold is observed at the time of fusion to assume a degree of fluidity far superior to any folder made of oxydable metals, although the latter be assisted with the best flux.

In the fusion of those metals liable to oxydate, whether the fusion may be for the purpose of foldering or casting, certain fluxes are found to be indispensable. The fluidity is so much improved, that in the latter process, without a flux, the folder would not be able to run between the surfaces to be united, independent of its action in preventing the oxydation of the surfaces. In the casting of metals, the fluidity would sometimes be so imperfect, without the presence of the flux, that impressions taken from the mould would be exceedingly defective, and small articles, such as needles and fish hooks, could not be cast at all.

We shall conclude this article by giving a short explanation of the cause of increase of fluidity by the agency of fluxes.

Although an idea is entertained by chemists, that there is no medium between that pulverulent state called the oxydated and the metallic states, it will be found that the oxydable metals combine with oxygen when exposed to the air in a state of fusion, without losing their metallic form. They however lose much of their lustre and fluidity. Of this fact we have a striking proof in silver, which in the act of refining has been long exposed to a current of oxygen for the purpose of freeing it from the baser metals. At the time the silver assumes the solid form, the oxygen is given out in the form of gas. Mr. Lucas, a refiner of Sheffield, by throwing the liquid silver into water, collected an abundance of pure oxygen gas.

The partial loss of lustre and fluidity from the combined oxygen, is soon very apparent in melted zinc, both of which may be completely restored, by treating it in a close vessel with charcoal powder. All the oxydable metals are more or less susceptible of this change, proportionate to their affinity for that substance.

From what has been observed we may infer, that it is highly injudicious to expose much of the melted surface of metals to the air. Hence the iron ladles used for the fusible metals, as well as crucibles, ought to be as narrow as possible at the top, at the same time that some substance should be employed, which will either prevent the oxydation, or reduce the oxyd as it is formed.

FLUXES, in the *Manufacture of Glass*, are red-lead, pearl-ashes, nitre, sea-salt, borax, arsenic, the scorix of forges, commonly called clinkers, and wood-ashes. See GLASS.

FLUXION, was a term, in *Surgery*, much employed by the ancient writers and practitioners to signify the motion

by which, according to theories now exploded, the humours were spontaneously determined, with a certain velocity, towards any particular part of the body, so as to occasion there a tumour, attended with heat. When the humours were deposited in a slower and more gradual way, the old medical writers used to say, that the tumour was produced by *congestion*.

FLUXION, in the *Newtonian Analysis*, denotes the velocity with which a flowing quantity is increased by its generative motion: by which it stands contradistinguished from fluent or the flowing quantity, which is gradually, and indefinitely increasing, after the manner of a space which a body in motion describes.

Or, a fluxion may be more accurately defined, as the magnitude by which any flowing quantity *would be* uniformly increased in a given portion of time, with the generating celerity at any proposed position, or instant, supposing it from thence to continue invariable.

Thus, if the point *m* move from *A*, and generate the right line *Am*, (*Plate VII. Analysis, fig. 1.*) and the celerity at *R* be such as would be sufficient, supposing it to continue uniform from that point, to describe the line *Rr* in the given time; then *Rr* represents the fluxion of the variable line *Am* in that position. The rectangle *AS*, *fig. 2.* may be conceived to be generated by the parallel motion of the invariable line *mn* between *AF* and *BG*; and since *Rr* is the fluxion of *Am*, the rectangle *RrsS* will be the space which would be uniformly described by *mn*, whilst *Am* would be uniformly increased by *mr*, and it is, therefore, the fluxion of the generated rectangle *ABSR*. Farther, if the curvilinear space *Amn*, *fig. 3.* be generated by the parallel motion of *mn*, considered as variable, and *Rr* be the fluxion of *Am*, the rectangle *RrsS* would be uniformly generated with the celerity, with which it begins to be generated, and with which the space *Amn* is increased in the position *Rs*, when the length and velocity of *mn* are supposed to continue invariable from that position, and, therefore, agreeably to the definition, will be the fluxion of the generated space *Amn*.

From this definition it appears, that the fluxions of quantities are, always, as the celerities by which the quantities themselves increase in magnitude.

Mr. Simpson observes, that there is an advantage in considering fluxions, not as mere velocities, but as the magnitudes which these velocities would, uniformly, generate in a given finite time: the imagination is not here confined to a single point, and the higher order of fluxions are rendered much more easy and intelligible. And though sir Isaac Newton defines fluxions to be the velocities of motions, yet he hath recourse to the increments or moments generated in equal particles of time, in order to determine those velocities, which he afterwards teaches us to expound by finite magnitudes of other kinds. Simpson's Fluxions, vol. i. pref. p. 6. and p. 2, &c.

FLUXIONS, *Method of*, is the arithmetic and analysis of fluxions and fluents, or flowing quantities.

Foreigners usually define the method of fluxions as the arithmetic, or analysis, of infinitely, or rather indefinitely, small variable quantities; or the method of finding an infinitesimal, or infinitely small quantity, which, being taken an infinite number of times, becomes equal to a given quantity.

Sir I. Newton, and after him, the English authors, call these infinitely small quantities *moments*; considering them as the momentary increments, or decrements, of variable quantities, *c. gr.* of a line considered as generated by the flux

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flux of a point, or of a surface generated by the flux of a line.

Accordingly, the variable quantities are called fluent, or flowing quantities; and the method of finding either the fluxion, or the fluent, the method of fluxions.

M. Leibnitz considers the same infinitely small quantities as the differences, or differentials, of two quantities; and calls the method of finding those differences the *differential calculus*. (See CALCULUS.) Each of these ways of considering and denominating, has its advantages, which the retainers to this or that method strenuously assert.

Flowing quantities, *i. e.* such as, in the genesis of figures by local motion are continually increasing and diminishing, are certainly very properly denominated fluents: and as all figures may be conceived as so generated, the infinitely small increments or decrements of such quantities are very naturally denominated fluxions.

Beside this difference in the name, there is another in the notation.

Sir I. Newton expresses the fluxion of a quantity, as x , by a dot placed over it, as \dot{x} ; and M. Leibnitz expresses his differential of the same x , by prefixing a d , as dx ; each of which methods of notation has likewise its advantage.

Setting aside these circumstances, the two methods are the same.

The method of fluxions is one of the greatest, most subtle, and sublime discoveries of this, or, perhaps, of any age: it opens a new world to us, and extends our knowledge, as it were, to infinity; it carries us beyond the bounds that seemed to have been prescribed to the human mind, at least infinitely beyond those to which the ancient geometry was confined.

The history of this important discovery, as fresh as it is, is a little dark and embroiled. Two of the greatest men of this age do both of them claim the invention, sir I. Newton, and M. Leibnitz; and nothing can be more glorious for the method itself, than the zeal wherewith the partisans of either side have asserted their respective title.

To give the reader a just view of this noble dispute, and of the pretensions of each party, we shall lay before him the origin of the discovery, and mark where each claim commenced, and how it was supported.

The first time the method made its appearance in public, was in 1684, when M. Leibnitz gave the rules thereof in the Leipzig Acts of that year; but the demonstrations he kept to himself. The two brothers, the Bernouillis, were presently struck with it, and found out the demonstrations, though very difficult; and practised the calculus with surprising success.

However, M. Leibnitz began to propose his differential method in a letter, dated 21 Jun. 1677, in which he exactly pursues Dr. Barrow's method of tangents, published in 1670, and sir I. Newton communicated his method of drawing tangents to Mr. Collins in a letter dated 10 Dec. 1672: which letter, together with another dated 13 June. 1676, were sent to M. Leibnitz by Mr. Oldenburgh, in 1676. So that there is a strong presumption that he might avail himself of the information contained in these letters, and other papers transmitted with them, and also in 1675, before the publication of his own letter, containing the full hint of his differential method. And it fully appears, that sir I. Newton had invented his method before the year 1669, and that he actually made use of it in his *Compendium of Analysis and Quadrature of Curves* before that time. His attention seems to have been directed this way, even before the plague which happened in London in 1665,

and 1666, when he was about twenty-three years of age: and, therefore, there is no foundation for the hint suggested by the authors of the *Encyclopedic Art. Differentielle*, that sir Isaac borrowed the differential method from Dr. Barrow.

This is all we hear of it, till the year 1687, when sir Isaac Newton's admirable *Principia* came forth, which is almost wholly founded on the same calculus.

The common opinion, at that time, was, that sir Isaac, and M. Leibnitz, had each invented it about the same time: and what confirmed it was, that neither of them made any mention of the other; and that, though they agreed in the substance of the thing, yet they differed in their ways of conceiving; called it by different names, and used different characters.

In effect, M. Leibnitz's character was supposed, by foreigners, to be somewhat more commodious than that of sir Isaac Newton: accordingly, the method soon spreading itself, throughout Europe, M. Leibnitz's character went with it; by which means the geometricians were insensibly accustomed to look on him as the sole, or principal inventor.

The two great authors themselves, without any seeming concern, or dispute, as to the property of the invention, enjoyed the glorious prospect of the progress continually making under their auspices, till the year 1699, when the peace began to be disturbed.

M. Fatio, in a treatise "Of the Line of swiftest Descent," declared, that he was obliged to own sir Isaac Newton as the first inventor of the differential calculus, and the first by many years; and that he left the world to judge whether M. Leibnitz, the second inventor, had taken any thing from him. This precise distinction between first and second inventor, with the suspicion it insinuated, raised a controversy between M. Leibnitz, supported by the editors of the Leipzig Acts, and the English geometricians, who declared for sir Isaac Newton. Sir Isaac himself never appeared on the scene; his glory was become that of the nation; and his adherents, warm in the cause of their country, needed not him to animate them.

Writings succeeded each other but slowly on either side; probably on account of the distance of places; but the controversy grew still hotter and hotter; till, at length, it came to such pass, that in the year 1711, M. Leibnitz complained to the Royal Society, that Dr. Keill had accused him of publishing the method of fluxions invented by sir Isaac Newton, under other names and characters. He insisted, that nobody knew better than sir Isaac himself, that he had stolen nothing from him; and required, that Dr. Keill should publicly disavow the ill construction which might be put on his words.

The society, here appealed to as a judge, appointed a committee to examine all the old letters, papers, &c. that had passed among the several mathematicians relating to the point; and, after a strict examen of all the evidence that could be procured, gave in their report to this purpose: "That M. Leibnitz was in London in 1673, and that a correspondence with Mr. Collins by means of Mr. Oldenburgh, till Sept. 1676, when he returned from Paris to Leover, by way of London, and Amsterdam; that Collins appears that M. Leibnitz knew any thing of the differential calculus before his letter of the 21st June, 1677, which was a year after a copy of a letter, wrote by sir I. Newton, in the year 1672, had been sent to Paris to be communicated to him, and above ten years after Mr. Oldenburgh to communicate that letter to his country; and that the method of fluxions was sufficiently explained, to the mat-

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following cases. 1. To express the fluxions of simple variable quantities, as already mentioned, you need only put the letter, or letters, which express them, with a dot over them: thus, the fluxion of x is \dot{x} , and the fluxion of y is \dot{y} ; and the fluxion of $x + y + v + z$, is $\dot{x} + \dot{y} + \dot{v} + \dot{z}$, &c.

Note, For the fluxion of permanent quantities, when any such are in the equation, you must imagine 0, or a cypher; for such quantities can have no fluxion, properly speaking, because they are without motion, or invariable.

Again, the fluxion of a quantity, which decreases, instead of increasing, is to be considered as negative.

2. To find the fluxions of the products of two or more variable or flowing quantities.—Multiply the fluxion of each simple quantity by the factors of the products, or the product of all the rest; and connect the last products by their proper signs: then the sum, or aggregate, is the fluxion sought.

Thus, the fluxion of xy , is $\dot{x}y + x\dot{y}$. For let two right lines, DE and FG, move parallel to themselves from two other right lines, BA and BC, (Plate VII. *Analysis*, fig. 4.) and generate the rectangle DF. Let them always intersect each other in the curve BHR, and let Dd (\dot{x}) and Ff (\dot{y}) be the fluxions of the sides BD (x) and BF (y); and draw dm and fn parallel to DH and FH. The fluxion of the area BDH (see the beginning of this article) is Dm or $y\dot{x}$, and that of the area BFH is Fn or $x\dot{y}$, and therefore the fluxion of the whole rectangle EF = xy = BDH + BFG will be $\dot{x}y + x\dot{y}$. The fluxion of yzu is $\dot{y}zu + y\dot{z}u + yz\dot{u}$; for if x be put = zu , then yzu will be = yx , and its fluxion = $y\dot{x} + x\dot{y}$; but x being = zu , and $\dot{x} = z\dot{u} + u\dot{z}$, $y\dot{x} + x\dot{y}$, by substitution, will be = $\dot{y}zu + yu\dot{z} + yz\dot{u}$. And the fluxion of $xuyz$, is $xuy\dot{z} + xuy\dot{z} + x\dot{u}yz + \dot{x}uyz$; and the fluxion of $a + x \times b - y$ (the common product being $ab + bx - ya - xy$) will be $b\dot{x} - \dot{y}a - \dot{x}y - x\dot{y}$.

3. To find the fluxion of a fraction.—Multiply the fluxion of the numerator by the denominator, and from this product subtract the fluxion of the denominator drawn into the numerator; this will be the numerator, and the square of the denominator will be the denominator of the fraction expressing the fluxion of the given fraction.

Thus, the fluxion of $\frac{x}{y}$ is $\frac{\dot{x}y - x\dot{y}}{y^2}$.

For suppose $\frac{x}{y} = z$, then will $x = yz$, which equal quantities must have equal fluxions; therefore $\dot{x} = \dot{y}z + \dot{z}y$ and $\dot{x} - \dot{z}y = \dot{z}y$; and dividing all by y , $\frac{\dot{x} - \dot{z}y}{y} = \dot{z}$ =

(because $\frac{x}{y} = z$) $\frac{\dot{x} - \frac{x}{y} \times \dot{y}}{y} = \frac{\dot{x}y - x\dot{y}}{y^2} = \frac{\dot{x}y - x\dot{y}}{y^2}$;

wherefore this last is the fluxion of the fraction $\frac{x}{y} = z$;

because z being = $\frac{x}{y}$, \dot{z} will be equal to the fluxion of $\frac{x}{y}$.

And the fluxion of $\frac{a}{x}$ will be $-\frac{\dot{x}a}{x^2}$; for the permanent quantity a having no fluxion, there can be no product of the fluxion of the numerator into the denominator, as there would have been, had a been x , z , or any other variable quantity.

4. To find the fluxion of a power.—Multiply the fluxion of the root by the exponent of the power, and the product by that power of the same root, whose exponent is less by unit than the given exponent; and likewise by the invariable quantity and co-efficient, if there be any.

Thus, the fluxion of xx will be $2x\dot{x}$; for $xx = x \times x$; but the fluxion of $x \times x = \dot{x}x + x\dot{x} = 2x\dot{x}$, &c. and the fluxion of x^3 will be $3x^2\dot{x}$. That of x^4 will be $4x^3\dot{x}$, &c. that of $5x^5$ will be $25x^4\dot{x}$; that of $3ax^6$ will be $12ax^5\dot{x}$.

Or, if m express the index of any power, as suppose x^m : its fluxion will be $m x^{m-1} \dot{x}$.

If the power be produced from a binomial, &c. as suppose $(x + y)^2$, or $xx + 2xy + yy$, its fluxion will be $2x\dot{x} + 2y\dot{x} + 2x\dot{y} + 2y\dot{y}$.

If the exponent be negative, as suppose x^{-n} or $\frac{1}{x^n}$, its fluxion will be $-m \dot{x} x^{-n-1}$.

Or, if you would do it by way of fraction, $-\frac{m x^{m-1} \dot{x}}{x^{2m}}$ (for the square of x^n is x^{2n}) = $-m x^{m-1-2n} \dot{x} = -m x^{-m-1} \dot{x}$ as before; =, removing x^{-m-1} to the denominator, by changing the sign of the exponent, $\frac{-m \dot{x}}{x^{m+1}}$.

If the power be imperfect, i. e. if its exponent be a fraction, as suppose $\sqrt[n]{x^m}$; or in the other notation $x^{\frac{m}{n}}$,

suppose $x^{\frac{m}{n}} = z$: then if you raise up each member to the power of n , it will stand thus, $x^m = z^n$: the fluxion of which will be, by this general rule, $m x^{m-1} \dot{x} = n z^{n-1} \dot{z}$.

Wherefore \dot{z} will be = $\frac{m \dot{x} x^{m-1}}{n z^{n-1}}$ (by dividing both parts

by $n z^{n-1}$) and $\frac{m \dot{x} x^{m-1}}{n z^{n-1}} = \frac{m}{n} \times \frac{x^{m-1}}{z^{n-1}} \times \dot{x}$; or $\frac{m}{n} \dot{x} \sqrt[n]{x^{m-n}}$:

x^{m-n} ; putting, instead of z^{n-1} , its value $x^{\frac{m-n}{n}}$, and

the above expression will become $\frac{m}{n} \dot{x} \times \frac{x^{m-1}}{x^{\frac{m-n}{n}}} = \frac{m}{n} \dot{x} \times$

$x^{m-1 - \frac{m-n}{n}} = \frac{m}{n} \dot{x} \times x^{\frac{mn-n-m+n}{n}} = \frac{m}{n} \dot{x} \times$

$x^{\frac{m-n}{n}} = \frac{m}{n} \dot{x} \sqrt[n]{x^{m-n}}$. Or, more briefly, according to

the rule, the fluxion of $\sqrt[n]{x^m}$ or $x^{\frac{m}{n}}$ will be $\frac{m}{n} \dot{x} \times$

$x^{\frac{m}{n} - 1} = \frac{m}{n} \dot{x} x^{\frac{m-n}{n}}$, &c.

5. To find the fluxions of surd quantities.—Suppose it required to find the fluxion of $\sqrt{2rx - xx}$, or $(2rx - xx)^{\frac{1}{2}}$.

Suppose $(2rx - xx)^{\frac{1}{2}} = z$; then is $2rx - xx = z^2$; and consequently $r\dot{x} - x\dot{x} = z\dot{z}$; and by division,

$\frac{r\dot{x} - x\dot{x}}{z} = \dot{z}$ = (by substitution) $\frac{r\dot{x} - x\dot{x}}{\sqrt{2rx - xx}}$ = to the

fluxion of $\sqrt{2rx - xx}$.

Or, by the preceding rule, the fluxion of $(2rx - xx)^{\frac{1}{2}}$, will be $\frac{1}{2} \times (2rx - 2x\dot{x} \times 2rx - xx)^{-\frac{1}{2}} = r\dot{x} - x\dot{x}$

$\frac{r\dot{x} - x\dot{x}}{2rx - xx} = \frac{r\dot{x} - x\dot{x}}{\sqrt{2rx - xx}}$. See POWER.

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If it be required to find the fluxion of $\sqrt{ay - xx}$; for $\sqrt{ay - xx}$ put z ; then $ay - xx = z^2$, and $ay - 2xz = z^2$; and multiplying by 3, $3ay - 6xz = 2z^2$; and, consequently, $3az\dot{z} - 6z\dot{x} = 2z\dot{z}$; equal (substituting $ay - xx = z^2$) $3a^3y^2\dot{z} - 6a^2x^2\dot{z} + 3ax^4\dot{z} - 6a^2y^2x\dot{x} + 12ayx^3\dot{x} - 6x^5\dot{x} =$ to the fluxion of $\sqrt{ay - xx}$.

6. To find the fluxion of quantities compounded of rational and surd quantities.—Let it be required to find the fluxion of $\frac{bx^2 + cax + ea^2 \times \sqrt{xx + aa}}{bx^2 + cax + ea^2} = p$, and $\sqrt{xx + aa} = q$. Then the given quantity is $p/q = z$, and the fluxion thereof is $p\dot{q} + q\dot{p} = \dot{z}$; but \dot{q} is $\frac{\dot{x}}{\sqrt{xx + aa}}$, and \dot{p} is $2bx\dot{x} + ca\dot{x}$; therefore, in the equation $p\dot{q} + q\dot{p} = \dot{z}$, if in the place of p, q, \dot{p}, \dot{q} , we restore the quantities they represent, we shall have, $\frac{bx^2 + cax + ea^2 \times \dot{x}}{\sqrt{xx + aa}} + 2bx\dot{x} \times \frac{\dot{x}}{\sqrt{xx + aa}} + ca\dot{x} \times \frac{\dot{x}}{\sqrt{xx + aa}} = \dot{z}$. Which being reduced to one denomination, gives $\frac{3bx^2 + 2cax + ea^2 \times \dot{x}}{\sqrt{xx + aa}} = \dot{z}$ = to the fluxion of the given quantity.

7. To find the fluxion of a logarithm.—The fluxion of the hyperbolic logarithm of any quantity is equal to the fluxion of that quantity divided by the quantity itself: *e. gr.* the fluxion of the hyperbolic logarithm of x is $\frac{\dot{x}}{x}$: for let L Q, Plate VII. *Analysis*, fig. 5. be an hyperbola, whose asymptotes are OR and OS, and whose parameter is AL = AO = 1: draw an ordinate PM parallel to AL, and the space A P M L will be the hyperbolic logarithm of the line OP; and, therefore, the fluxion of the space A P M L will be equal to the fluxion of the hyperbolic logarithm of the line OP. But the fluxion of this space, OP being = x , and PM = y , is = $y\dot{x}$, and OP:AO :: LA:MP by the nature of the curve; *i. e.* $x:1::1:y = \frac{1}{x}$; therefore $y\dot{x} = \frac{\dot{x}}{x}$. Then, from the nature of logarithms, the hyperbolic logarithm of 10 (*viz.* 2.30258, &c.) is to the common logarithm of 10 (*viz.* 1) as the hyperbolic logarithm of any number x to the common logarithm of the same number x ; *i. e.* L being made = 2.30258, &c. L:1:: the hyperbolic logarithm of x : common logarithm of x ; and therefore L:1:: the fluxion of the hyperbolic logarithm of x : the fluxion of the common logarithm of x : *i. e.* L:1:: $\frac{\dot{x}}{x} : \frac{\dot{x}}{Lx}$, which is the fluxion of the common logarithm of x ; or because $\frac{1}{L} = 0.43429$, &c. the modulus of the Briggsian or common form of logarithms, if $\frac{1}{L}$ be = M, the fluxion of the common logarithm of x (*viz.* $\frac{\dot{x}}{Lx}$) will be = $\frac{\dot{x}}{x} \times M$; or, the fluxion of the hyperbolic logarithm of any number multiplied by M or

0.43429, &c. is = the fluxion of the common logarithm of the said number.

8. To find the fluxion of an exponential or percurrent quantity, *i. e.* of a quantity having a variable exponent as y^x . Suppose $y^x = u$; then by the properties of logarithms, $x \times \log. y = \log. u$. And finding the fluxions of these terms, $\dot{x} \times \log. y + \frac{M\dot{y}}{y} \times x = \frac{M\dot{u}}{u}$, M being as in the preceding article: consequently, the fluxion of y^x or $u = \frac{u\dot{x}}{M} \times \log. y + \frac{\dot{y}x u}{y} = \frac{\dot{x}}{M} \times y^x \times \log. y + x y^{x-1} \dot{y}$. Hence, if y be constant, then $\dot{y} = 0$, and $\dot{u} = \frac{\dot{x}}{M} \times y^x \times \log. y$. If x be constant, $\dot{x} = 0$, and $\dot{u} = x y^{x-1} \dot{y}$.

9. To find the fluxion of a rectangle, when one side x increases, and the other y decreases.—In this case the fluxion of the decreasing quantity is negative with respect to that of the increasing quantity (see the beginning of this article), and therefore the sign of the term affected with it ought to be changed; *e. gr.* the fluxion of the rectangle xy in these circumstances will be expressed by $\dot{x}y - x\dot{y}$.

10. To find the second, third, &c. fluxion of a flowing quantity.—These fluxions differ in nothing, except their order and notation, from first fluxions, being actually such to the quantities from which they are immediately derived; and therefore they may be found, in the same manner, by the general rules already delivered.

Thus, by the 4th rule, the first fluxion of x^3 is $3x^2\dot{x}$; and if x be supposed constant, or if the root x be generated with an equable celerity, the fluxion of $3x^2\dot{x}$, or $3\dot{x} \times x^2$, will be $3\dot{x} \times 2x\dot{x} = 6x\dot{x}^2$, which is the second fluxion of x^3 ; and $6x\dot{x}^2$ will be its third fluxion: but if the celerity with which x is generated be variable, either increasing or decreasing, then \dot{x} , being variable, will have its fluxion denoted by \ddot{x} , &c. In this case, the fluxion of $3x^2 \times \dot{x}$ will be, by the 2d and 4th rules, $6x\dot{x} \times \dot{x} + 3x^2 \times \ddot{x} = 6x\dot{x}^2 + 3x^2\ddot{x}$, the second fluxion of x^3 . And the third fluxion of x^3 , obtained in like manner from the last, will be $6\dot{x} \times \dot{x}^2 + 6x \times 2\dot{x}\ddot{x} + 6x\dot{x} \times \ddot{x} + 3x^2\ddot{\ddot{x}} = 6\dot{x}^3 + 18x\dot{x}\ddot{x} + 3x^2\ddot{\ddot{x}}$. Thus also, if $y = n x^{n-1} \dot{x}$, then $\dot{y} = n \times n - 1 \times x^{n-2} \dot{x}^2 + n\dot{x} x^{n-1}$; and if $\dot{z} = \dot{x}\dot{y}$, then $2\dot{z}\dot{x} = \dot{x}\ddot{y} + \dot{y}\ddot{x}$, &c.

FLUXIONS, *inverse method of*, or *calculus integralis*, consists in finding finite magnitudes from the infinitely small parts thereof, and in determining the variable quantity or fluent from the velocity with which it flows at any point or term assigned, or the given fluxion.

It proceeds, as already observed, from infinitely small quantities to finite; and recomposes and sums up what the other has resolved; whence it is also called, by some, the *summatory calculus*.

But what that has decomposed, this does not always re-establish; so that the inverse method is limited and imperfect, at least hitherto; if it were once complete, geometry would be arrived at its last perfection.

To give an idea of its nature and office, take the instance already proposed in the direct method: in that the infinitely small quantities of the ordinates and absciss, being known, give the subtangent required; in this, on the contrary, the subtangent of an unknown curve being had, gives the infinitely small quantities of the absciss and ordinate which produced it, and, of consequence, the absciss and ordinate themselves; which are finite magnitudes, in whose relation the whole essence of the curve is founded.

But the distinguishing use of this method is in measuring. The

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The base of a parallelogram multiplied by the infinitely small element of its altitude, gives an infinitely small parallelogram; which is the element of the finite parallelogram, and is repeated an infinity of times therein, *i. e.* as many times as there are points in the height of the parallelogram.

To have the finite parallelogram, therefore, by means of its element, the element must be multiplied by the altitude; which is the inverse method of fluxions, re-ascending from the infinitely small quantity to the finite.

Such a circuit of infinitesimals, it is true, would be impertinent, in so simple a case; but when we have to do with surfaces terminated by curves, the method then becomes necessary, or at least superior to any other.

Suppose, *e. gr.* in a parabola, the space included between two infinitely near ordinates, an infinitely small portion of the axis, and an infinitely little arc of the curve; it is certain, this infinitely small surface is no parallelogram; since the two parallel ordinates which terminate it on one side are not equal; and the arc of the curve, opposite to the little portion of the axis, is frequently neither equal nor parallel thereto; and yet this surface, which is no parallelogram, may be considered, in the strictest geometry, as if it really were one, because it is infinitely small; and the error, of consequence, infinitely little, *i. e.* none.

So that, to measure it, there needs nothing but to multiply an ordinate of the parabola by the infinitely small portion of the axis corresponding thereto. Thus we have the element of the whole parabola; which element being raised, by the inverse method, to a finite magnitude, is the whole surface of the parabola.

This advantage, so peculiar to the geometry of infinites, of being able, without any error, to treat little arcs of curves as if they were right lines; curvilinear spaces, as if rectilinear ones, &c. enables it not only to go with more ease and readiness than the ancient geometry to the same truths, but to reach a great number of truths which were inaccessible to the other.

Its operations, in effect, are more easy, and its discoveries more extensive; and simplicity and universality are its distinguishing characters.

The preceding observations are more properly applicable to the method of infinites and indivisibles than to the Newtonian method of fluxions, in which magnitudes of various kinds are capable of increase, not by a repeated accession of parts, but by a continued motion or flux. See the sequel of this article.

Fluxion given, to find the flowing quantity belonging to any.—To have the doctrine of the inverse method correspond and keep pace with that of the direct, we will apply it in the same cases.

1. In the general, to express the variable quantity of a fluxion, there needs nothing but to write the letters without the dots, or to substitute the variable or flowing letter for its fluxion. Thus, the flowing quantities of \dot{x} , \dot{y} , \dot{z} , are x , y , z .

2. To find the fluent of a compound fluxional expression consisting of the products of two or more flowing quantities drawn into their fluxions; or which consists of the fluxion of each quantity drawn into the other, or product of the rest of the quantities.

Multiply the flowing quantities together; and the product is the fluent required. *E. gr.* the fluent of $\dot{x}y + x\dot{y}$ is xy ; of $\dot{x}y\dot{z} + x\dot{y}\dot{z} + xy\dot{z}$ is xyz , &c.

3. To find the fluent of a fraction. The following rule will serve in many cases. Divide the last term in the numerator by the fluxion of the negative square root of the

denominator; then divide this quotient by the affirmative square root of the denominator for the required fluent.

Thus, the fluent of $\frac{\dot{x}y - x\dot{y}}{y^2}$ is $\frac{x}{y}$.

4. To find the fluent of an expression compounded of different fluxional terms connected together by the signs + and -.

Find the separate fluents of the different terms, and connect them together by the signs of their respective fluxions.

Thus, the fluent of $a\dot{x} + \dot{x}y + x\dot{y} - \frac{\dot{x}y - x\dot{y}}{y}$ is $a + xy - \frac{x}{y}$.

5. To find the flowing quantity belonging to the fluxion of any power, either perfect or imperfect. Take the fluxional letter, or letters, out of the equation; then augment the index of the fluxion by 1, or unity; lastly, divide the fluxion by the index of its power so increased by unity.

Thus, suppose $3xx\dot{x}$ proposed; by taking away \dot{x} it will be $3xx$; and by increasing its index by unity, it will be $3xxx$; then dividing it by 3, its now (augmented) index, the quotient will be xxx ; the flowing quantity required.

Again, the fluent of $\frac{n}{m} \dot{x} x^{\frac{n}{m} - 1}$ will be $\frac{x^{\frac{n}{m}}}{\frac{n}{m}}$. In

compound fluxional expressions, if the fluxional part is equal, or in an invariable ratio to the fluxion of the quantity under the vinculum, the fluent may be had by adding 1 to the index of the power, and dividing by the fluxion of the quantity under the vinculum drawn into the index of the power thus increased. *E. gr.* the fluent of $(x + x^2)^3 \times 3\dot{x} + 6x\dot{x}$

is $\frac{(x + x^2)^3 \times 3\dot{x} + 6x\dot{x}}{3 \times \dot{x} + 2x\dot{x}} = (x + x^2)^3$; the fluent

of $(a + cz^n)^m \times d\dot{z}^{n-1}$ is $\frac{(a + cz^n)^{m+1} \times d\dot{z}^{n-1}}{m+1 \times n c \dot{z}^{n-1}}$

$= \frac{(a + cz^n)^{m+1} \times d}{n c \times m + 1}$; and the fluent of $(a^n + z^n)^m \times$

$z^{n-1} \dot{z}$ is $\frac{(a^n + z^n)^{m+1}}{m \times n + 1}$.

By these methods the fluent is found when the fluxion is given; and the rules are derived from those of the direct method; as the rules in division and evolution in algebra are deduced from those of multiplication and involution. As when a fluent consists of a variable and invariable part, the latter does not appear in the fluxion; so when any fluxion is proposed, it is only the variable part of the fluent that can be derived from it. If \dot{x} represent any fluxion that may be proposed, the variable part of the fluent will be equal to x ; for supposing y to be any variable quantity, if $x + y$ could represent the fluent of \dot{x} , then $\dot{x} + \dot{y}$ would be equal to \dot{x} , and $\dot{y} = 0$, or y would be invariable, against the supposition. But supposing K to represent any invariable quantity, then $x + K$ may generally represent the fluent of \dot{x} . If it be required to find such a fluent of \dot{x} as shall vanish when x is supposed to vanish, it can be no other than x ; and if it be required that the fluent should vanish when x is equal to any given quantity a , then by supposing $x + K$ to vanish when x becomes equal to a ; we shall have $a + K = 0$, or $K = -a$; whence the fluent is $x - a$. In the same manner, the fluent of $-\dot{x}$ may be generally represented by $K - x$. When a fluxion that is proposed

proposed coincides with any of those which were deduced from their fluents in the preceding articles, the variable part of the fluent required must coincide with that which was there proposed. As division in algebra leads us to fractions, and evolutions to surds; so the inverse method of fluxions leads us often to quantities that are not known in common algebra, and that cannot be expressed by common algebraic symbols. Maclaurin's Flux. art. 735.

We cannot here pretend to enter into a detail of the rules of the inverse method of fluxions. We shall only observe in general, that a fluxion being proposed, its fluent may sometimes be found accurately in algebraic terms; but this is far from being always possible; and recourse must sometimes be had to a converging series. Thus, if $n x^{n-1} \dot{x}$ were proposed, the variable part of the fluent is found by adding unity to the exponent of the power, dividing by the exponent thus increased, and by the fluxion of the root; that is, the variable part of the fluent of $n x^{n-1} \dot{x}$ will be $\frac{n x^{n-1+1} \dot{x}}{n-1+1 \times \dot{x}} = x^n$. But in many cases this

fluent requires the addition or subtraction of some constant quantity to render it complete, which can only be known from the nature of the problem under consideration: e.g. the fluent of $n x^{n-1} \dot{x}$ may be either represented by x^n or by $x^n \pm a$, because a being constant, the fluxion of $x^n \pm a$, as well as of x^n is $n x^{n-1} \dot{x}$. To find this invariable quantity that must be added or subtracted, is to correct the fluent. In order to do this, the best way is to consider how much the variable part of the fluent, first found, differs from the truth, in that particular circumstance when the required quantity which the whole fluent ought to express, is equal to nothing; then, that difference added to or subtracted from the variable part, as occasion requires, will give the fluent truly corrected. For, since the difference of two quantities flowing with the same celerity, or having equal fluxions, is either nothing at all, or constantly the same, the difference in that circumstance will likewise be the difference in all other circumstances; and therefore, being added to the lesser quantity, or subtracted from the greater, both become equal. Let the variable quantities x and y be first supposed to begin their existence together, or to be generated at the same time: e.g. 1. Let $y = a^2 x \dot{x}$, the fluent will be $y = \frac{a^2 x^2}{2}$; if $y = 0$, $\frac{a^2 x^2}{2}$ vanishes, because x is also $= 0$, and the fluent needs no correction.

2. Let $y = \sqrt{a+x}^3 \times \dot{x}$; and y will be equal $\frac{a+x^3}{4}$;

but when $y = 0$ and $x = 0$, $\frac{a+x^3}{4}$ becomes $= \frac{a^3}{4}$; and, therefore, $\frac{a+x^3}{4}$ always exceeds y by $\frac{a^3}{4}$, and the fluent

properly corrected will be $y = \frac{a+x^3-a^3}{4} = a^2 x + \frac{3 a^2 x^2}{2} + a x^3 + \frac{x^4}{4}$. But this fluent may be found with-

out correction, by expanding $\sqrt{a+x}$ in the original equation, which will become $y = a^3 \dot{x} + 3 a^2 x \dot{x} + 3 a x^2 \dot{x} + x^3 \dot{x}$, whence $y = a^3 x + \frac{3 a^2 x^2}{2} + a x^3 + \frac{x^4}{4}$. 3. Let y

$= \sqrt{a^2-x^2}^{\frac{1}{2}} \times x \dot{x}$; then $y = -\frac{a^2-x^2}{3}$, and y being

$= 0$, $-\frac{a^2-x^2}{3}$ becomes $= -\frac{a^2}{3}$; therefore $-\frac{a^2-x^2}{3}$ is too little by $\frac{a^2}{3}$; and the fluent corrected will be $y = \frac{a^2-x^2}{3} + \frac{a^2}{3}$, &c.

In the solution of other problems, the value of y will be equal to nothing, when that of x is equal to any given quantity a . E.g. Let $y = x^2 \dot{x}$, and y is $= \frac{x^3}{3}$; but when $y = 0$, $\frac{x^3}{3}$ is $= \frac{a^3}{3}$, by supposition; therefore the corrected

fluent will be $y = \frac{x^3-a^3}{3}$. 2. Let $y = -x^n \dot{x}$, then $y = -\frac{x^{n+1}}{n+1}$, which corrected becomes $y = \frac{a^{n+1}-x^{n+1}}{n+1}$, &c. But if the proposed fluxion were $\frac{a \dot{x}}{a-x}$, we cannot find

its fluent by the rule above given; however, we may throw the fluxion into an infinite series (see SERIES) by dividing a by $a-x$ in the usual method, and we shall find the quotient or $\frac{a}{a-x} = 1 + \frac{x}{a} + \frac{x^2}{a^2} + \frac{x^3}{a^3}$, &c. Hence $\frac{a \dot{x}}{a-x} = \dot{x} + \frac{x \dot{x}}{a} + \frac{x^2 \dot{x}}{a^2} + \frac{x^3 \dot{x}}{a^3} +$, &c. Now the fluent of each term of this series may be found by the foregoing rule; and therefore the fluent of $\frac{a \dot{x}}{a-x}$

is $x + \frac{x^2}{2a} + \frac{x^3}{3a^2} + \frac{x^4}{4a^3}$, &c. which may be of use for

determining the fluent when x is very small in respect of a ; because in that case, a few terms at the beginning of the series will be nearly equal to the value of the whole. But it often happens that the series deduced in this method converges to slowly, as to be of little or no use. Or, because the fluxion of the hyperbolic logarithm of any quantity is equal to the fluxion of that quantity divided by the quantity itself, the fluent of $\frac{a \dot{x}}{a-x}$ will be $= x \times \text{hyp. log. of } a-x$. For the fluxion of $a-x$ is $-\dot{x}$, which divided by $a-x$ is $\frac{\dot{x}}{a-x}$. See Maclaurin's Tr. of

Fluxions, art. 737. 744. 827. Stirling, De Summat. Serier. p. 28. and Simpson's Fluxions, vol. i. p. 87. &c.

Mathematicians do not always immediately recur to infinite series, when it does not appear that a fluent can be assigned in a finite number of algebraic terms. The arcs of a circle, and hyperbolic areas or logarithms cannot be assigned in algebraic terms, but have been computed with great exactness by several methods. By these with algebraic quantities, any segments of conic sections, and the arcs of a parabola, are easily measured; and when a fluent can be assigned by them, this is considered as the second degree of resolution. When it does not appear that a fluent can be measured by the areas of conic sections, it may however be measured in some cases by their arcs, and this may be considered as the third degree of resolution. If it does not appear that a fluent can be assigned by the arc of any conic sections (the circle included), it may however be of some use to assign the fluent by an area or arc of some other figure, that is easily constructed or described; and it

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is often important, that the proposed fluxion be reduced to a proper form, in order that the series for the fluent may not be too complex, and that it may not converge at too slow a rate.

We may, therefore, constitute three orders or classes of fluents. First, such as can be accurately assigned in finite terms by common algebraic expressions. Secondly, those which can be reduced to circular arcs and logarithms. Thirdly, such as can be assigned by hyperbolic or elliptic arcs. The first two classes (considering triangles and circles as conic sections) may therefore be measured by the areas of conic sections; and the third class by their perimeters, or lines that bound them.

The fluent of $\frac{\dot{x}}{\sqrt{1 \pm x}}$ is of the first class; that of $\frac{\dot{x}}{\sqrt{x} \times \sqrt{1 \pm x}}$, or of $\frac{\dot{x}}{\sqrt{1 \pm x^2}}$ of the second; but the fluents of $\frac{\dot{x}}{\sqrt{1 \pm x^2}}$, $\frac{\dot{x}}{\sqrt{x} \times \sqrt{1 \pm x^2}}$, $\frac{\dot{x}}{(1 \pm x^2)^{\frac{3}{2}}}$, and $\frac{\dot{x}}{(1 \pm x^2)^{\frac{5}{2}}}$ are of the third class, and as far as has appeared hitherto, cannot be reduced to the former. See Maclaurin's Flux. Book ii. chap. iii. art. 755. 798, &c.

It is to be observed, as to the fluent of $\frac{\dot{x}}{\sqrt{x} \times \sqrt{1 \pm x}}$, or of $\frac{\dot{x}}{(1 \pm x^2)^{\frac{3}{2}}}$, that it does not appear possible to represent them by any hyperbolic and algebraic quantities. But by assuming an elliptic arc likewise, they may be constructed. See Maclaurin, lib. cit. art. 802.

Solikewise to represent the fluent of $\frac{\dot{x}}{\sqrt{x} \times \sqrt{b^2 \pm 2cx - x^2}}$ or of $\frac{\dot{p}}{\sqrt{a^2 b^2 \pm 2acep^2 - p^4}}$, we must have recourse to both the hyperbolic and elliptic arcs. Maclaurin, lib. cit. art. 805.

The fluent of $\frac{r^n}{\sqrt{e + fx^n}}$ is assignable by the arcs of conic sections, when r is an integer number; that is, by right lines, when r is equal to four, or to any multiple of 4; by circular and parabolic arcs (reducible to logarithms) with right lines, when r is any other even number; by arcs of an equilateral hyperbola with right lines, when r is any number of the series 3, 7, 11, 15, &c. and by arcs of the same hyperbola and right lines, with arcs of an ellipsis, that has its eccentricity equal to the second axis, when r is any of the numbers 1, 5, 9, 13, &c. See Maclaurin, *ibid.* art. 809. See FLUENT and FUNCTION.

We presume, upon the whole, that few will be so scrupulous as to deny the Newtonian doctrine of fluxions to be intelligible, and accurately demonstrated. But on the other hand it must be confessed, that the introduction of the notions of motion and velocity, which are mechanical, seems not to have thrown any light on this part of geometry. The consideration of the limiting ratios of variable quantities, and that of the limiting polygons of curves, as it requires no other knowledge but what depends on the common properties of number and magnitude, so it seems, in all respects, the most clear and unexceptionable manner of considering the subjects treated

of in the higher geometry. An eminent mathematician seems to declare himself of this opinion, when he says, that quadrature by limiting polygons is one of that kind which requires no other knowledge but what depends on the common properties of number and magnitude; and so may serve as an instance to shew, that no other is requisite for the establishment of principles for arithmetic and geometry; a truth which, though certain in itself, may perhaps seem doubtful from the nature and tendency of the present inquiries in mathematics. For among the moderns some have thought it necessary, for the investigation of the relations of quantities, to have recourse to very hard hypotheses; such as that of numbers infinite and indeterminate; and that of magnitudes in *fluente fieri*, existing in a potential manner, which are actually of no bigness. And others, whose names are truly to be revered, on account of their great and singular inventions, have thought it requisite to have recourse even to principles foreign to mathematics, and have introduced the consideration of efficient causes and physical powers, for the production of mathematical quantities; and have spoken of them, and used them, as if they were a species of quantities by themselves. Vide Machin, in Phil. Trans. N^o 447.

The elements of the doctrine of fluxions have been delivered by its great author in so concise a manner, as to give occasion to one of the most ingenious writers of the last age to represent it as founded on inconceivable principles, and full of false reasonings. This author in a letter, under the title of the "Analyt," published in the year 1734, has been at great pains to convince his readers that the objects, principles, and inferences of the modern analysis by fluxions, are not more distinctly conceived, or more evidently deduced, than religious mysteries and points of faith. He says he does not controvert the truth of the conclusions, but only the logic and method of mathematicians. He asks how they demonstrate, what objects they are conversant with, and whether they conceive them clearly; what principles they proceed upon, how found they may be, and how they apply them; declaring himself not concerned about the truth of the theorems, but only about the way of coming at them, whether it be legitimate or illegitimate, clear or obscure, scientific or tentative. He considers the conclusions not in themselves, but in their premises; not as true or false, useful or insignificant, but as derived from such principles, and by such inferences. And for as much as it may seem an unaccountable paradox, that mathematicians should deduce true propositions from false principles, he right in the conclusion, and yet err in the premises, he endeavours particularly to explain how this may come to pass, and shew how error may bring forth truth, though it cannot bring forth science. His solution of the paradox is, that in the application of the method of infinitesimals and fluxions, two errors are committed, which being equal and contrary, destroy each other. We cannot enter into a detail of all he says on these and many other heads, nor of all that has been said on the other side, in defence of the method of fluxions, and of its inventor, sir Isaac Newton. An answer to the "Analyt," under the title of "Geometry no Friend to Infidelity," appeared very early under the name of Philethes Cantabrigienis, supposed to be Dr. Jurin; a second, by the same hand, in defence of the first, intitled, "The Minute Mathematician, or the Free-thinker no just Thinker," published in 1735; a Discourse of Fluxions, by Mr. Robins, first published in 1735 (see his Collection of Tracts, by Wilson, vol. ii.); a Treatise of sir Isaac Newton's, with a commentary by Mr. Colson; and several other pieces were published on this subject; particularly a very full and excellent treatise of fluxions,

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by Mr. Maclaurin, late professor of mathematics in the university of Edinburgh, containing not only a most distinct account of the principles of fluxions, but also of the chief discoveries in geometry, and mathematical philosophy of this age. The curious may find an elegant account of this treatise in the Philosophical Transactions, N^o 468, 469.

We presume that Mr. Maclaurin's demonstrations are sufficient to satisfy the most scrupulous; it would exceed the bounds of our design to insert them at length here; but we cannot omit mentioning what seems necessary to explain and illustrate the notion of fluxions; and the principles on which this method of computation is founded. In the doctrine of fluxions, magnitudes are conceived to be generated by motion; and the velocity of the generating motion is the fluxion of the magnitude. Lines are supposed to be generated by the motion of points: the velocity of the point that describes the line, is its fluxion, and measures the rate of its increase or decrease. When the motion of a point is uniform, its velocity is constant, and is measured by the space described by it in a given time: when the motion varies, the velocity at any term of the time is measured by the space which would be described in a given time, if the motion was to be continued uniformly, from that term, without any variation. And this is analogous to the general doctrine of powers, or may be considered as a particular application of it. As a power which acts continually and uniformly is measured by the effect that is produced by it in a given time, so the velocity of an uniform motion is measured by the space that is described in a given time. If the action of the power vary, then its exertion at any rate of the time is not measured by the effect that is produced after that term in a given time, but by the effect that would have been produced if its action had continued uniform from that term; and in the same manner, the velocity of a variable motion at any given term of time is not to be measured by the space that is actually described after that term in a given time, but by the space that would have been described, if the motion had continued uniformly from that term. If the action of a variable power, or the velocity of a variable motion, may not be measured in this manner, they must not be susceptible of any mensuration at all. When it is supposed that a body has some velocity or other at any term of the time, during which it moves, it is not therefore supposed, that there can be any motion in a term, limit, or moment of time, or in an indivisible point of space; and as velocity is always measured by the space that would be described by it, continued uniformly for some given finite time, it cannot surely be said, that geometers pretend to conceive motion or velocity without regard to space or time, as the author of the *Analyst* often suggests. This is a short view of the nature and tendency of the doctrine of fluxions, which we shall now proceed to explain more particularly.

We have already said that lines may be conceived as generated by the motion of points; in like manner surfaces may be conceived as generated by the motion of lines; solids, by the motion of surfaces; angles, by the rotation of their sides; the flux of time being supposed to be always uniform. The velocity with which a line flows, is the same as that of the point which is supposed to describe or generate it. The velocity with which a surface flows, is the same as the velocity of a given right line; that, by moving parallel to itself, is supposed to generate a rectangle which is always equal to the surface. The velocity with which a solid flows, is the same as the velocity of a given plain surface, that, by moving parallel to itself, is supposed to generate an erect prism or cylinder that is always equal to the solid. The velocity with which an angle flows, is measured by the velocity of a

point, that is supposed to describe the arch of a given circle, which always subtends the angle, and measures it. In general, all quantities of the same kind (when we consider their magnitude only and abstract from their position, figure, and other affections) may be represented by right lines, that are supposed to be always in the same proportion to each other as these quantities. They are represented by right lines in this manner in Euclid's *Elements*, in the general doctrine of proportion, and by right lines and figures in the data of that accurate geometer. In this method likewise, quantities of the same kind may be represented by right lines, and the velocities of the motions by which they are supposed to be generated, by the velocities of points moving in right lines. All the velocities we have mentioned are measured, at any term of the time of the motion, by the spaces which would be described in a given time, by these points, lines, or surfaces, with their motions continued uniformly from that term.

A fluxion being the velocity with which a quantity flows at any term of the time while it is supposed to be generated, is therefore always measured by the increment or decrement that would be generated in a given time by this motion, if it was continued uniformly from that term without any acceleration or retardation; or it may be measured by the quantity that is generated in a given time by an uniform motion, which is equal to the generating motion at that term.

Time is represented by a right line that flows uniformly, or is described by an uniform motion; and a moment or termination of time is represented by a point or termination of that line. A given velocity is represented by a given line, the same which would be described by it in a given time. A velocity that is accelerated or retarded, is represented by a line that increases or decreases in the same proportion. The time of any motion being represented by the base of a figure, and any part of the time by the corresponding part of the base; if the ordinate at any point of the base be equal to the space that would be described, in a given time, by the velocity at the corresponding term of the time continued uniformly, then any velocity will be represented by the corresponding ordinate. The fluxions of quantities are represented by the increments or decrements, described in the foregoing paragraph, which measure them; and instead of the proportion of the fluxions themselves, we may always substitute the proportion of their measures.

When a motion is uniform, the spaces that are described by it in any equal times are always equal. When a motion is perpetually accelerated, the spaces described by it in any equal times that succeed after one another, perpetually increase. When a motion is perpetually retarded, the spaces that are described by it in any equal times that succeed after one another, perpetually decrease.

It is manifest, conversely, that if the spaces described in any equal times are always equal, then the motion is uniform. If the spaces described in any equal times that succeed after one another perpetually increase, the motion is perpetually accelerated; for it is plain, that if the motion was uniform for any time, the spaces described in any equal parts of this time would be equal; and if it was retarded for any time, the spaces described in equal parts of this time that succeed after one another would decrease; both of which are against the supposition. In like manner it is evident, that a motion is perpetually retarded, when the spaces that are described in any equal times that succeed after one another, perpetually decrease. The following axioms are as evident as that a greater or

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less space is described in a given time, according as the velocity of the motion is greater or less.

Axiom 1. The space described by an accelerated motion is greater than the space which would have been described in the same time, if the motion had not been accelerated, but had continued uniform from the beginning of the time.

Axiom 2. The space described by a motion while it is accelerated, is less than the space which is described in an equal time by the motion that is acquired by that acceleration continued uniformly.

Axiom 3. The space described by a retarded motion is less than the space which would have been described in the same time if the motion had not been retarded, but had continued uniform from the beginning of the time.

Axiom 4. The space described by a motion while it is retarded is greater than the space which is described in an equal time by the motion that remains after that retardation, continued uniformly.

From these axioms, general theorems concerning motion, of use in the doctrine of fluxions, may be demonstrated.

Thus, when the spaces described by two variable motions are always equal, or in a given ratio, the velocities are always equal, or in the same given ratio; and conversely, when the velocities of two motions are always equal to each other, or in a given ratio, the spaces described by those motions in the same time are always equal, or in that given ratio; that when a space is always equal to the sum or difference of the spaces described by two other motions, the velocity of the first motion is always equal to the sum or difference of the velocities of the other motions; and conversely, that when a velocity is always equal to the sum or difference of two other velocities, the space described by the first motion is always equal to the sum or difference of the spaces described by these two other motions. See Mr. Maclaurin's Treatise of Fluxions, book i. chap. 1.

The main point, in the method of fluxions, is to obtain the fluxion of the rectangle, or product of two indeterminate quantities, since from thence may be derived rules for all other products and powers, be the co-efficients, or the indices, what they will, integers, or fractions, rational or surd; according to the manner of sir Isaac Newton, in the second lemma of his second book of Principles.

Mr. Maclaurin has therefore been very full in establishing this point; and after what he has said, we presume that no reasonable objection can lie either against the clearness and distinctness of the notion of fluxions, or against the truth of the principles, or accuracy of the demonstrations by which their measures are determined. We cannot here insert his demonstrations at length; but as many readers may, perhaps, be desirous of seeing the argument contracted into a narrow compass, we shall here give a summary of it, from the Philosophical Transactions, N^o 468, p. 331, or Martyn's Abridg. vol. viii. p. 31, &c.

A triangle that has two of its sides given in position, is supposed to be generated by an ordinate moving parallel to itself along the base. When the base increases uniformly, the triangle increases with an accelerated motion, because its successive increments are trapezia, that continually increase; therefore if the motion with which the triangle flows, was continued uniformly from any term for a given time, a less space would be described by it than the increment of the triangle, which is actually generated in that time by axiom 1; but a greater space than the increment which was actually generated in an equal time preceding that term, by axiom 2. And hence it is demonstrated, that the fluxion of the triangle is accurately measured by the

rectangle contained by the corresponding ordinate of the triangle, and the right line which measures the fluxion of the base. The increment which the triangle acquires in any time, is resolved into two parts; that which is generated in consequence of the motion with which the triangle flows at the beginning of the time, and that which is generated in consequence of the acceleration of this motion for the same time. The latter is justly neglected in measuring that motion (or the fluxion of the triangle at that term), but may serve for measuring its acceleration, or the second fluxion of the triangle. The motion with which the triangle flows, is similar to that of a body descending in free spaces by an uniform gravity, the velocity of which, at any term of the time, is not to be measured by the space described by the body in a given time, either before or after that term, because the motion continually increases, but by a mean between these spaces.

When the sides of a rectangle increase or decrease with uniform motions, it may be always considered as the sum or difference of a triangle and trapezium; and this fluxion is derived from the last proposition. If the sides increase with uniform motions, the rectangle increases with an accelerated motion; and in measuring this motion at any term of the time, a part of the increment of the rectangle that may be determined, is rejected, as generated in consequence of the acceleration of that motion.

Those who have well understood what precedes will not be at a loss to conceive, that the fluxions of a curvilinear area, whether generated by an ordinate moving parallel to itself, or by a radius revolving round a given centre, may be determined by demonstrations of the same kind. When the ordinates of the figure increase, the increment of the area may be resolved in like manner into two parts, one of which only is to be retained in measuring the fluxion of the area, the other being rejected as generated in consequence of the acceleration of the motion with which the figure flows.

What has been hitherto said will set the difference between the notion of fluxions and that of infinitesimals in a clear light. Fluxions may always be represented by finite quantities. The supposition of an infinitely little magnitude is too bold a postulatam for such a science as geometry. Nor have authors accounted explicitly for the truth and perfect accuracy of the conclusions derived from this consideration. When they determine what is called the *difference*, but more accurately the fluxion of a quantity, they tell us, they reject certain parts of the element, because they become infinitely less than the other parts. But this is no proper reason, not only because a proof of this nature may leave some doubt as to the accuracy of the conclusion, but because it may be demonstrated that these parts ought to be neglected by them at any rate, or that it would be an error to retain them. If an accountant, that pretends to a scrupulous exactness, should tell us, he had neglected certain articles, because he found them to be of small importance; and it should appear that they ought not to have been taken into consideration by him on that occasion, but belong to a different account, we should approve his conclusions as accurate, but not his reasons. See Maclaurin's Treatise of Fluxions in the preface, and book i. chap. 12. where the method of infinitesimals is expressly treated of. Mr. Maclaurin, in the first part of his treatise, considers fluxions in a merely geometrical form, and has demonstrated the rules of the method with all possible accuracy and rigour; but as the great improvements made by this doctrine are chiefly to be ascribed to the facility, conciseness, and great extent of the methods of computation, or the algebraic part, it is necessary to add some account of these methods also.

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Any quantities produced from each other by an algebraic operation, or whose relation is expressed by any algebraic form, being supposed to increase or decrease together, some will be found to increase or decrease by greater differences, or at a greater rate, others by less differences, or at a less rate: and while some are supposed to increase or decrease at one constant rate by equal successive differences, others increase or decrease by differences that are always varying. These rates of increase or decrease may be determined by comparing the velocities of points that always describe lines proportional to the quantities as before mentioned, but they may also be determined without having recourse to such supposition, by a just reasoning from the simultaneous increments or decrements themselves.

When a quantity A increases by differences equal to a , $2A$ increases by differences equal to $2a$, and manifestly increases or decreases at a greater rate than A in the proportion of $2a$ to a or 2 to 1 ; and if m and n be invariable, $\frac{m}{n}A$ increases or decreases by differences equal to $\frac{m}{n}a$, and therefore at a greater or less rate than A in proportion as $\frac{m}{n}a$ is greater or less than a , or m is greater or less than n . This seems to be easily conceived, without having recourse to any other considerations than the relation of the differences by which the quantities increase or decrease. In order therefore to avoid figurative expressions in the algebraic part, it will be proper to substitute in the place of the definition and axioms before mentioned, others that are rather of a more general import, but are perfectly consistent with them: Thus,

Fluxions of quantities are any measures of their respective rates of increase, or decrease, while they vary or flow together.

There can be no difficulty in determining those measures when the quantities increase or decrease by successive differences, that are always in the same invariable proportion to each other. While A by increasing becomes equal to $A + a$, or by decreasing equal to $A - a$, $2A$ becomes equal to $2A + 2a$, or to $2A - 2a$; and as $2A$ increases or decreases at a greater rate than A in the proportion of $2a$ to a ; so the fluxion of A being supposed equal to a , the fluxion of $2A$ must be equal to $2a$.

In the same manner the fluxion of $\frac{m}{n} \times A$, or of $\frac{m}{n} \times A \mp e$, (supposing m , n , and e to be invariable) is $\frac{m}{n} \times a$; and since m may be to n in any assignable ratio, a quantity may be always assigned that shall increase or decrease at a greater or less rate than A in any proportion, or that shall have its fluxion greater or less than the fluxion of A in any ratio. In such cases, the ratio of the fluxions and that of the differences, by which the quantities increase or decrease, are the same.

But while A is supposed to increase at a constant rate by any equal successive differences, if B increase or decrease by differences that are always varying, B cannot be said to increase or decrease at any one constant rate; and it is not so obvious how the fluxion of A being supposed equal to its increment a , the variable fluxion of B is to be determined. It cannot be supposed that the fluxions and differences are always in the same proportion in this case; but it is evident that if B increase by differences,

that are always greater than the equal successive differences by which $\frac{m}{n} \times A$ increases, it cannot increase at a less rate than $\frac{m}{n} \times A$; and it cannot increase at a greater rate than $\frac{m}{n} \times A$, while its successive differences are always less than those of $\frac{m}{n} \times A$. The fluxion of A being still represented by a , the fluxion of B therefore cannot be less than $\frac{m}{n} \times a$ in the former case, or greater than $\frac{m}{n} \times a$ in the latter. The following propositions are consequences of this, and will enable us to determine at what rate B increases, when its relation to A is known.

The successive values of the root A being represented by $A - a$, A , $A + a$, &c. which increase by any constant difference a , let the corresponding values of any quantity produced from A , by any algebraic operation (or that has a dependence upon it so as to vary with it) be $B - b$, B , $B + b$, &c. Then if the successive differences b , b , &c. of the latter quantity always increase, how small soever a may be, then B cannot be said to increase at so great a rate as a quantity that increases uniformly by equal successive differences greater than b , or at so small a rate as any quantity that increases uniformly by equal successive differences less than b . In like manner, if the relation of the quantities is such, that the successive differences b , b , &c. continually decrease; then B cannot be said to increase at the same rate as a quantity that increases uniformly by equal successive differences greater than b , or less than b .

Therefore the fluxion of A being supposed equal to the increment a , the fluxion of B cannot be greater than b or less than b , when the successive differences b , b , &c. continually increase; and cannot be greater than b or less than b , when these successive differences always decrease.

In the same manner, if the latter quantity decrease while the former increases, and its successive values be $B + b$, $B - b$, &c. then if the decrements b , b , &c. continually increase, B cannot be said to decrease at so great a rate as a quantity that decreases uniformly by equal successive differences greater than b , or at so small a rate as a quantity that decreases uniformly by equal successive differences less than b . Therefore in this case the fluxion of A being supposed equal to a , the fluxion of B cannot be greater than b or less than b . And in the same manner if the successive decrements b , b , &c. always decrease, the fluxion of B cannot be greater than b , or less than b . Vide Maclaurin's Flux. book ii. chap. 1. tom. ii. p. 579, seq.

As the fluxions of quantities are any measures of the respective rates, according to which they increase or decrease; so it is of no importance how great or small those measures are, if they be in the just proportion or relation to each other. Therefore if the fluxions of A and B may be supposed equal to a and b respectively, they may be likewise supposed equal to $\frac{1}{2}a$ and $\frac{1}{2}b$, or to $\frac{m}{n}a$ and $\frac{m}{n}b$.

Prop. 1. *The fluxion of the root A being supposed equal to a , the fluxion of the square A^2 will be equal to $2A \times a$.*

To demonstrate this, let the successive values of the root be

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be $A - u$, A , $A + u$, and the corresponding values of the square will be $AA - 2Au + uu$, AA , $AA + 2Au + uu$, which increase by the differences $2Au - uu$, $2Au + uu$, &c. and because those differences increase, it follows from what has been said, that if the fluxion of A be represented by u , the fluxion of AA cannot be represented by a quantity that is greater than $2Au + uu$, or less than $2Au - uu$. This being premised, suppose, as in the proposition, that the fluxion of A is equal to a ; and if the fluxion of AA be not equal to $2Aa$, let it first be greater than $2Aa$ in any ratio, as that of $2A + o$ to $2A$, and consequently equal to $2Aa + oa$. Suppose now that u is any increment of A less than o ; and because a is to u as $2A + oa$ is to $2Au + ou$, it follows, that if the fluxion of A should be represented by u , the fluxion of AA would be represented by $2Au + ou$, which is greater than $2Au + uu$. But it has been shewn, that if the fluxion of A be represented by u , the fluxion of AA cannot be represented by a quantity greater than $2Au + uu$. And these being contradictory, it follows, that the fluxion of A being equal to a , the fluxion of AA cannot be greater than $2Aa$. If the fluxion of AA can be less than $2Aa$, when the fluxion of A is supposed equal to a , let it be less in any ratio of $2A - o$ to $2A$, and therefore equal to $2Aa - oa$. Then because a is to u as $2A - oa$ is to $2Au - ou$, which is less than $2Au - uu$, (u being supposed less than o , as before) it follows, that if the fluxion of A was represented by u , the fluxion of AA would be represented by a quantity less than $2Au - uu$, against what has been shewn. Therefore the fluxion of A being supposed equal to a , the fluxion of AA must be equal to $2Aa$.

The fluxion of A and B being supposed equal to a and b , respectively, the fluxion of $A + B$ will be $a + b$, the fluxion of $\overline{A + B}$, or of $AA + 2AB + BB$, will be $2 \times \overline{A + B} \times a + b$, or $2Aa + 2Bb + 2Ba + 2Ab$, by the last article. The fluxion of $AA + BB$ is $2Aa + 2Bb$, by the same; consequently the fluxion of $2AB$ is $2Ba + 2Ab$; and the fluxion of AB is $Ba + Ab$. Hence if P be equal to AB , and the fluxion of P be p , then p will be equal to $Ba + Ab$, and dividing by P , or AB , we find $\frac{p}{P} = \frac{a}{A} + \frac{b}{B}$. If $Q = \frac{A}{B}$, and q be the fluxion of Q , then $QB = A$, $\frac{q}{Q} + \frac{b}{B} = \frac{a}{A}$, or $\frac{q}{Q} = \frac{a}{A} - \frac{b}{B}$; and consequently $q = \frac{QA}{A} - \frac{QB}{B} = \frac{a}{B} - \frac{Ab}{B^2}$, or $\frac{aB - Ab}{B^2}$.

When any one of the quantities decreases, its fluxion is to be considered as negative.

The rule for finding the fluxion of a power is usually deduced from the binomial theorem of sir Isaac Newton. But as this theorem, though easily found by induction, is not so easy to demonstrate, it is proper to proceed upon a principle, the truth of which may be shewn from the first algebraic elements, with more facility and perspicuity. This principle is, that if n be any integer number, and the sum of the terms E^n , $E^{n-1}F$, $E^{n-2}F^2$, $E^{n-3}F^3$, &c. continued till their number be equal to n , be multiplied by $E - F$, the product will be $E^n - F^n$. For the terms being formed by subtracting continually unity from the index of E , and adding it to the index of F , the last term will be F^n . The product of the sum of the terms multiplied by E will be $E^n + E^{n-1}F + E^{n-2}F^2 + \dots$

+ $E^{n-2}F^2 + \dots + E^{n-1}F + F^n$; and the sum of these two products is $E^n - F^n$. Supposing E to be greater than F , $E^n - F^n$ will be less than $nE^{n-1} \times E - F$, but greater than $nE^{n-1} \times E - F$. For each of the terms E^{n-1} , $E^{n-2}F$, $E^{n-3}F^2$, is greater than the subsequent term in the same ratio that E is greater than F , and E^{n-1} is the greatest term; consequently the number of terms being equal to n , nE^{n-1} is greater than their sum; and $nE^{n-1} \times E - F$ is greater than their sum multiplied by $E - F$, or (by the last paragraph) greater than $E^n - F^n$. Because the last term F^n is less than any preceding term, $nE^{n-1} \times E - F$ is less than the sum of the terms multiplied by $E - F$, or less than $E^n - F^n$.

When n is any integer positive number, the root A being supposed to increase by any equal successive differences, the successive differences of the power A^n will continually increase. For let $A - a$, A , $A + a$ be any successive values of the root, and $\overline{A - a^n}$, A^n , $\overline{A + a^n}$ will be the corresponding values of the power. But $\overline{A + a^n} - A^n$ is greater than $nA^{n-1}a$; as appears by substituting in the last paragraph $\overline{A + a}$ for E , A for F , and a for $E - F$. In like manner, $nA^{n-1}a$ is greater than $A^n - \overline{A - a^n}$. Therefore $\overline{A + a^n} - A^n$ is greater than $A^n - \overline{A - a^n}$, and the successive differences of the power continually increase.

Prop. II. The fluxion of the root A being supposed equal to a , the fluxion of the power A^n will be naA^{n-1} .

For if the fluxion of A^n can be greater than naA^{n-1} , let the excess be equal to any quantity r ; suppose o equal

to the excess of $\sqrt[n]{A^{n-1} + \frac{r}{na}}$ above A , and conse-

quently $\overline{A + o^{n-1}} = A^{n-1} + \frac{r}{na}$. Then $na \times \overline{A + o^{n-1}}$

will be equal to $naA^{n-1} + r$, the fluxion of A^n . Let u be any increment of A less than o ; and because a is to u as $na \times \overline{A + o^{n-1}}$ to $nu \times \overline{A + o^{n-1}}$, it follows (from what has been said) that if the fluxion of A be now represented by the increment u , the fluxion of A^n will be represented by $nu \times \overline{A + o^{n-1}}$, which is greater than $na \times \overline{A + u^{n-1}}$, and this last is itself greater than $\overline{A + u^n} - A^n$. But when the successive values of the root are $A - u$, A , $A + u$, those of the power are $\overline{A - u^n}$, A^n , $\overline{A + u^n}$, the successive differences of which continually increase; consequently if the fluxion of A be represented by u , the fluxion of A^n cannot be represented by a quantity greater than $\overline{A + u^n} - A^n$, or less than $A^n - \overline{A - u^n}$. And these being contradictory, it follows, that when the fluxion of A is supposed equal to a , the fluxion of A^n cannot be greater than naA^{n-1} . If it can be less than naA^{n-1} , let it be equal to naA^{n-1} , or (by supposing o

$= A - \sqrt[n]{A^{n-1} - \frac{r}{na}}$) to $na \times \overline{A - a^{n-1}}$. Then

u being supposed less than o , if the fluxion of A was represented by u , the fluxion of A^n would be represented by $nu \times \overline{A - a^{n-1}}$, which is less than $na \times \overline{A - u^{n-1}}$ (because we suppose u to be less than o) and therefore less than $A^n - \overline{A - u^n}$. But this is repugnant to what has been demonstrated. Therefore the fluxion of A being sup-

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posed equal to a , the fluxion of A^n must be equal to $na A^{n-1}$.

Prop. III. *The fluxion of A being supposed equal to a , the fluxion of $A^{\frac{m}{n}}$ will be $\frac{m a}{n} \times A^{\frac{m}{n}-1}$.*

First, let the exponent $\frac{m}{n}$ be any positive fraction whatever, suppose $A^{\frac{m}{n}} = K$; consequently $A^m = K^n$; and the fluxion of K being supposed equal to k , $m a A^{m-1} = n k K^{n-1}$, and k , or the fluxion of $A^{\frac{m}{n}}$, will be equal to $\frac{m a A^{m-1}}{n K^{n-1}} = \frac{m a K}{n A} = \frac{m}{n} \times a A^{\frac{m}{n}-1}$. When $\frac{m}{n}$ is negative, let it be equal to $-r$; and suppose $A^{-r} = K$, or $1 = A^r K$, then taking the fluxions, $r A^{r-1} a K + k A^r = 0$, and $k = -\frac{r A^{r-1} a K}{A^r} = -r A^{-r-1} a = \frac{m}{n} \times a A^{\frac{m}{n}-1}$.

Prop. IV. *Supposing P to be the product of any factors $A, B, C, D, E, \&c.$ and the fluxions of $P, A, B, C, \&c.$ respectively equal to $p, a, b, \&c.$ then will $\frac{p}{P} = \frac{a}{A} + \frac{b}{B} + \frac{c}{C} + \frac{d}{D}, \&c.$*

Let Q be equal to the product of all the factors of P , the first A excepted, that is, suppose $P = A Q$. Suppose R equal to the product of all the factors, the first two, A and B , excepted; that is, let $P = A B R$, or $Q = B R$. In the same manner let $R = C S$, $S = D T$, and so on. Then the fluxions of $Q, R, S, T, \&c.$ being supposed respectively equal to $q, r, s, t, \&c.$ it follows that $\frac{p}{P} = \frac{a}{A} + \frac{q}{Q} = (\text{because } \frac{q}{Q} = \frac{b}{B} + \frac{r}{R}) \frac{a}{A} + \frac{b}{B} + \frac{r}{R} = (\text{because } \frac{r}{R} = \frac{c}{C} + \frac{s}{S}) \frac{a}{A} + \frac{b}{B} + \frac{c}{C} + \frac{s}{S} = (\text{because } \frac{s}{S} = \frac{d}{D} + \frac{t}{T}) \frac{a}{A} + \frac{b}{B} + \frac{c}{C} + \frac{d}{D} + \frac{t}{T}$, and so on. Therefore $\frac{p}{P}$ is equal to the sum of the quotients when the fluxion of each factor is divided by the factor itself.

If the factors be supposed equal to each other, and their number be equal to n , then $P = A^n$, and by the last proposition $\frac{p}{P} = \frac{na}{A}$; consequently $p = \frac{n P a}{A} = na A^{n-1}$, as was before demonstrated.

Prop. V. *If $P = \frac{A B C, \&c.}{K L M, \&c.}$ and the fluxions of the respective quantities be expressed by the small letters $p, a, b, c, \&c.$ as before, then $\frac{p}{P} = \frac{a}{A} + \frac{b}{B} + \frac{c}{C} - \frac{k}{K} - \frac{l}{L} - \frac{m}{M}, \&c.$*

For $PKLM, \&c. = ABC, \&c.$ and $\frac{p}{P} + \frac{k}{K} + \frac{l}{L} + \frac{m}{M}, \&c. = \frac{a}{A} + \frac{b}{B} + \frac{c}{C}, \&c.$ whence by transposition $\frac{p}{P} = \frac{a}{A} + \frac{b}{B} + \frac{c}{C} - \frac{k}{K} - \frac{l}{L} - \frac{m}{M}, \&c.$ Maclaurin, *ibid.*

The notation we have hitherto used is the same as Sir

Isaac Newton's, in the second lemma of the second book of his Principles. But it is generally more convenient to distinguish fluxions from other algebraic expressions, and in such manner, that the second and higher fluxions may be represented so as to preserve the original fluent in view. Hence Sir Isaac Newton, in his last method, represented variable or flowing quantities by the final letters of the alphabet, as x, y, z ; their first, second, &c. fluxions, respectively, by $\dot{x}, \dot{y}, \dot{z}$; and $\ddot{x}, \ddot{y}, \ddot{z}$, &c. But as this doctrine has been contested and represented by the author of the Analyst, as inconceivable and sophistical, we thought it proper more fully to explain and demonstrate the principles thereof, from Mr. Maclaurin's excellent treatise on this subject.

It is to be observed, that the fluxions of powers are commonly delivered in an algebraic form; but this is not necessary. The same may be done geometrically, by supposing a series of lines in geometric progression, the first term of which is invariable. Then if the second term be supposed to increase uniformly, all the subsequent terms will increase with an accelerated motion. The velocities of the points that describe those lines being compared, it may be demonstrated from common geometry, that the fluxions of any two terms, are in a ratio compounded of the ratio of those terms, and of the ratio of the numbers that express how many terms precede them respectively in the progression. Thus, if $A, B, C, D, E, \&c.$ represent any lines in geometric progression, the first term (A) of which is invariable, then will the fluxion, for instance, of E be to the fluxion of D as $4 E$ is to $3 D$, and the fluxion of E will be to the fluxion of B , as $4 E$ to B . The analogy between powers in algebra and lines in geometric progression is sufficiently known. Thus, A being invariable may be called unity, or 1 ; let $B = x$, then will $C = x x$, $D = x^3$, $E = x^4$, &c. and consequently the fluxion of E , or x^4 , will be to the fluxion of B or x , as $4 x^4$ is to x , or as $4 x^3$ is to 1 . Therefore if the fluxion of x be expressed by \dot{x} , the fluxion of x^4 will be expressed by $4 x^3 \dot{x}$, agreeably to the common algebraic method of expression. Vide Mr. Maclaurin's Flux. book i. chap. 6. See also the Present State of the Rep. of Let. Oct. 1735, p. 248, 249, &c.

If the fluxion of B , or the second term of the progression be invariable, every term of the progression will have fluxions of as many degrees as there are terms that precede it in the progression. And the increment of any term, generated in a given time, may be resolved into as many parts as it has fluxions of different orders; and each part may be conceived to be generated in consequence of its respective fluxion. Hence fluxions of all orders may be illustrated and measured.

As to the higher order of fluxions, it is to be observed, that when a motion is accelerated or retarded continually, the velocity may itself be considered as a variable or flowing quantity, and may be represented as a line that increases or decreases continually. When a velocity increases uniformly, so as to acquire equal increments in equal times, its fluxion is measured by the increment which is generated in any given time. In this case the velocity is represented by a line that is described by an uniform motion; and its fluxions by the constant velocity of the point that describes the line, or by the space which this point describes in a given time. When a velocity is not accelerated uniformly, but acquires increments in equal times, that continually increase or decrease, then its fluxion at any term of the time is not measured by the increment which it actually acquires

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acquires, but by that which it would have acquired, if its acceleration had been continued uniformly from that term for a given time. And in the same manner, when a motion is retarded continually, the quantity by which it would be diminished in a given time, if its retardation was continued uniformly for any term, measures its fluxion at that term. While the point M describes the line E e, let the point Q describe the line I i, so that I Q may be always equal to the space that would be described by the motion of M, if it was continued uniformly for a given time. Then I Q shall always represent the velocity of M, and the velocity of the



point Q shall represent the fluxion of the velocity of M; which therefore is measured, at any term of the time, by the space which would be described by Q, with its motion at that term continued uniformly for a given time. The velocity of M is the fluxion of E M; and therefore the velocity of Q represents the fluxion of E M. (See the beginning of this article.) Thus, when a fluxion of a quantity is variable, it may be considered itself as a fluent, and may have its fluxion which is called the second fluxion of that quantity. This may also have its fluxion, which is called the third fluxion of the first fluent; and motions may be easily conceived to vary in such a manner, as to give ground for admitting second fluxions, and those of any higher order. And as the first fluxion of a variable quantity, at any term of the time, is measured by the increment or decrement, which would be produced, if the generating motion was continued uniformly from that term, for a given time; so its second fluxion may be measured by twice the difference betwixt this increment, or decrement, and that which would be produced, if the acceleration, or retardation, of the generating motion was continued uniformly from that term for the same time. Maclaurin, lib. cit. book i. chap. 1. § 70. 75. and chap. 5, 6.

See a farther illustration of second and third fluxions, in the same author (chap. 3, and 4.) deduced from the consideration of the fluxions of solids.

The author of the Analyst has represented the notions of second and third fluxions as inextricable mysteries; and, indeed, when some speak of the velocities of velocities, &c. it is not easy to say what they mean. But it is to be observed, that the first fluxion of any fluent is not the velocity of that fluent, but the velocity of the motion by which the fluent is conceived to be generated. And in like manner, the second fluxion of that fluent is not the velocity of the velocity of this fluent, but the velocity of the motion by which the quantity is generated that always represents its first fluxion; and so of the rest.

When the fluxion of a quantity is variable, it may be considered as a fluent; and its fluxion, which is the second fluxion of the proposed quantity, may be determined by the preceding propositions. Thus the fluxion of A being supposed equal to a, the fluxion of A A is 2 A a; and if A be supposed to increase at an uniform rate, or its fluxion a to be invariable, 2 A a will increase by equal successive differences; consequently its fluxion, or the second fluxion of A A, will be equal to any of these differences, as to 2 a × A + a - 2 A a, or 2 a a. If a be variable, let its fluxion be equal to z, and the fluxion of 2 A a (or second fluxion of A A) will be 2 a a + 2 A z. In the same manner the fluxion of A being constant, the fluxion of n Aⁿ⁻¹ a, or the second fluxion of Aⁿ, is n a × n - 1 ×

Aⁿ⁻² a, or n × n - 1 × a a Aⁿ⁻²; the fluxion of this, or third fluxion of Aⁿ, is n × n - 1 × n - 2 × a² Aⁿ⁻³. And the fluxion of Aⁿ of any order denoted by m, is n × n - 1 × n - 2 × n - 3, &c. × a^m A^{n-m}, where the factors in the coefficient are to be continued till their number be equal to m. When n is in any integer positive number, the fluxion Aⁿ, of the order n, is invariable and equal to n × n - 1 × n - 2 × n - 3, &c. × aⁿ. The quantities that represent these fluxions of Aⁿ depend on a, which represents the fluxion of A. When A remains of the same value, the first fluxion of Aⁿ is greater or less in the same proportion, as a is supposed to be greater or less; the second fluxion of Aⁿ, is in the duplicate ratio of a; and its fluxion of the order m, is as a^m. If a be variable, but z the fluxion of a, or the second fluxion of A, be constant, then the fourth fluxion of A A will be constant and equal to 6 z z; for we found that the second fluxion of A A was 2 a a + 2 A z; the fluxion of this is 4 a z + 2 a z, or 6 a z; and the fluxion of this is 6 z z. In like manner, the fifth fluxion of A³ will be constant in this case, and equal to 90 z².

The second differences of any quantity B are the successive differences of its first differences; and as the fluxion B increases when its successive differences increase; so its second fluxion, or its fluxions of any higher order increase when its second or higher differences increase. If we arrive at differences of any order that are constant, the fluxion of the same order is constant, and is expressed by that difference. Thus, when A is supposed to increase by constant differences equal to a, and its fluxion is supposed equal to a, the second difference of A A (or A + a² - 2 A A + A - a²) is 2 a a, which is likewise its second fluxion; and the third difference of A³ is 6 a², which is its third fluxion. When n is any integer and positive number, the fluxion of Aⁿ of the order n is equal to the fluxion of any of its first differences of the order n - 2, and so on. For the fluxion of A + aⁿ - Aⁿ (one of the first differences of Aⁿ) of the order n - 1 is n × n - 1 × n - 2, &c. × A + aⁿ⁻¹ - A × aⁿ⁻¹ = n × n - 1 × n - 2, &c. × aⁿ, where the coefficients are supposed to be continued till their number be n - 1, so that the last must be 2. And this we found to be the fluxion of Aⁿ of the order n, in the preceding paragraph. In the same manner the fluxion of A + aⁿ - 2 Aⁿ + A - aⁿ (the second difference of Aⁿ) of the order n - 2, is equal to the fluxion of A + aⁿ - A of the order n - 1; and consequently equal to the fluxion of Aⁿ of the order n. These fluxions are invariable and equal to the last or invariable differences. But in other cases the fluxions of Aⁿ of any order are less than its subsequent differences of the same order, but greater than the preceding differences, as before mentioned. Maclaurin's Flux. art. 720, seq.

By supposing one of the variable quantities to flow uniformly, it will have no second or higher fluxions, and the higher fluxions depending on it will be expressed in a more simple manner. Thus the fluxion of x being supposed constant, the first fluxion of xⁿ being n xⁿ⁻¹ x, its second fluxion will be n × n - 1 × xⁿ⁻² x², and its fluxion of any order m will be n × n - 1 × n - 2 × n - 3, &c. × x^{n-m} x^m, where the factors in the coefficient are to be continued till their number be equal to m.

The second or higher fluxions of quantities may be found by particular theorems (without computing those of the preceding orders) as may be seen by the last example. See farther

farther in Maclaurin's Fluxions, art. 734. See rule 10, in the beginning of this article.

The use of the direct method of fluxions, see specified under the articles EVOLUTE, INFLECTION, MAXIMIS and MINIMIS, and TANGENTS.

Those of the inverse method, see under QUADRATURE and RECTIFICATION of Curves.

FLY, in *Natural History*. See MUSCA; see also ENTOMOLOGY.

FLY, *Fire*. See FIRE-flies.

FLY, *Fishing*. See FISHING-fly.

FLY, *Moscer*, in *Natural History*, the name of a small but very beautiful fly, described by Clavius. It is black, and has two silvery wings, two white eyes, seven yellow spots on the back, and a black one in the middle.

FLY, *Harvest*. See HARVEST.

FLY, *Humble bee*. See HUMBLE-BEE-fly.

FLY, *Lantern*. See LANTERN-fly.

FLY, *Rose*. See ROSE.

FLY, *Scorpion*. See SCORPION-fly.

FLIES, *Eggs of*. See EGGS.

FLIES, *Eyes of*. See EYE.

FLIES, *Legs of*. See LEGS.

FLIES, *Rings of*. See RINGS.

FLY, *St. Mark*, the name of a species of fly, which makes its first appearance every year about St. Mark's day, and is then seen in vast numbers; it is somewhat smaller than the large blue flesh-fly, and has no trunk, but a mouth without teeth: notwithstanding this seemingly innocent organization, the creature does great mischief, and every gardener knows the effects of it at one time or other.

FLY, in *Mechanics*, is an apparatus employed to equalize and regulate the velocity and power of many machines which require such regulation from the inequality either of the moving power, or of the resistance it has to overcome. A fly acts upon the principle that any body, being put in motion with a certain velocity at a certain expence of power, will continue to move until its motion is stopped by a resistance equal to its momentum or sum of the power and velocity which first caused its motion. This principle is carried into effect by various forms of the apparatus; the mass being generally made to revolve upon a centre, and the parts on the opposite sides of the centre being balanced. Two, four, or any other number of equal weights, placed on the opposite ends of arms or radii which are affixed to an axis, constitute a fly. If the weights be supposed to touch each other, or a hoop or ring of one piece be substituted, its form will be much improved; and it is now termed a fly-wheel, and is the manner in which the fly is most generally used.

The friction or resistance which the air opposes to any body in motion, and the friction of the pivots which support the axis of a fly-wheel, are considerable deductions from the power communicated to it; so that instead of a fly-wheel gaining power, as some imagine, it requires a constant exertion of power to keep it in motion, even when no other resistance is applied to prevent it. For this reason a mechanic should never introduce a fly-wheel into a machine, unless the advantages to be derived from its action are greater than the actual loss of power it occasions. As an instance, we will suppose a heavy stamp or hammer to be raised by a water-wheel; the action of the water upon the wheel is constant and uniform, and whilst the machine is lifting the hammer, this action is nearly balanced; but the instant the hammer falls, the principal resistance or load to the water-wheel is removed, and the water urges it rapidly forwards, until it meets the hammer again, when it is suddenly checked, and moves with diminished velocity, until it again loses its load.

In such a case as this the fly-wheel is of great service, for in the interval while the resistance to the water-wheel is not in action, it prevents its acceleration, the power of the water-wheel being employed to give a momentum to the fly-wheel; and as soon as the velocity of the water-wheel is at all diminished, by the return of its load, the momentum of the fly acts to carry it forwards, and continue the motion with the same velocity until the momentum is expended in assisting the water-wheel. By this time the hammer has fallen, and the water-wheel left at liberty to communicate a new impulse to the fly.

In this, and many other similar cases, the power expended in giving motion to the fly is trifling, compared with what it preserves from complete loss during the interval in which the resistance of the water-wheel is inactive. If the water-wheel had been applied to raising a stamp, the equalization might have been made by using three or four stamps in place of one, and adapting the machine to raise them successively: by this means, the load being divided and applied continually, the motion would be rendered nearly as uniform as by a fly-wheel, and without its inconveniences.

In this manner in many machines where fly-wheels are introduced, they are not absolutely necessary, saw mills, pump mills, &c., where a single machine which only acts in one direction is to be moved, all these might be improved by dividing the load, and causing its parts to act in succession; and for pump mills the double acting pumps may be used to great advantage, in lieu of a single one with a fly-wheel.

It is a great object in constructing flies to form them so as to present the smallest resistance to the air. For this purpose a wheel should always be used; the ring should be smooth and truly circular without any projecting nuts, &c.; the radii should be made to present a thin edge to the air, and the whole should be made of metal, that the greatest weight may be contained under the smallest surface; and for this purpose, if the section of the ring is a circle, the smallest surface will be exposed to form a resistance to the air, the radii should be of an elliptic figure, the narrowest edge meeting the air. This form of a fly-wheel is used by Messrs. Murray and Wood of Leeds in the steam engines which they erect, and is included in a patent they have for steam engines, and though they may have been the first who applied it to steam engines, the idea is not original, as Mr. Sully gave that form to his watch-balances many years ago.

A fly-wheel should be cast in one piece of metal, if it is not too weighty; in which case, the pieces of which it is composed should be melted together in the most solid manner imaginable, lest the centrifugal force of such a large mass, moving with a considerable velocity, should endanger the separation of its pieces. If by any accident the bolts connecting them become loose, or are weakened by rusting, (this failure, which has some times happened, is truly dreadful,) the force with which a fragment of the wheel is projected is irresistible; and if it should chance to strike the walls of the building, it would be in danger of total destruction. A method has been lately introduced of putting fly-wheels together, by dove-tailing instead of screw-bolts. The arms are fastened into the ring, and the segments of the ring fastened together by a system of dove-tails, which only admit of being put together in one direction, which is contrary to that in which the centrifugal force acts. Precaution on this head will not appear useless, when it is considered that fly-wheels of 8 and 10 tons in weight in the ring and arms are common in the machinery used for the manufacturing of iron, and their circumference moving at the rate of 300 feet per minute. We have seen one applied to a steam engine of 16 tons in weight, and moving much quicker. The ring is usually in six pieces, of about

about a ton each, and connected only by a few wrought iron bolts as it revolves. The weight of these pieces, constantly acting in new directions, independent of the centrifugal force, is a severe strain upon the bolts and parts forming the connection.

The mode of calculating the size, weight, and velocity of a fly-wheel, proper to regulate the motion of any given piece of machinery, must be very intricate; though it is not usual for practical mechanics to employ calculation, their fly-wheels being adopted from the proportion of some other similar machine, which is found to answer its purpose. This subject has not been investigated in the elementary works on mechanics that we have seen; though, from its great practical utility, it would well repay the labour of any competent analyst, who would turn his thoughts to the subject.

The fly-wheel only acts when the velocity of the machine is variable: for having naturally a tendency to preserve a uniform velocity in itself, it will tend to move the machine connected with it in the same manner. On this account, it would be absurd to employ a fly-wheel in any machine where the power and resistance are always uniform, or bear the same proportion to each other: hence the motion of any machine, deriving assistance from a fly-wheel, cannot be perfectly regular, as it is only when a change in the velocity of the machine takes place that the fly-wheel has any action, and the power it exerts to continue the motion is greater or less, as the change in velocity of the machine is more sudden or slow.

In rolling mills, where the power which will be required is not to be estimated, and at the same time the resistance to the mill is not in action, a great proportion of the time, a large and heavy fly-wheel is necessary; in this case it acts as a collector of power. If the workman has an extraordinary large piece of metal to be rolled, he suffers the mill to work without obstruction a few revolutions of the water-wheel, that the fly-wheel may acquire such a velocity as will overcome the resistance to be opposed to it, which is perhaps far beyond the power of the mill to accomplish without such aid.

The coining press, or fly-press, is another example of the same sort. The momentum of a fly, put in motion by a continued action of several seconds, is expended in an instantaneous stroke upon a piece of metal, acting with astonishing power. The sledge hammer may be instanced as a similar case. The power given to the hammer in a certain space of time, is exerted in an infinitely short time, and with proportional power.

In all cases where the moving force is variable, a fly-wheel must be added, unless the resistance can be adapted to vary in the same degree. A man, turning a winch by his hand, or a crank by his foot, can exert three times the power in many positions which he can in others, particularly in the latter case: a fly-wheel is, therefore, of essential service, and the rotative motion obtained from the steam engine is wholly dependent on the assistance of the fly-wheel.

The fly may be applied to several sorts of engines, whether moved by men, horses, wind, or water; and is of great use in those parts of an engine which have a quick circular motion, and where the power or resistance acts unequally in the different parts of a revolution. In this case the fly, without adding any new force, becomes a moderator, making the motion of revolution almost every where equal and uniform: thus the engine becomes more easily and conveniently acted upon and moved by the impelling force; and this is the only advantage obtained by the fly. The best form of this appendage to machines is that of a wheel

or circle, of a proper size, as this will not only be less resisted by the air, but by being continuous, and the weight every where equally distributed through the perimeter of the wheel, the motion will be more easy, uniform, and regular. In this form, the fly is most aptly applied to the perpendicular drill, which it likewise serves to keep upright by its centrifugal force; as also to a windlass or common winch, where the motion is quick; for in pulling upwards from the lower part, a person can exercise a greater power than in thrusting forward in the upper quarter; when, of course, part of his force would be lost, if it were not accumulated and maintained in the equable motion of the fly. Hence, by this application of force, a man may work all day in drawing up a weight of 40 lbs. whereas 30 lbs. would occasion to him greater labour in a day without the fly.

The force of a fly, when joined with the screw, for stamping the image upon coins, may be calculated thus: suppose its two arms to be each fifteen inches long, measuring from the centre of the weights to the axis of the motion, and the weights to be fifty pounds each, and the diameter of the axis pressing upon the dye to be one inch; if every stroke be made in half a second, and the weights describe an half circumference, which will in this case be of four feet, the velocity will at the instant of the stroke be at the rate of eight feet in a second, and, therefore, the momentum eight hundred; but the arms of the fly being as levers, one brachium of which is fifteen inches long, whilst the other, viz. the semi-axis, is but half an inch, we must increase this force thirty times, which will give twenty-four thousand; an immense force, equal to that of a hundred pound weight falling a hundred and twenty feet, or near two seconds in time; or to that of a body of seven hundred and fifty pounds, falling 16 $\frac{1}{2}$ feet, or one second in time.

Some of these engines for coining crown-pieces have the arms of the flies five times as long, and the weight twice as heavy as those here mentioned, so that the effect is ten times greater. Defaguliers' Exper. Philosoph. vol. i. p. 245. 339.

Besides the utility of fly-wheels, as regulators of machinery, they have been employed for accumulating or collecting power. If motion be communicated to a fly-wheel by means of a small force, and if this force be continued till the wheel has acquired a great velocity, such a quantity of motion will be accumulated in its circumference as to overcome resistances, and produce effects, which could never have been accomplished by the original force. So great is this accumulation of power, that a force equivalent to 20 pounds, applied for the space of 37 seconds to the circumference of a cylinder, 20 feet diameter, which weighs 47 $\frac{1}{2}$ pounds, would, at the distance of one foot from the centre, give an impulse to a musket-ball equal to that which it receives from a full charge of gun-powder. In the space of six minutes ten seconds, the same effect would be produced, if the cylinder were driven by a man who constantly exerted a force of 20 pounds at a winch one foot long. This has been demonstrated by Mr. Atwood in his "Treatise on Rectilinear and Rotatory Motion." This accumulation of power is exemplified in the Sling; and also in the machine for firing, as already stated. Messrs. Watt and Boulton have employed a new kind of fly, called the "Comical Pendulum," for regulating the admission of steam into the cylinder of the Steam-engine, which see.

Notwithstanding the great advantages of fly-wheels, both as regulators of machines, and collectors of power, their

utility wholly depends upon the position which is assigned them, with respect to the impelled and working points of the engine. This position depends altogether on the structure of the machinery. It may be observed, however, in general, that where fly-wheels are employed to regulate machinery, they should be near the impelling power. And, when used to accumulate force in the working point, they should not be far distant from it. In hand-mills for grinding corn, the fly is for the most part very injudiciously fixed on the axis to which the winch is attached. It should always be fastened to the upper mill-stone, so as to revolve with the same rapidity. In the first position, indeed, it must equalize the varying efforts of the power which moves the winch, but when it is attached to the turning mill-stone, it not only does this, but contributes very effectually to the grinding of corn. Ferguson's *Mechanics*, by Brewster, vol. 1.

Fly-press, an instrument of most extensive use in many manufactures for stamping or cutting small articles in metal. It consists of a chisel, punch, or cutting tool, moved by a screw, which is furnished with weights acting as a fly. When these are turned rapidly round, the tool exerts an immense power on any substance subjected to its action. The press is often used without the fly, and is still called, though improperly, a fly-press.

Figs. 1, 2, 3, and 4, of Plate XXVII. (Mechanics) represent a fly-press with its minor parts, such as is in common use in Sheffield in a variety of manufactures, which we shall enumerate in their proper heads. A *AA*, *figs. 1 and 2*, is a massive frame of cast-iron, of the dimensions expressed by the drawing and scale annexed. In the upper part of this frame a female screw, or screw-box is fitted, and the screw *B* passes through it. The top of the screw is fixed to a curved handle *a b c*, furnished with a heavy weight *c*, which acts as a fly, when the handle is turned round by a workman sitting before a bench or table, on which the press is fastened by two bolts passing through projecting pieces, *d, d*, of the iron frame. At *e* a piece of iron is fastened, projecting from the iron frame, and supporting a socket for the square iron slider *f* to slide up and down through, and to avoid any shake in its motion. The socket can be at any time made to fit the slider by the four screws (seen in both figures) which draw the two halves of the socket together. The upper end of the slider *f* is connected with the screw *B*, by a joint which allows the screw to turn round independent of the slider, but obliges the latter to accompany the screw in its vertical motion, either ascending or descending. At the lower end of the slider *f*, the punch or tool, *g*, is fastened by a clamp-screw: it acts in combination with another tool, *h*, called the die, fixed below it in the frame by four screws *i*, as shewn in *fig. 3*, which allow of its adjustment in the true position beneath the tool. The lower tool, or die, *i*, is fitted into a block, which is held by the four screws, and by this means the die can be quickly changed without disturbing the press. The upper tool can be removed in the same manner by releasing the clamp-screw which holds it in the slider *f*.

These, as the essential parts of the fly-press and its operation, are too simple to require much explanation. The workman, being seated before the press, holds the piece of metal to be acted upon in his left-hand, and draws the handle *a* towards him with the other: this, by turning the screws, forces the punch down upon the metal, and the momentum of the weight *c* causes it to act with such force, that the resistance of punching through a thick piece of metal is scarcely perceptible upon the handle. The principal part of this power is gained by the screw as well as by the accumulated *vis inertiae* of the fly. For many purposes

where the resistance is but slight, the weight *c* is removed: the press acts simply by the lever and screw. It still retains, though improperly, the name of the fly-press. This alteration is intended to give the workman such a command of the machine, that he can more quickly reverse the motion than will be the case when the fly is in action. This can be only done where the resistance is very slight. Nails, the teeth of saws, open-work of fenders, and similar articles, are cut with appropriate tools in this manner. *Figs. 4 and 5*, represent some of the tools to be used in the press; *a* is a punch, and *b* the socket, or die, for perforating a circular hole, either with the view of forming a hole in a metallic plate for rivetting, &c. or to preserve the piece struck out for boat-builders rivets, washers, or collets, buttons, ornamental studs for fenders, and a vast variety of other purposes in which small circles of metal are useful. These pieces are forced through the die, and fall through a hole made in the frame *A*, into a small drawer placed beneath the bench for their reception.

C, D, are another pair of tools, in which the die *D* is embossed to the shape intended to be impressed on the ornamental studs cut by the former punch. These are forced into it by the flat surface of the upper tool *C*. In some cases this tool at the same time punches a small hole by which the stud is to be rivetted to the article it is intended to ornament, and the die must then be perforated with a small hole to convey away the fragment of metal forced out by the punch. In many cases these studs are intended to be fastened on by a small pin projecting from their lower surface: in this case they are forged or cast in the manner of a nail, and the point or shank of a stud being inserted into a hole. In the lower die the upper tool is forced down upon it, and imprints its figure upon its head: it is plain that here the upper tool must be embossed instead of the lower. A concave or convex figure is given to the small circles before-mentioned, by making the end of the punch *a*, *fig. 4*, concave or convex, and the pressure it exerts to force out a piece of plate is sufficient to impose upon the fragment the figure of the punch. In *fig. 5*, *E, F* are another small pair of dies for punching small circular holes, and *G H* is a similar pair of tools for square holes.

The manner of punching out the concave shells for small buttons, which are termed *shell buttons*, is deserving of notice. First, small circles, (one of which is seen in the section at *r*, *fig. 6*.) are cut out from plate-brass, by a plain round punch and die, similar to *a b*, *fig. 4*; the dies, (*fig. 6*.) are now used. The circle of brass, being placed over the hole of the die *L*, is forced through it by the end of the other tool, *K*, which being smooth and of a spherical figure, causes the plate of metal to assume the same form, and fall into the drawer beneath in the state of *s*, when it is fit for use. It must be observed, that the aperture through the die, *L*, is as much larger than the tool *K*, as to admit the thickness of the metal all round it, and the upper side of the whole must not be left sharp, but rounded off, so as not to cut, but only bend the piece of metal in passing through it: also the circle of metal must be larger than the hole, that there may be a sufficiency to form the cup or hemisphere *s*. The size of this circle is shewn by the dotted circle *r*, in the plan *fig. 6*, which likewise shews a piece of brass *t*, in the form of a square; it is fastened upon the die, to guide and stop the circle in the point where it is concentric with the hole over which it is placed.

The open-work in fenders, and ornamental fire-grates, is stamped out by the fly-press. For this purpose the pattern intended

intended to be cut out is described upon the plate of cast-steel intended to form the fender, and by appropriate punches the holes are successively cut out. In this manner the diamonds, lozenges, triangles, and other figures, we observe in these articles are removed with great facility. This operation has lately received great improvement from Mr. Proctor of Sheffield. By this new method a great number of punches, and of different figures, are moved at the same time, and the necessity of describing the pattern upon the plate is obviated; whereas in the common method the fenders must pass through the prefs as many times as there are figures in the pattern, and it requires some skill and judgment in placing the fender so correctly in its true position beneath the tool of the prefs, as to have no inaccuracies in the pattern discernible to the eye.

Fig. 7. is the prefs used for the purpose, though not exclusively, all heavy articles being stamped in a prefs of this kind. The improved apparatus is seen on the ground by the side of the prefs, where *AA* is the piece of steel plate, inclosed between two leaves of a frame *B*, similar to book-lids. The leaves are two plates of steel, hardened and tempered; the figure of *D* (*fig. 8.*) cut out in exactly the same pattern as the fender is intended to be. These plates are attached, by four screws in each, to an iron frame *B*, connected by hinges *E*; when shut together, as at *AA*, the apertures in the upper and lower leaves correspond, and the plate *A* is interposed between them. A number of steel punches of the proper figure, as *T*, are placed in the holes of the upper leaf, so as to fill them all up, and the whole is placed upon the lower bed *H* of the prefs, and the flat iron bed *I* being forced down upon the punches by the screw, drives them all through at once, and removes corresponding pieces from the steel plate *AA*. The punches fall through the plate, and are received in a small drawer, beneath the bed of the prefs. The screw being turned back, the tools and plate are removed to the table *K* before the prefs, the book opened, and the plate is put forwards through the leaves, so as to cut out another length. To ensure the parallelism and proper distance from the former pattern, the leaves have one more hole in them than is intended to be cut out at the operation. In *fig. 8.* *a* represents this hole, which is brought to coincide with the hole cut by *b* at the former operation. By this means, it is certain to be in a straight line, and to keep it so. A punch is put through the plate in this hole *a* before it is placed under the prefs a second time. The workman is seated upon the beam *L*, before the table *K*, and finds the punches, which had fallen through into the drawer, standing up in it in the true position; and he has only to transfer them to the leaves for the next stamp. At *N* is shewn another pair of leaves; and at *fig. 9.* a piece of the plate cut between them: *u*, are two of the punches; the leaves are represented as opened to admit the plate, and its position is adjusted by passing two of the punches through the holes stamped in the plate by the former stroke.

The prefs (*fig. 7.*) is of large dimensions; its frame *P* double to give greater strength; the lever *R* loaded at each end with heavy weights. It is many feet in length, though it is seen endways, and consequently foreshortened in the drawing. The frame *S S L* is placed beneath the surface of the ground, and a circular walk is made for the two men who run round with the end of the lever *R*, to give it as great a velocity as possible, that its momentum may give a great energy to the action of the screw. The workman seated upon *L*, is low enough to be beneath the lever as it moves over his head. The screw is pointed at the lower end, and sets in a socket on the top of the slider *M*; to the lower

end of which the moving bed *I* of the prefs is fastened; to balance the weight of the slider and bed, a lever *X*, and a heavy weight *Y*, are applied, which raises them up when the screw is turned back, so as to admit the work being placed beneath the prefs.

FLY, in *Rural Economy*, a disease incident to sheep, in consequence of their being stricken by a fly, which produces a sort of maggot that eats into, and remains in the flesh. The sheep that are in a poor weakly state, and in the wool of which there is a deficiency of what is denominated the *yoke*, are the most exposed to such attacks, as the most suitable *nidus* is, in such cases, afforded for the fly to deposit its *ova* in. After the eggs are thus deposited, they are quickly hatched by the warmth of the animal, directly eating into, and feeding upon it when not guarded against. Its attacks are the most frequent in hot sunny seasons. In order to the removal of the maggots, some have recourse to the cutting or clipping away the wool about the parts affected, and afterwards to the application of tar, or a mixture of train oil and sulphur upon them. When, however, the maggots are not completely formed, the parts are often only dusted with white lead in the state of fine powder. Where precautions of these kinds are neglected, the sheep are speedily destroyed by the disease. In situations where the inclosures are small and much surrounded with woods, it is essentially necessary to keep a constant attention to sheep, to see that they are not struck by the fly, as a few hours may often prove of the utmost consequence in the removal of the disease, and the safety of the animals.

It has been suggested that the shepherds in the midland districts of the kingdom employ a variety of applications as preventatives of the fly, especially with lambs. They find train oil efficacious, but it souls the wool, and makes the sheep unpleasent to touch. An ointment, composed of butter, and the flower of sulphur, is in the highest esteem. In preparing it the butter is first melted over a slow fire, and then a proper quantity of sulphur stirred into it, until it becomes of a pretty thick consistence, and rather firm. In applying it, a piece about the size of a small walnut is rubbed between the hands, which are then drawn along the back; or other parts of the sheep. As insects have certainly their antipathies, it is useful and interesting to send out those of the sheep-fly. The manner of destroying the maggots just noticed is both effectual, and when referred to its time, simple and easy. In the part of the country mentioned above, instead of clipping the wool from the part which is affected, and forcing out the maggots with the points of the shears, the wool is parted by the fingers, and the maggots removed by the point of a knife, or dislodged in some other manner, without breaking the coat; and then a small quantity of white lead, finely scraped from a lamp, is mixed in the wool, which, by being agitated with it, is carried down in an even manner upon the part which had been affected. It is found that a large quantity discolours the wool, while a little prevents any further harm from the maggots that may have been left among it, driving them away from the wound; and at the same time promotes its healing. It is stated that in well shepherded flocks, that are seen regularly twice in the course of the day, there is no such thing as a broken coat. But though the practice that has been just laid down may be extremely proper in many cases, it does not always prove successful. The oxyds or calces of mercury are found far more effectual in some cases of this troublesome disease.

FLY, a disease in turnips, which is supposed to be produced by a fly that eats the leaves. It has been observed by the author of the "Philosophy of Agriculture

and Gardening," that if this destructive insect be of the *scarabeus* or beetle kind, which arises out of the earth, it may be destroyed by rolling. He remarks, that the Chinese are said by Sir George Staunton to steep all their seeds in liquid manure until they swell, and their germination begins to appear, which they believe not only hastens the growth of the plants, but also defends them against insects beneath the soil; and that to this, Sir George observes, it may be owing that the Chinese turnips escape the fly, so injurious to them in this country. An observation of Mr. Guillet, in the Bath Agricultural Papers, seems, he says, also to confirm this idea. He asserts, that when turnip seed is sown during rain, or has rain immediately afterwards, the first leaves are so vigorous that the fly never attacks them; or that the rain itself is so inconvenient to the fly as to prevent its appearance. It is likewise supposed by the Rev. Mr. Stacy, in his "Observations on the Failure of Turnip Crops," that the dryness of the soil at the time the seed is put into the ground, and the great heat of the season, by not suffering the seed to vegetate quickly, is a principal cause of the destruction that so frequently takes place in crops of this kind. It is also asserted by Mr. Eeter, in the Transactions of the London Society of Arts, that the sowing turnips in drills deeper than by broadcast, accelerates the growth of the plant, by giving it more moisture; whence it sooner puts forth its rough leaves, and escapes the depredations of the fly. He speaks highly of the use of the drill, advises the rows to be one foot distant, uses three quarters of a pound of seed to an acre, and sows them from one inch and a half to two inches deep. As it is probable that injury may be done by sowing too deep, as well as by the contrary, in either case it will be the most proper practice to constantly choose as moist a season as possible for sowing the summer crops of this sort of plants. And whenever the season is very dry, to have recourse to the steeping of the seed for a few hours, but not more than that, before it is put into the ground. It is likewise supposed by some, that by sowing raddish, mustard, or some other sort of seed that this insect may prefer when in the state of young plants, at the same time with the turnip seed, the disease may be much lessened, if not wholly prevented.

But another, and probably a better mode of guarding against and preventing the disease, is that of having the land well enriched with manure before the crop is put in, as by that means the young plants are rapidly pushed forward into broad leaf, when they become secure from the ravages of the fly: The footing the rows of the young turnips just as they appear, by sprinkling the foot along them in a sort of stream, from a seed lip, has also been advised as a successful practice, which was long ago known to Ellis. Several other methods have been recommended at different times, but no certain mode of removing or preventing the effects of this insect on young turnip plants has hitherto been discovered. See TURNIPS.

FLY, in the *Sea Language*, that part of the mariner's compass on which the thirty-two winds are drawn, and to which the needle is fastened underneath. See COMPASS.

FLY of an *Ensign*, is the breadth or extent from the staff to the extremity or edge that flutters loose in the wind.

Let FLY the *sheets*, at *Sea*, a word of command, in case of a gust of wind, lest the ship should overfet, or spend her top-sails and masts, to have the sheet go-amain, and then the sail will hold no wind.

FLY the *Heels*, in the *Manege*. A horse is said to fly the heels when he obeys the spurs. See HEELS and SPURS.

To FLY *grofs*, in *Falconry*, is said of a hawk, when she flies at the great birds; as cranes, geese, herons, &c.

FLY on *Head*, is when the hawk, missing her quarry, betakes herself to the next check, as crows, &c. See HAWK.

FLY-*boat*, or *Flight*, a large flat-bottomed Dutch vessel, whose burthen is generally from four to six hundred tons. It is distinguished by a remarkably high stern, resembling a Gothic turret, and by very broad buttocks below.

FLY-*tool*, is a very light narrow wooden spade shod with iron, which the navigators of a canal use for cutting or throwing out any soft clay, peat, or the like, and which they do so quickly and dextrously as to keep two successive pieces flying in the air together.

FLY-catcher, in *Ornithology*. See MUSCICAPA.

FLY-catcher of *Edwards*, grey and yellow. See TODUS cinereus.

FLY-catcher of *Latham*, *paradise*. See TODUS paradiseus.

FLY-catcher, *green black-cap*, and *blue-headed green*, varieties of the C RETHIA Spiza.

FLY-catcher, *yellow tail*. See MOTACILLA flavicauda.

FLY-bane, in *Botany*. See SILENE.

FLY-honey-suckle. See LONIC RA.

FLY-honey-suckle, *African*. See HALLERIA.

FLY-tree, in *Natural History*, a name given by the common people in America to a tree, whose leaves, they say, at a certain time of the year, produce flies. On examining these leaves about the middle of summer, the time at which the flies used to be produced, there are found on them a sort of bags of a tough matter, of about the size of a filbert, and of a dusky greenish colour; on opening one of these bags with a knife, there is usually found a single full-grown fly of the gnat kind, and a number of small worms, which, in a day or two more have wings, and fly away in the form of their parent. The tree is of the mulberry kind, and its leaves are usually very largely stocked with these insect bags, and the generality of them are found to contain the insects in the worm state; when they become winged, they soon make their way out. The bags begin to appear when the leaves are young, and afterwards grow with them; but they never rumple the leaf, or injure its shape. They are of the kind of leaf-galls, and partake in all respects, except size, of a species we have frequent on the large maple, or, as it is called, the sycamore. Philof. Trans. N^o 431. See farther, Reaumur's Hist. vol. vi. p. 34. See PUCERON.

FLY-wort. See SILENE.

FLY-island, in *Geography*, an island in the South Pacific ocean, discovered by Le Maine and Schouten in the year 1616, so called from the number of flies found there. It is covered with trees, but within overflowed at high water. Some inhabitants were seen naked. S. lat. 15. W. long. 150 20'.

FLYERS, in *Architectur*, are the series of steps, which taken altogether constitute a flight, and any single step is called a flyer, the treads of which are of equal breadth throughout, and thus flyers differ from winders; the treads of the latter diminish continually from the wall of the staircase to the well-hole.

FLYING, the progressive motion of a bird, or other winged animal, in the liquid air.

Flying is either *natural* or *artificial*.

FLYING *Army*. See ARMY.

FLYING *Bridge*. See BRIDGE.

FLYING *Camp*. See CAMP.

FLYING, *natural*, is not produced by an apparatus, or structure

structure of parts, concerted for that end by nature herself. Such is that of most birds and insects, and of some fishes.

The parts of birds, &c. chiefly concerned in flying, are the wings and tail: by the first, the bird sustains and wafts himself along; and by the second, he is assisted in ascending and descending, to keep his body poised and upright, and to obviate the vacillations thereof.

It is by the largeness and strength of the pectoral muscle, that birds are so well disposed for quick, strong, and continued flying. These muscles which, in men, are scarcely a seventieth part of the muscles of the body, in birds exceed and outweigh all the other muscles taken together; upon which Mr. Willughby makes this reflection, that if it be possible for man to fly, his wings must be so contrived and adapted, that he may make use of his legs, and not his arms, in managing them.

The flying of birds is thus effected:

The bird first bends his legs, and springs with a violent leap from the ground; then opens, or expands the jointures of his wings, so as to make a right line, perpendicular to the sides of his body: thus, as the wings with the feathers therein, constitute one continued lamina, being now raised a little, and vibrating the wings, with great force and velocity, perpendicularly against the air; the air, though a fluid, resists those succussions, both from its natural inactivity, and from its elasticity, which makes it restore itself after it has been compressed, and re-act as much as it has been acted on; by such means is the whole body of the bird protruded. The sagacity of nature is very remarkable in the opening and recovering of the wing for fresh strokes. To do it directly, and perpendicularly, it must needs have a great resistance to overcome; to avoid which, the bony part, or bend of the wing, into which the feathers are inserted, moves sideways with its sharp end foremost, the feathers following it like a flag.

The resistance the air makes to the withdrawing of the wings, and consequently, the progress of the bird will be so much the greater, as the waft, or stroke, of the fan of the wing is the longer: but as the force of the wing is continually diminished by this resistance, when the two forces are come to be in equilibrio, the bird will remain suspended in the same place; for the bird only ascends so long as the arch of air the wing describes makes a resistance equal to the excess of the specific gravity of the bird above the air: if the air, therefore, be so rare as to give way, with the same velocity as it is struck withal, there will be no resistance, and, consequently, the bird can never mount.

Mr. Ray, Willughby, &c. have supposed the tail to do the office of a rudder, in steering and turning the body this way or that; but Borelli has shewn it to be unfit for any such office. The flying of a bird, in effect, is quite a different motion from the sailing of a ship: birds do not vibrate their wings towards the tail as oars are struck towards the stern, but waft them downwards; nor does the tail of the bird cut the air at right angles, as the rudder does the water, but is disposed horizontally, and preserves the same situation what way soever the bird turns.

In effect, as a vessel in the water is turned about on its centre of gravity to the right, by a brisk application of the oars to the left, so a bird, in beating the air with its right wing alone, towards its tail, its fore part will be turned to the left; as when in swimming, by only striking out with the right arm and leg, we are driven to the left.

Add, that birds with long necks have another way of altering their course; for, by only inclining the head and neck towards this or that side, the centre of gravity of the

whole being changed, the bird will proceed according to this new direction.

Birds never fly upwards in a perpendicular line, but always in a parabola, the line described by projectiles. In a direct ascent, the natural and artificial tendency would oppose and destroy each other; so that the progress would be very slow. In a direct descent, they would aid one another, so that the fall would be too precipitate. Indeed the hawk very frequently did take that advantage in seizing of the partridge; but ordinarily birds keep their wings expanded, and at rest, to retard their descent; and at the same time stretch out their legs.

FLYING, *Artificial*, is that attempted by men, by the assistance of mechanics.

The art of flying is one of the great desiderata of mechanics: it has been attempted in divers ages: the discovery of it might prove of great service, and also of great disservice to mankind.

Nobody seems to have bid so fair for that invention as our famous friar Bacon, who lived near six hundred years ago. He not only affirms the art feasible, but assures us he himself knew how to make an engine, in which a man sitting might be able to carry himself through the air like a bird; and affirms, that there was another person who had actually tried it with success. See the article BACON.

The secret consisted in a couple of large thin hollow copper globes, exhausted of air, which being much lighter than air, would sustain a chair, whereon a person might sit.

F. Francisco Lana, in his Prodomo, proposes the same thing, as his own thought. He computes, that a round vessel of plate-brass, fourteen feet diameter, weighing three ounces the square foot, will only weigh 1843 ounces; whereas a quantity of air of the same bulk will weigh 2155 $\frac{2}{3}$ ounces; so that the globe will not only be furnished in the air, but will carry with it a weight of 373 $\frac{1}{3}$ ounces; and by increasing the bulk of the globe, without increasing the thickness of the metal, he adds, a vessel might be made to carry a much greater weight.

But the fallacy is obvious: a globe of the diameter he describes, Dr. Hook shews, would not sustain the pressure of the air, but would be crushed inward. Therefore, in whatever ratio the bulk of the globe were increased, in the same must the thickness of the metal be also, and consequently the weight increased: so that there would be no advantage in such augmentation.

The same author describes an engine for flying, invented by the Sieur Besnier, a smith of Sable, in the county of Maine. Vide Philosoph. Collect. N. 1.

The famous bishop Wilkins was so confident of success in this art, that he seems to intimate, that, in future ages, it will be as usual to hear a man call for his wings when he is going a journey, as it is now to call for his boots. See Math. Magie, b. ii. ch. 7. Discovery of a new World, prob. xiv. p. 135. Secret and Swift Messenger, ch. iv. See AEROSTATION.

FLYING *Battlements*, in *Pointed Architecture*. This is one of the boldest and most striking features of the style of building in question; being a prop of masonry work, raised over the air to support some elevated part of a building, which cannot be propped immediately from the ground. Flying buttresses are generally seen on the outside of our ancient cathedrals, and other large magnificent churches, stretching over the side aisles from the main exterior buttresses to the upper walls of the nave, to prevent them from spreading.

The geometrical principle on which they support the walls and the buttresses, by means of the straight sloping line of their upper part, and are supported by them, by means of the arches beneath, is one proof, amongst many others, of the ingenuity and scientific skill of the architects of the middle ages.

FLYING of Colours, is used by painters to denote their want of durability, which they express by their *flaming*.

FLYING-fish, in *Ichthyology*, a name given by the English writers to several species of fish, which by means of their long fins have a method of keeping themselves out of water for some time. The flying-fish, most properly so called, is the *exocoetus* of the ancient authors, and of Arædi. (See *EXOCOETUS*.) See a minute and accurate description of the *exocetus volitans*, or flying-fish, in the *Phil. Trans.* vol. lxxviii. part ii. p. 791.

FLYING-fish is also a name of a fish of the gurnard kind. See *CALLYONIMUS Lyra*.

FLYING Pinion, is a part of a clock, having a fly or fan, whereby to gather air, and so bridle the rapidity of the clock's motion, when the weight descends in the striking part. See *CLOCK*.

FO, or **FOE**, in *Mythology*, the object of religious veneration and worship in China, and also, under various other appellations, in different parts of India. Fo is supposed by Sir William Jones to be the Buddha of the Hindoos (see *BOODH*); and it has been generally supposed that the worship of this deity was introduced into China, together with a few of his votaries and fragments of the canonical books of the Indians, about the 65th year of the Christian era; though some have referred this event to so late a period as the year 630. See under the article *CHINA*, the account of the *Religion of the Chinese*. The native place of this pretended god is unknown; nor can his origin and the etymology of his name be satisfactorily ascertained. Some suppose that he lived about 600 years before Christ; and that he first appeared in the southern part of India, among the nations situated on the borders of the Indian ocean, and thence disseminated his philosophy, by means of his disciples, to all India. It is related by his followers, that at the age of 19 he retired to a desert accompanied by some philosophers, to whose tuition he committed himself. At the age of 30, it is said, he felt himself suddenly inspired, and that he attained to the intuitive knowledge of the first principles of all things, from which time he took the name of Fœ, which signifies "something more than human." His mystical philosophy he is said to have delivered to innumerable disciples, under the veil of allegory; and the Japanese add, that in his contemplations, during which his body remained unmoved, and his senses unaffected by any external object, he received divine revelations, which he communicated to his disciples. As soon as he became a god, he thought of establishing his doctrine, and of proving his celestial mission by performing miracles. The number of his disciples was immense, and they soon spread his opinions through every part of India, and the higher extremities of Asia. His priests are generally known by Europeans under the appellation of *Bonzes*. For an account of their character and office, we refer to that article.

Buddha, Xekias, or Fœe, for by these and other names he is called, is said to have had both an exoteric and esoteric doctrine; in the former he taught the difference between good and evil; the immortality of the souls of men and brutes; different degrees of reward or punishment in a fu-

ture world; and the final advancement of the wicked, after various transmigrations, to the habitations of the blessed. This doctrine of the transmigration of souls has given rise to that multitude of idols, which are revered in every place, where the worship of Fo is established. Quadrupeds, birds, reptiles, and the vilest animals had temples, and became objects of public veneration, because the soul of the god in his transmigrations and metamorphoses might have inhabited their bodies. His followers also say, that the god Fo came upon earth to save mankind; that by him their sins are expiated; and that he alone can procure for them happiness in the life to come. They enjoin the strict observance of five precepts; the first forbids the killing of any living creature; the second, the taking away of the goods of another; the third forbids men to pollute themselves by uncleanness; the fourth, to lie; and the fifth, to drink wine. They, above all, recommend the practice of certain acts of mercy; such as, to treat their bonzes well, to build monasteries and temples for them, and to supply them with every thing necessary, in order that they may be able, by the assiduity of their prayers, and the penance which they impose, to merit forgiveness, and the remission of all their sins. The Bonzes pretend, that when Fo had attained to the age of 79, he perceived that his borrowed divinity could not prevent his paying the debt of nature like other men; and, therefore, he would not leave his disciples without revealing to them the whole secret and hidden mysteries of his doctrine. Having called them together he declared that till that moment he had always thought proper to speak to them in parables, and that for 40 years he had disguised the truth under figurative and metaphorical expressions; but being about finally to leave them, he would unveil the whole mystery of his wisdom. "Learn then," said he, "that there is no other principle of all things, but a vacuum and nothing; from nothing all things have sprung, to nothing they must again return, and then all our hopes end." This is the sum of his esoteric or internal doctrine. To one of his favourite disciples he committed his most secret thoughts, and him he entrusted with the charge of propagating his doctrine. He desired him never to attempt to support his tenets by proofs and long reasoning, and commanded him to put only at the beginning of the books which he published; "Thus have I learned." In one of his works the same Fo mentioned another master more ancient than himself, whom the Chinese name "O-mi-to," and the Japanese "Amida." The bonzes assure us, that the latter became so eminently holy, that it is at present sufficient only to invoke him, in order to obtain immediate pardon for the greatest crimes. The Chinese, therefore, on almost every occasion, have continually in their mouth these two names, "O-mi-to, Fo!"

FO-HI, one of the first and most celebrated legislators of China, and said to be the founder of the Chinese monarchy. (See *CHINA*.) Little is known of the methods which this legislator adopted for civilizing the country: and the precise era of his establishment is so ancient, that it cannot be ascertained. An ancient book, called "Yekin," which is still preserved in China, is ascribed to Fo-hi; but it is written in hieroglyphics; and no one has been able to give a satisfactory explanation of its contents. The most probable conjecture is that of Leibnitz, that it was intended to teach the art of numeration. Fo-hi was succeeded by several emperors, who carried forward the work of civilization, particularly by means of moral allegories, fables, and poems.

FOA, in *Geography*, one of the Hapæe islands, in the S. Pacific ocean, between Haano and Lefooga, to both

which it is joined by a reef, hardly half a mile from either.

FOAL, in *Rural Economy*, is the common name of the young of the horse kind. The male is termed a *colt* foal, and the female a *filly* foal. Foals, when they are of the valuable kind, should always be kept as well as possible while they are growing, as without attention in this respect they seldom make good horses. See HORSE.

It is contended by some experienced horse breeders, that it is not by any means difficult to ascertain in the foal, what the form of it will be when grown to the full size, as it will carry the same shape at six years old that it carried during the first month, if it be not improperly managed in the keeping afterwards. And it will have the good or defective form accordingly. In judging of the height, the shin-bone should be particularly regarded; where that is large, and long from the knee to the pastern, it indicates a tall or full sized horse. And another method of judging is that of examining the space between the knee and withers, which being doubled will mostly give the height of the animal when full grown. The means of ascertaining their probable goodness at this early period is more difficult, but it is commonly supposed that where they are active, stirring, not easily frightened, and anxiously striving for mastery, they will prove well metted horses in their full grown state.

FOAL-foot, a common name applied sometimes to the troublesome weed termed colt's foot. See COLT's-foot.

FOAL-teeth, those which are put forth during the first year of the animal's age. See AGE of the HORSE, and HORSE.

FOALING, a term signifying the act of parturition or bringing forth in the mare. Great attention should be paid to the animals about this period, as it not infrequently happens that mares destroy their foals by becoming entangled in the stables or other places, by means of their halters, &c. or by the difficulty of bringing them forth. It is the best way to look to them frequently at such times.

FOCA, in *Geography*, an island in the Atlantic, near the coast of Guinea, and the mouth of the Calbari, with a town of the same name, called by the Dutch *Wandorp*.

FOCAGE, or FUAGE, fire-money, hearth-money, or chimney-money. See FUAGE.

FOCAI, in *Geography*, a town of Egypt; 20 miles N. of Abu-Girzé.

FOCARO, a mountain of Naples, in Otranto; 20 miles N.E. of Tarento.

FOCAS, a town of Japan, in the island of Nippon; 145 miles N.W. of Jedo.

FOCHABERS, a market town of Scotland, in Bauffshire, consisting of one street, on the right hand of the Spey; 12 miles W. of Cullen and 9 E. of Elgin. Near it stands Gordon castle, a magnificent seat, in a very extensive park, founded by George, second earl of Huntley; originally called the castle of the Bog of Galt. A little below the common ferry across the river is the ford, through which the duke of Cumberland marched his army in 1746, in the face of the rebels, who were advantageously posted on a rising ground. Thence to Elgin, the soil, for most part, is light, moorish, and barren. At the mouth of the Spey is Garmouth harbour, where great quantities of salmon, preserved in ice, are shipped for London. From this port fir-timber of a good quality is exported. N. lat. 57° 26'. W. long. 3° 3'.

FO-CHAN, a famous village of China, 4 leagues from Canton, said to be the largest and most populous in the world; it is called a village, because it is not inclosed by

walls, and has not a particular governor, although it carries on a great trade, and contains more houses and inhabitants than even Canton itself. It is reckoned to be three leagues in circumference; and to contain a million of inhabitants.

FOCHEA, FOGGIA, or PHOGGIA, a sea-port of Asiatic Turkey, in Natolia, situated at the mouth of the Hermus, in the gulf of Smyrna, anciently called Phocæa; 28 miles N.W. of Smyrna. N. lat. 38° 44'. E. long. 26° 39'.

FOCHIA, a town of Bosnia; 75 miles S.S.W. of Belgrade.

FOESANI, a town of European Turkey, in Moldavia, on the Milcou; 54 miles W.N.W. of Galacz. N. lat. 44° 42'. E. long. 27° 13'.

FOCUS, in *Geometry*, and the *Conic Sections*, is applied to certain points in the *parabola*, *ellipse*, and *hyperbola*; wherein the rays reflected from all parts of these curves do concur or meet.

The *foci* of an *ellipse* are two points in the axis, on which, as centres, the figure is described; or two points in the longer axis, whence two right lines, being drawn to any point in the circumference, shall be together equal to the axis itself. These are also called *umbilici*. See CONIC SECTIONS and ELLIPSE.

FOCUS of the *Hyperbola*. See CONIC SECTIONS and HYPERBOLA.

FOCUS of a *Parabola*, is a point in its axis, wherein the semi-ordinate is equal to the semi-parameter: or, a point in the axis distant from the vertex, by a fourth part of the parameter, or latus rectum. See CONIC SECTIONS and PARABOLA.

FOCUS, in *Optics*, is a point wherein several rays concur, and are collected; either after having undergone refraction, or reflection.

It is thus called, because the rays being here brought together, and united, their force and effect are increased; so that they become able to burn; accordingly, it is in this point that bodies are placed to sustain the force of burning-glasses, or mirrors.

It must be observed, that the focus is not, strictly speaking, a point; the rays are not all accurately collected into the same place: Huygens demonstrates, that the focus of a lens, convex on both sides, is $\frac{1}{3}$ ths of the thickness of the lens.

FOCUS, in *Diptics*, is the point wherein refracted rays, rendered convergent by refraction, do concur or meet, and cross the axis.

The same point is also called the *point of concurrence*, or *concurrency*.

FOCUS, *Virtual*, is the point from which refracted rays, when by refraction they are rendered divergent, do begin to diverge or recede from each other.

The same point is also called *pointum divergentis*, or *point of divergence*, in opposition to the focus, which is called the *point of concurrence*. Suppose, e.g. the concavity of a glass to be a *b c*. *Plat. V. Optic. p. 11.* and its axis *d e*; let *f g* be a ray of light falling on the glass parallel to the axis *d e*, and let *d* be the centre of the arch *a b c*. This ray *f g*, after it has passed the glass, at its emission at *c*, will not proceed directly to *b*, but will be refracted from the perpendicular *d g*, and become the ray *g l*. Draw then directly *g l*, so that it may cross the axis in *e*. The point *e* so found, is called by Mr. Molyneux the *virtual focus*, or *point of divergence*.

The effect of convex glasses, or lenses, is to render the rays transmitted through them, convergent, and to bring them together into a focus, which will be nearer or farther

farther off, as the lens is a portion of a greater or less sphere.

The effect of concave lenses is to render the rays transmitted through them divergent, or to disperse them from a virtual focus.

For the place, position, distance, &c. of the foci of rays refracted through plain, concave, and convex mediums of divers densities, as air, water, glass, &c., see REFRACTION, LENS, &c.

The laws of the foci of glasses, and the methods of finding the same, being those of most use and importance; we shall here subjoin them apart, as delivered and demonstrated by Mr. Moynaux, in his "Dioptrica Nova."

1. The focus of a convex glass, *i. e.* the point wherein parallel rays transmitted through a convex glass, whose surface is the segment of a sphere, do unite, is distant from the pole, or vertex of the glass, almost a diameter and half of the convexity.

2. In a plano-convex glass the focus of parallel rays, or the place where they unite with the axis, is distant from the pole of the glass a diameter of the convexity, provided the segment do not exceed thirty degrees.

The rule or canon in plano-convex glasses is as 107 : 193 :: fo is the radius of the convexity : to the refracted ray taken to its concurrence with the axis; which in glasses of larger spheres is almost equal to the distance of the focus taken in the axis.

3. In double convex glasses of the same sphere, the focus is distant from the pole of the glass about the radius of the convexity, if the segment be but thirty degrees.

But if the convexities be unequal, or if the two sides be segments of different spheres, then the rule is,

As the sum of the radii of both convexities : to the radius of either convexity alone :: fo is the double radius of the other convexity : to the distance of the focus.

Here observe that the rays which fall nearer the axis of any glass are not united with it so near the pole of the glass as those farther off : nor will the focal distance be so great in a plano-convex glass when the convex side is towards the object, as when the plain side is towards it.

Hence it is truly concluded, that, in viewing any object by a plano-convex glass, the convex side should always be turned outward; as also in burning by such a glass.

Focus, for the virtual, observe, 1. That in concave glasses, when a ray falls from air parallel to the axis, the virtual focus, by its first refraction, becomes at the distance of a diameter and a half of the concavity.

2. In plano-concave glasses, when the rays fall parallel to the axis, the virtual focus is distant from the glass the diameter of the concavity.

3. In plano-concave glasses, as 107 : 193 :: fo is the radius of the concavity : to the distance of the virtual focus.

4. In double concaves of the same sphere, the virtual focus of parallel rays is at the distance of the radius of the concavity.

But, whether the concavities be equal or unequal, the virtual focus, or point of divergency of the parallel rays, is determined by this rule :

As the sum of the radii of both concavities : is to the radius of either concavity :: fo is the double radius of the other concavity : to the distance of the virtual focus.

5. In concave-glasses, exposed to converging rays, if the point to which the incident ray converges be distant from the glass farther than the virtual focus of parallel rays, the rule for finding the virtual focus of this ray is this :

As the difference between the distance of this point from the glass, and the distance of the virtual focus from the glass : is to the distance of the virtual focus :: fo is the distance of this point of convergence from the glass : to the distance of the virtual focus of this converging ray.

6. In concave glasses, if the point to which the incident ray converges, be nearer to the glass than the virtual focus of parallel rays, the rule to find where it crosses the axis is this :

As the excess of the virtual focus, more than this point of convergency : is to the virtual focus :: fo the distance of this point of convergency from the glass : is to the distance of the point where this ray crosses the axis.

Rules for finding the foci of glasses.—To find the focus of a convex spherical glass, being of a small sphere, apply it to the end of a scale of inches, and decimal parts, and expose it before the sun; upon the scale you will have the bright intersection of the rays measured out : or, expose it in the hole of a dark chamber; and where a white paper receives the distinct representation of distinct objects, there is the focus of the glass.

For a glass of a pretty long focus, observe some distant object through it, and recede from the glass till the eye perceives all in confusion, or the object begins to appear inverted; here the eye is in the focus.

For a plano-convex glass : make it reflect the sun against a wall; you will on the wall perceive two sorts of light; one more bright within another more obscure: withdraw the glass from the wall, till the bright image is in its least dimensions; the glass is then distant from the wall about a fourth part of its focal length.

For a double convex : expose each side to the sun in like manner; and observe both the distances of the glass from the wall. The first distance is about half the radius of the convexity turned from the sun; and the second, about half the radius of the other convexity.

Thus we have the radii of the two convexities; whence the focus is found by this rule.

As the sum of the radii of both convexities : is to the radius of either convexity :: fo is the double radius of the other convexity : to the distance of the focus.

Focus, in *Catoptrics*, is a point wherein the rays reflected from the surface of a mirror, or speculum, and by reflection rendered convergent, do concur, or meet.

The effect of concave mirrors is to collect the rays falling on the concave surface into a focus.

The effect of convex mirrors is to disperse the rays falling on them, or render them more divergent.

For the laws of the foci of rays reflected from mirrors, or specula, see MIRRORS.

The foci of concave glasses are had by reflection : for, as a concave mirror burns at the distance of about half the radius of the concavity; so a concave glass, being supposed a reflecting speculum, unites the rays of the sun at the distance of about half the radius of the concavity.

To find the foci of all glasses geometrically.—Dr. Halley furnishes us with a general method for finding the foci of spherical glasses of all kinds, both concave and convex : exposed to any kinds of rays, either parallel,

parallel, converging, or diverging; under the following problem.

To find the focus of any parcel of rays diverging from, or converging to, a given point in the axis of a spherical lens, and inclined thereto under the same angle, the ratio of the sines of refraction being given:

Suppose GL (*Plate V. Optics, fig. 2.*) a lens; P a point in its surface; V its pole; C the centre of the sphere whereof it is a segment; O the object, or point in the axis, to or from which the rays do proceed; and OP a given ray: and suppose the ratio of refraction to be as r to s . Then making CR to CO , as s to r for the immersion of a ray; or as r to s for the emerision (*i. e.* as the sines of the angles in the medium which the ray enters, to the corresponding sines in the medium out of which it comes), and laying CR , from C towards O , the point R will be the same for all the rays of the point O . Lastly, drawing the radius PC , if need be, continued; with the centre R , and distance OP , strike a piece of an arc, intersecting PC in Q . The line QR , being drawn, shall be parallel to the reflected ray; and PF , being made parallel thereto, shall intersect the axis in the point F ; the focus sought.

Or, make it, as $CQ : CP :: CR : CF$; then will CF be the distance of the focus from the centre of the sphere.

This author gives a demonstration of the method; and adds various figures, exhibiting the various cases of rays either diverging or converging as they enter, or emerge out of, the surface either of a convex or concave lens.

From this principle all the rules for the foci of rays parallel to the axis, as likewise for the principal focus where the rays nearest the axis do unite, are deduced. As,

Hence, 1. If OP be equal to CR the points Q and C are coincident, and the rays OP , after refraction, run on parallel to the axis. 2. If the point Q fall on the same side of the axis, as is the point P ; then the beams after refraction do tend on, either diverging or converging, as before; but if Q fall on the other side the axis, the diverging rays are made to converge by a convex, or the converging to diverge by a concave glass. 3. If OP do exceed CR , the focus is in all cases on the same side of the glass, as is the centre of the sphere C . But contrariwise if OP be less than CR , the focus falls on the other side of the glass beyond the vertex V . 4. An object may be so placed, that the rays next the axis of a convex glass shall have an imaginary focus transmitting diverging rays, when the more remote parts thereof shall make them converge to a real focus. 5. If OV , the distance of the object from the pole or vertex of the glass, be taken instead of OP , then will CQ be the difference of OV and CR ; and as that difference is to CR , so is the radius CV to CF , the distance of the principal focus from the centre of the sphere, whereof the glass is a segment. Or else as $CQ : OP$ or $RQ :: PC : VF$, the focal distance from the pole of the glass. Whence follows a general rule for the foci of all glasses; only according to Corol. 3. if OV do exceed CR , the focus is on the same side of the glass as the centre of the sphere; but if CR be greater, then the focus is on the opposite side of the glass: whence it will be determined whether the focus be real or imaginary.

What has been said of one surface of the lens, is easily applicable to the other, taking F the focus for an object.

FODDER, in *Agriculture*, a term employed to signify all such substances as hay, straw, haulm, &c. which are

given to cattle with the view of feeding and keeping them. These substances, when blended together, are in some districts particularly called fodder. In the giving of fodder to all sorts of animals, care should be taken that waste is not committed by their having too much given at a time; and that it be well put into racks or cribs, which should be sufficiently nurcrans for the quantity of cattle. Where these points are not properly attended to, there must be great loss, not only by the fodder being littered about the yard, but from many of the more weak cattle not getting the quantity of food that may be necessary for their support. In respect to racks, those of the staddrag and basket kinds are best for foddering, if made strong enough, that is, so as not to be overturned; for these racks may be lifted up as the dung rises in the yard, which those fixed in the ground cannot be.

It may be observed that open winters make hay the dearest, if a hard frost and snow happen to come at the beginning of them: for if once cattle come to fodder they must be held to it, or they will receive great damage. In wet or washy weather, all the hay that can be given to cattle will not make them thrive so well as in such as is dry and frosty. Hence sheds are highly useful, in order to shelter them in such cases.

At the beginning of winter, as the latter end of October and great part of November, while cattle still continue out in the field at grass, it is very necessary to fodder them early in the morning, while the hoar-frost hangs on the grass, which they will not eat kindly off till the sun has warmed it, and dissolved the hoary matter that hangs upon it.

It is a practice in many places to tie cattle up to racks to fodder. This may be done with great advantage with cows, where the fodder is good as hay, or very good straw; but with young cattle, or such as have straw fodder only, it is unnecessary. And as cattle eat their fodder when fresh thrashed much better than when it has been thrashed two or three days, especially if the straw be but indifferent: it is proper that this should be attended to by the careful farmer.

As it is well known in general that little dependence can be placed on sending cattle out of the foddering yard to grass before the middle of May, the farmer ought always to be well provided with winter-fodder, for his cows and young stocks, for this and the preceding months, as he will otherwise be in great difficulty, and run much risk in his stock.

In regard to the economy of cattle-buildings, it may be observed, that to have several divisions over and above what is constantly used in the foddering-yards or back sheds, or other out-houses, has great conveniencies in it; one of which is, that in them the farmer can dispose of and separate his two-yearling cows, or other cattle, at the time of bulging; not only to keep them from the bull, but from the other beasts also, that would be leaping such cows, whereby they may hurt each other, &c. especially as cows forward with calf are apt to warp by leaping bulging cows. It may therefore, in many cases, prevent much injury to such sorts of live-stock.

FODDER, *Compositum*, a sort of fodder formed by cutting, mixing together, and compressing, by means of proper machinery, various sorts of coarse substances, such as the haulm of peas, beans, potatoes, and various other vegetables, as well as clover, hay, straw, &c. so as to make them come into a narrow compass. The utility and advantages of this sort of fodder have been shewn by Mr. Lawton,

a sudden cold is induced by a change of wind; the air then is coldest, next to it the land, and last the water, which is but slowly reduced in temperature, for the reason just mentioned. But the water being comparatively warm, will, from that circumstance, be disposed to give out a quantity of steam, which rising into the cold air, is immediately condensed into fog, and wafted along the earth's surface by the stream of air. Hence arise the fogs which mariners often find in approaching land in frosty weather, and which are so common in London and other places where the tide penetrates inland. The writer of this article lived some years near a river of 30 or 40 yards in breadth; on certain evenings in summer, after sun-set, a dense fog was found to accompany the course of the river; it was observed that this phenomenon never occurred but when the temperature of the water was at least 10 above that of the air, and that it almost always occurred when a difference of temperature to that amount took place; but it is likely that a less difference of temperature would have been sufficient if the river had been broader. Some philosophers, particularly Saussure, maintain that fogs and clouds consist of water in a vesicular state; or that the molecules are surrounded with films of water: this opinion seems to require further confirmation. The effect of fogs in apparently magnifying distant objects is notorious; it is an optical deception: the fog diminishes the brightness of objects, and consequently suggests a greater distance; but when the visual angle remains the same, the greater the distance the greater is the magnitude: hence objects at a moderate distance appear to be magnified. See CLOUD, EVAPORATION, &c.

FOG, or *Fogg*, in *Rural Economy*, is a term that properly signifies the fine soft grass that immediately springs up after the hay crop has been taken from the ground; but which is sometimes used for the long grass remaining in the pastures till the winter season. See AFTER-GRASS.

FOGARAS, in *Geography*, a town of Transylvania, on the Alauta, the see of a Greek bishop; 28 miles W. of Cronstadt. N. lat. 46°. E. long. 24° 34'.

FOGBARRY, a town of Bengal, on the borders of Bootan.

FOGELN, a small island on the W. side of the gulf of Bothnia. N. lat. 60° 38'. E. long. 17° 44'.

FOGGAGE, a term applied to coarse or rank grass not eaten down in the summer or autumnal season by any sort of live stock. The practice of fogging grass lands for the winter support of stock has, it is said, been found highly useful in different situations. See GRASS-LAND.

FOGGI, in *Geography*, a town on the E. coast of the island of Bourro. N. lat. 3° 28'. E. long. 126° 24'.

FOGGIA, FRANCESCO, in *Biography*, was a native of Rome, a disciple of Paolo Agostini, and an eminent musical composer, who flourished from 1645 to 1681. In his youth he was several years in the service of the court of Bavaria, and the arch-duke Leopold, afterwards emperor; but returning to Rome, he was appointed maestro di capella to the church of St. John Lateran, to Santa Maria Maggiore, to San Lorenzo in Damaso, and other great churches in that city. Antimo Liberati calls him the prop and father of music and true ecclesiastical harmony: and says, that in his printed and manuscript productions he had manifested such a variety in his manner of writing as was seldom found in the works of one man, being equally excellent in the grand, the learned, the noble, the refined, the simple, and the pleasing style. And in examining his works, this panegyric does not seem overcharged, as far as music then went, which was not arrived at melody, grace, or expression.

He lived to upwards of eighty, is celebrated by Kircher in his "Musurgia;" and P. Martini has illustrated his doctrine in the "Saggio di Contrappunto," with two admirable motets from his eighth opera, in which there is much ingenuity, and a greater variety of measure than usual in church music of a century, where a movement in triple time had seldom admission.

FOGGIA, in *Geography*, a town of Naples, in Capitanata, without walls, citadel, or gates; though a principal town of the province. It is neatly built of white stone, and has two or three good streets; the custom-house is a handsome edifice. The old town having been ruined by an earthquake in 1732, its place was supplied by the present town, which was built with greater neatness and regularity. In summer the air is insalubrious; and many of the inhabitants remove during the hot months; in winter it is supposed to contain about 20,000 persons, including strangers. Underneath all the large streets and squares are granaries, in which corn is preserved sound from year to year; the orifices being closed with boards and earth, and the sides within faced with stone. The importance of this town, both in ancient and modern times, has been owing to its being a staple for corn and wool, and to a tax or register office, called "Tribunale della dogana della mena della puore di Puglia," *i. e.* "The custom-house for the toll of sheep that pass to and from Puglia." It is under the management of a governor, auditor, and two advocates, and has the distribution of a fixed assessment upon all sheep that descend in autumn from the mountains of Abruzzo into the warm plains of Puglia, where they yearn, and in May they return to the high country; 16 miles S. W. of Manfredonia. N. lat. 41° 25'. E. long. 15° 38'.

FOGGIA. See FOCHEA.

FOGGING, a term made use of to signify a particular practice in the management of grass-lands, which has been chiefly confined to South Wales, and some districts in its vicinity. It is said by Mr. Young to consist in keeping the whole growth of the grass, in meadows of the upland kind, free from both the scythe and live stock during the summer and autumn, and eating it off in the winter. It is added that he many years ago knew a Suffolk clergyman who was in the regular habit of this singular practice, and who spoke of it as a most profitable one. He farther states that he has himself tried it three times, and constantly with success. It is found that it thickens the herbage greatly, and yields far more valuable winter and spring food than any person would expect who never tried it. But it is suggested that it should only be practised on dry land, or such as is in a tolerably dry state.

The advantages of this system of grass husbandry have not however been shewn by any correct statements; and it must be evident that considerable loss must be sustained in such a full body of grass remaining upon the ground for such a great length of time.

FOGGY ISLAND, in *Geography*, an island so called by Beering, in the N. Pacific ocean, near the west coast of America, about nine leagues in compass. N. lat. 56° 10'. E. long. 202° 45'.

FOGGY, *Cape*, the north-east extreme point of the above-named island. N. lat. 56° 31'. E. long. 202° 46'.

FOGLIA, a river of Urbino, which runs into the Adriatic, at Pefaro.

FOGLIANESE, a town of Naples, in Principato Ultra; 7 miles W. of Benevento.

FOGLIANO, a lake of the Campagna di Roma, near the sea, with which it communicates.

FOGLIETTA,

FOGLIETTA, UBERTO, in *Biography*, was descended from an ancient and noble family in Genoa. He was born in the year 1518, and was brought up for the profession of the law, which, however, he did not pursue, but spent much of his early life in travelling from place to place, and at Rome, where he resided some time, he made himself known by several elegant treatises and orations. From some passages in the latter, he is supposed to have been in priest's orders, though there are no other facts that go to prove the circumstance. In 1559 he published his work, entitled "Della Repubblica di Genova," for which he was prosecuted, his property confiscated, and himself banished. The cause of these harsh proceedings was the freedom which he exercised on the conduct of the nobles and great men of the country. He had, however, the good fortune not to be wholly deserted; he found a liberal patron in cardinal Hippolite d'Este, who received him into his house upon terms of intimate friendship, and he was likewise held in considerable estimation by several other persons of rank. To divert his solitary hours in exile, he employed himself in writing a general history of his own times, beginning from the war of the emperor Charles V. against the protestants. He was the author of many other pieces of a miscellaneous nature: but the last was the history of his own country, of which he lived to finish twelve books, from the foundation of Genoa to the year 1527. He died in the year 1581 at the age of sixty-three. The history of Genoa was published by his brother Paul, who was himself a man of learning, and a good Italian poet.

FOGLOE, or FUELOF, in *Geography*, the most easterly of the Faroer islands, towards the North. N. lat. 62° 3'.

FOGO, a small island near the east coast of Newfoundland. N. lat. 50° 2'. W. long. 54° 10'.

Fogo. See **FUEGO**.

FOHR, or FORA, an island of Denmark, near the coast of Sleswick, in the German ocean, about twelve miles in circumference, with a small sea-port, and a safe road for ships; the soil is fertile, and the island contains 3 parishes. N. lat. 54° 44'. E. long. 8° 31'.

FOHRAG, a town of Persia, in Faristan; 18 miles S. of Yeld.

FOHRAG, or Fohraj, a town of Persia, in the province of Mecran; 260 miles W.N.W. of Kidge. N. lat. 23°. W. long. 58° 20'.

FOHRN-SEE, a lake of Carinthia; 10 miles S.E. of Saxenburg.

FOIANO, a town of Naples, in the Capitanata; 12 miles S.W. of Manfredonia.

FOIBLE, a French term, frequently used also in our language.

It literally signifies *weak*; and in that sense is applied to the body of animals, and the parts thereof; as foible reins, foible sight, &c. being derived from the Italian *fevole*, of the Latin *febilis*, to be lamented, pitied.

But it is chiefly used with us substantively, to denote a defect or flaw in a person, or thing. Thus we say, every person has his foible; and the great secret consists in hiding it artfully; princes are gained by flattery, that is their foible; the foible of young people is pleasure; the foible of old men is avarice; the foible of the great and learned is vanity; the foible of women and girls, coquetry, and an affectation of having gallants.

It is a term also used in *Fencing*, to denote the weakest or third part of a blade, or that part of the farther extremity next the point; in opposition to the fort which is the strongest.

FOIBLE, Fr. *feible*, as *tems foible*, the unaccented part of a bar. See **TIML**, and **ACCENT**.

FOIL, in *Fencing*, denotes a blunt sword, or one that has a button at the end covered with leather, used in learning the art of fencing. The amateurs and teachers of fencing caution the learner never to fence in assaults with short foils, but prescribe them of a proper length, measuring from one extremity to the other three feet two inches; which will enable him to keep a regular distance, and execute his movements with a greater degree of justness and dexterity: and besides, this mode of practice will preclude erroneous habits which persons are apt to contract by fencing with short foils. See **SWORD**.

FOIL, among *Jewellers*, a thin leaf of metal, placed under a precious stone, in order to make it look transparent to improve the colour, or to give it an agreeable different colour, either deep or pale. Thus the effect of giving lustre is produced by the polish of the surface of the foil, which is colourless; but if a stone is wanted to be of a pale colour, a foil of that colour must be put under it. If deep, a dark one must be laid under it.

These foils are made either of copper, tin, gold, or gold and silver together: the copper foils are generally known by the name of Nuremberg or German foils. They are prepared as follows:

Procure the thinnest copper-plates that can be got; beat these plates gently upon a well-polished anvil, with a polished hammer, as thin as writing paper; or pass them between a pair of fine steel rollers, very close set; and placing them between two iron plates, as thin as possible, beat them in the fire, then boil the foils in a pipkin, with equal quantities of tartar and salt, constantly stirring them, until by boiling they become white; after which, taking them out and drying them, give them another hammering, until they are fit for use. Care however must be taken not to give the foils too much heat, for fear of melting; neither must they be too long boiled for fear of attracting too much salt.

The manner of polishing these foils is as follows; take a plate of the best copper, one foot long, and about five or six inches wide, polished to the greatest perfection; bend this to a long convex, fasten it upon half a roll, and fix it to a bench or table: then take some chalk, washed as clean as possible, and filtered through a fine linen cloth, until it be as fine as can be made; having laid some of this upon the roll, and wetted the copper all over, lay the foils upon it, and with a polished stone and the chalk, polish them till they are as bright as a looking-glass. After this they must be dried and laid up secure from dust.

The best method of preparing foils, so as to give to colourless stones, as crystals, pebbles or paste, the lustre and play of diamonds, is as follows:

Take leaves of tin, prepared in the same manner as for silvering looking-glasses, and cut them into small pieces, of such size as to cover the surface of the socket of the stones that are to be set; lay three of these one upon another, and having moistened the inside of the socket with thin gum water, and suffered it to dry, that only a slight thickness may remain, put the three pieces of leaves lying on each other into it, and adapt them to the surface in as even a manner as possible. When this is done, heat the socket, and fill it with warm quicksilver, which must be left in it for three or four minutes, and then gently poured out. The stone must then be thrust into the socket, and closed with it; care having been previously taken that it may enter the socket without slipping off the tin and quicksilver from any part of the surface. The work should be well closed round

the stone, to prevent the tin and quicksilver contained in the socket from being shaken out by any violence. The lustre of stones set in this manner will continue longer than when they are set in the common way.

When colouring foils are wanted, those of copper, above described, may be either tinged with smoke, or stained, or painted with some pigment or other colouring substance. The colours used for this purpose may be tempered with oil, gummed or sized water, or varnish; for red, in imitation of ruby, carmine, with a little lake used in isinglass size, or shell-lac varnish, or bright lake in oil, should be employed: for the garnet-red, dragon's blood, dissolved in seed-lac varnish, may be used; and for the vinegar garnet, orange lake, tempered with shell-lac varnish. For the amethyst, lake, with a little Prussian blue, used with oil for blue: where the effect of sapphire is wanted, Prussian blue in oil, and spread on the foil more or less thinly, according to the lightness or deepness of the colour required; for the eagle marine, common verdigris with a little Prussian blue, tempered in shell-lac varnish, should be used; for a full yellow, yellow lacquer; and for the slighter colour of topazes, the burnish and foil itself will serve, without any addition. For a deep green, the crystal of verdigris, tempered in shell-lac varnish; but for the emerald, a little yellow lacquer should be added. See DOUBLET'S. Handmaid to the Arts, vol. ii. p. 333, &c.

FOIL, or Foyle, among *Looking glass Grinders*, a sheet of tin, with quicksilver, or the like, laid on the back-side of a looking-glass, to make it reflect. See FOLIATING. The word is formed of the Latin *folium*, leaf.

FOILING, among *Hunters*, the footing and treading of deer, which remains on the grass, but scarcely visible.

FOISSEN, in *Rural Economy*, is a term sometimes used to signify the natural juice or moisture of grass, or other herbage.

FOIST, a term used to signify a musty sort of smell among hay, straw, grain, and other farm products.

FOISTY, having a musty disagreeable smell.

FOIX, in *Geography*, a small province of France, before the revolution, including Dounezau and the valley of Andorre, bounded on the N. and E. by Languedoc, on the S. by Roussillon and the Pyrenées, and on the W. by Gasconne; lying between 42° 25' and 43° 20' N. lat., and between 1° 15' and 2° 40' E. long.; sixty miles from N. to S., and towards the southern boundary thirty miles from W. to E., but more northward its breadth is from 15 to 20 miles. This province is traversed by the river Arriège. It was anciently governed by its own counts, and united to the crown of France in the year 1607. It is divided into Upper and Lower; the former, being mountainous and barren, produces wood and pasturage; the latter, more level and tolerably fertile, yields grains, fruits, and wine, and both abound in mines, mineral waters, and natural curiosities.

FOIX, a town of France, formerly the capital of the above described province, and now the principal place of a district, in the department of the Arriège, is an ancient small town, at the foot of the Pyrenées, on the left bank of the Arriège, with a castle or a rock commanded by two adjacent hills; 15 leagues S.S.E. of Toulouse. The place contains 3,600, and the canton 13,322 inhabitants, on a territory of 292½ kilometres, in 24 communes. N. lat. 42° 58'. E. long 1° 40'.

FO-KIEN, a small but flourishing province of China, bounded on the N. by the province of Tche-kiang, on the W. by that of Kiang-si, on the S. by Quang-tong, and on the E. by the Chinese sea. It has few plains, but industry

fertilizes even the mountains, which are disposed in the form of amphitheatres, and arranged in terraces one above another. The valleys are watered by rivers and springs, which descend from the mountains, and which the Chinese husbandman contrives to distribute so as to favour the culture and growth of his rice; he raises the water even to the summits of the mountains, and conveys it in different directions by means of bamboo pipes. The mountains are covered with trees fit for naval architecture, and the province furnishes musk in abundance, precious stones, quicksilver, iron, and tin. Tools of steel of various kinds, stuffs of silk, and cloths of surprising fineness and beauty are made in this province. It is also said to contain gold and silver mines; which the inhabitants are prohibited to open under pain of death. In the bays, and on the coasts guarded by fortresses, great quantities of fish are taken, which being dried and salted, are carried into the interior provinces of the empire. This part of China acquires great opulence from the trade which its inhabitants carry on with Japan, the Philippines, Java, Camboya, Siam, and the island of Formosa, and they also import from other countries aloes, cinnamon, pepper, sandal-wood, amber, coral, and other similar commodities. Fo-kien contains nine *fou*, or cities of the first class, and sixty *hien*, or cities of the third class. Its capital is Fou-tcheou-fou. Each city has its own peculiar dialect; but the language of the Mandarins is spoken every where; few in this province understand it; nevertheless, it produces a great number of literati. The climate is hot, but the air is pure and salubrious. The number of inhabitants, according to the estimate of sir George Staunton, is fifteen millions.

FOLARD, CHARLES, *Chevalier de*, in *Biography*, was born at Avignon in 1669. He received the rudiments of classical learning, and by reading Cæsar's Commentaries, became exceedingly desirous of entering the military service of his country. His designs were at first thwarted by his father, till at length, finding opposition of no avail, he allowed him to follow the bent of his inclination. He served during the war of 1688, and was made aid-de-camp to the duke de Vendome in 1702. In these campaigns he not only distinguished himself as a soldier, but acquired an exact knowledge of the country in which the battles were fought, and drew maps and plans of every thing which he saw, and which was calculated to be serviceable to him in his future pursuits. At the battle of Cassano he was thrice wounded; and afterwards, at the battle of Malplaquet, he was wounded and taken prisoner. In 1714 he went to Malta, in order to assist in defending that island against the Turks. After this he visited Sweden, and was entrusted by Charles XII. with negotiating a plan, with the court of France, for a projected invasion of Scotland for the restoration of king James II. This scheme having failed he returned to Sweden, and followed the emperor to Frederichshall, where that heroic prince was killed by a cannon shot. (See CHARLES XII.) Folard served his last campaign in 1719 under the duke of Berwick, and from this period he devoted himself to the study of military tactics. In 1727 he published his great work, entitled "Commentaries on Polybius," in six volumes 4to. which was, in fact, a depositary of his military reflections and inventions, and though it was not distinguished for the neatness of its style, and was moreover defective in method and order, yet it was highly esteemed as containing much useful matter. Folard wrote a piece, entitled "New discoveries respecting War," and some other treatises on military subjects. In 1749 he was elected a fellow of the Royal Society of London, and in 1752 he died at Avignon at the age of

eighty-three. He was a man of great worth and integrity, and was entrusted during the last forty years of his life with the government of Bourbourg: he would probably have risen to much higher honours and more important duties in the state, had he not been a zealous defender of the miracles of the Abbé Paris, which gave offence to cardinal Fleury. A more elaborate account has been given of this distinguished soldier in a work entitled "Memoires pour servir a l'Histoire de M. le Chevalier de Folard." Moreri.

FOLD, in *Rural Economy*, a small inclosed space formed for confining any sort of live stock, &c. Folds are of several different kinds, according to the objects they have in view; and are essential in many cases where a number of animals are to be kept. See *FARM-yard*.

FOLD Garth, the old term employed to signify a farm-yard or inclosed place in which cattle are confined. See *FARM-yard*.

FOLD-net, among *Sportsmen*, a sort of net with which small birds are taken in the night: there are two sizes of it; the least may be managed by one man, but the largest must be carried by two, and used thus: let the net be fixed on both sides to two strong poles about twelve feet long, each man holding one of them; let a third carry lights behind them, at the distance of two yards: the net should be carried between the wind and the birds, which roost on their perches with their breasts against the wind; another person who beats the bushes on the other side of the hedge, will drive out the birds towards the light.

FOLD-foca, in *Law*. See *FALDAGE*.

FOLD-yard, in *Rural Economy*, the yard where cattle of different sorts are confined and fed during the winter season. Yards of this nature should be properly fitted up with convenient sheds and racks for the animals to eat their fodder from, and have suitable divisions for containing different denominations of cattle, or other live stock. See *FARM-yard*.

FOLD, Sheep, the yard or inclosure in which sheep are confined during the nights in the winter months. Yards of this kind are not by any means so common as their great advantages and utility would seem to demand. They are capable of being made the means of raising great quantities of excellent manure, at the same time that they contribute greatly to the health and preservation of the sheep. These folds are of two kinds, as erections of the house or shed fort constructed for the purpose adjoining to the farm-yards, or such as are moveable and formed by art by means of hurdles in the fields. In the former, which is still the common practice in France, Flanders, &c., the floors of the sheds or houses are occasionally covered with straw, sand, or other light dry earthy matters, by which a large quantity of valuable manure is obtained; which, when applied to cold wet fishy soils, is highly advantageous in producing abundant crops. It is observed, however, by the author of *Modern Agriculture*, that, since a spirit for inclosing, planting, and improvements in general has been introduced, the original breeds of sheep have been banished to the mountainous districts in the northern parts of the island, where cultivation has hitherto been deemed impracticable. Within these few years, indeed, some valuable breeds of sheep have been brought from the southern parts of the kingdom, but they are generally kept in gentlemen's parks, and are never penned or housed; so that he thinks the quantity of sheep dung applied to tillage lands in the ancient manner is very trifling compared to what it was formerly; that practice existing in those parts of the country only which separate the lands that are generally or closely cultivated from the mountainous districts, where sheep-hut-

bandry, on a large scale, and under a regular system, is established and kept up.

Moveable houses have been found in many districts extremely beneficial in the management of sheep. See *SHEEP-HOUSE*.

The farmers of Hertfordshire, as stated in the agricultural account of that county, find much advantage from the raising of manure in these sorts of folds. At the Grove the earl of Clarendon is said to have a yard that contains good room for three hundred sheep, the number which is usually kept in it. It is surrounded by an open shed, except on one side, where a barn is the tence; the outside of the shed is formed of wattled hurdle-work, without straw or other materials, for coolness, lest a greater closeness should make the yard too hot. The whole is kept well littered with stubble, and yields from the above number of sheep eighty large cart-loads of manure. And the system is found to agree perfectly well with the sheep, keeping them more healthy than when they were left in the fields in the common manner. His lordship has likewise another yard for lambing, which has also a shed connected with it. Mr. Bevan of Norfolk is stated by Mr. Young to have been attentive to this useful practice so early as the year 1792, having then a yard well fenced in for a standing fold, in sight of the shepherd's windows, calculated for littering and folding in bad weather. And that in 1802 he found him continuing the practice, and to be well persuaded of the great advantage of it; he indeed considers it now as indispensable, and intends in future to have his flock in for yearning, whether the season be good or bad; having constantly fifteen or twenty loads of hay stacked up in it, for the sheep to help themselves at: he is said to find this not attended with any waste. It is difficult, however, to conceive that a number of sheep can continue pulling hay from a large stack daily, without trampling much of it under their feet, and in that way causing waste of the fodder. It is a much better method to have the hay pressed tightly into racks formed for the purpose with the staves near together, and placed upon low wheels so as to be conveniently moved.

In various other districts of the kingdom, the system of folding sheep in covered folds constructed for the purpose, has been found a highly beneficial method by those individuals who have had recourse to it; and where it is well followed up during the months of November, December, January, February, March and April, with a sufficient supply of litter, a dung heap of at least from sixty to seventy loads of very good stuff, may be produced from not more than a hundred sheep; which will be capable of manuring two acres of land in a very perfect manner. But the same number of sheep, when folded in the field, where the grass land is even dry enough for the purpose, will not in the same time manure in an equal degree much more than one acre of ground. This fully shews the great superiority of the yard method over that of the field.

The latter method, which is now the most common, is to pen or fold the sheep themselves upon the land, which on dry friable soils in particular is found to produce beneficial effects. They are sometimes, however, folded on old pastures, but more frequently on lands in tillage, especially on fallows, as a preparation for a succeeding crop of wheat, and on light soils, by way of top-dressing after the grain is sown, or on fields of turnips. This last method is most generally adopted in the inclosed and best improved districts of the kingdom. The hurdles or rails which form the fold are commonly about four feet six inches long, and three feet six inches high, made for the most part of either hazel or willow. About fourteen or fifteen dozen of hurdles are sufficient

sufficient to inclose a statute acre. They are tied to stakes fixed in the ground at regular distances, with small branches of trees twined when green for the purpose. An acre is considered as a space sufficient for folding from twelve to thirteen hundred sheep. The sheep should never be allowed to lie above one night on the same spot of ground, and of course twelve or thirteen hundred will manure an acre of land daily. By thus connecting sheep-husbandry with the improvement of arable land, much may in many cases be effected, especially upon the more dry and light sorts of soil, where it is capable of being carried to the greatest extent, and where the quantity of grafs land either in common or otherwise is also considerable.

FOLDAGE and FOLK-COURSE. See FALDAGE.

FOLDERID, in *Geography*, a town of Norway, in the diocese of Drontheim; 114 miles N.N.E. of Drontheim.

FOLDING DOORS, in *Architecture*, are those that are made in two parts, each part hung to each jamb, and their other vertical edges meet each other, lapping the rebates together when the door is shut. See article DOORS.

FOLDING SHEEP, the practice of confining them upon arable or other lands, by hurdles or other means, so as to ameliorate and improve them. This is a method that is much resorted to by all open-field farmers as a preparation for wheat, and their chief dependance is upon this species of top-dressing, where the quantity of farm-yard dung is insufficient for their purpose. This mode of manuring is peculiarly adapted to farms where there is a considerable extent of hill or common pasture, or grafs lands that never come under the plough. In such farms, by bringing the sheep in the evening to the fold a considerable quantity of manure will be made that would otherwise be lost. If the pasture upon which the sheep feed through the day be good, they may be folded without much detriment to the animal for a great part of the year; but where the pasture is scanty this cannot well be done, for the sheep will not be able to pick up a sufficiency of food through the day to enable them to bear the fatigue of travelling to and from the fold and fasting all night; and unless the sheep have turnips or hay during the winter their dung will be of small value. It is a bad practice to crowd more sheep into a fold than can lie down at their ease, and it is equally bad to confine young and old, strong and weak, in the same fold. It is far better to afford them room enough, and, in particular cases, to let them remain on the same spot two or three nights till it is sufficiently manured. Feeding sheep in a fold can only be practised upon light dry soils. Here it is still more necessary neither to crowd the stock nor to put in the weak with the strong, for they will tread down and waste the food, and in the contention for it the strong will deprive the weak of their proper share. On such light dry soils sheep will do good by giving it cohesion with much treading; but on clays or strong loams this does much injury to the lands: turnips or other green crops cannot therefore be fed off in such soils, except in dry seasons, but must be pulled and eaten upon a dry stubble or pasture. Upon farms entirely arable, where artificial grasses make a small part of the rotation, to bring the flock from the pasture to fold it upon a fallow, is supposed by some to be only enriching one part of the farm at the expence of another: or, as Mr. Bakewell always called folding, *robbing Peter to pay Paul*. It is well known that heaths and sheep-walks that have been fed time out of mind, but the sheep constantly folding on other lands, continue as miserably poor as they ever were at any former period. But besides this, lambs and ewes are damaged by folding, to the amount probably of at least 1s. a-head. Now the benefit arising

from their dung is estimated at about 1s. 6d. a-head, which leaves only 6d. each for the advantage of this practice. But there is still another deduction to be made on the number kept, and losses on stock. Divide one thousand sheep into ten flocks of one hundred each, by means of inclosures, and twelve hundred would be kept easier than a thousand were before; and as to many of the distempers and accidents to which flocks are liable, some of which are contagious, they result very much from this practice of folding the sheep.

It may be farther observed, that if folding be supposed necessary on account of the manure, where farm-yard dung is not made in sufficient quantity, and other manure is not readily to be obtained, a greater stock of muck might be raised by littering a dry part of the yard, or a warm corner of some pasture with leaves, straw, fern, or whatever litter could be had in the greatest plenty, penning the sheep and feeding them there in hard weather, and letting them run into the adjoining pasture only during the day in fine weather. A great quantity of manure might thus be raised in winter from a flock; and provided they had ample room in the pen, and were to be well supplied with dry litter, the sheep might sustain less injury in thus lying warm and dry, than from being folded on naked ground, often wet, and in an open exposure. However, where other good effects are to be produced on land, besides those that arise from the dung and urine of the sheep, such as their treading, and a certain warmth communicated to the soil by their breath, their perspiration, and the natural heat of their bodies, folding may be the most advisable means for obtaining them that can be adopted.

Methods of folding.—Mr. Young has observed on this practice, that a very great change has lately taken place in it on inclosed farms, especially with the best farmers in the county of Norfolk. They are now, he asserts, fully convinced that it is an unprofitable system of management, except where the openness of down and common fields renders it necessary for the purpose of confinement. It is contended, that the number of sheep that may be kept on a farm without folding, is much greater than that which can be supported with it. This is a most essential point; and there is a deduction from the farmer's profit in the injury done to both ewes and lambs by folding, which is stated to have been estimated by the most experienced judges, at from 2s. 6d. to 4s. per ewe; so that a farmer should consider well before he determines to follow a practice, which, from a multitude of observations, is pronounced unprofitable. Mr. Bakewell considered it as stated above. And the arguments now urged in its defence are not, it is contended, satisfactory: it is maintained, that if sheep be not folded they will draw under the hedges and other places for shelter in bad weather: if so, they ought to be allowed to do it, for more would be lost in such cases by forcing the sheep from shelter, than the value of their fold. Where this practice takes place, good shepherds will, in case of rain, get up in the night and let their flocks out of the fold, knowing the consequence of confinement on arable land in wet weather. The instinct of these animals will, it is supposed, conduct them much better than our reason, not only where to fly for shelter, but also for choosing their own time to go to rest, and to feed in the morning. These they vary according to seasons and weather; but folding prevents it, and forces them to a regularity never called for by the weather, nor perhaps the economy of the animals. It is added, that when he began first to entertain doubts of the propriety of folding sheep, on any farms, in which they can be kept to certain fields in the night without that practice, he earnestly desired to try

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try some experiments that might throw more light upon the question than it was possible for reason to do; but to effect this comparatively was very difficult, as the trial wished for was such as should carry some positive conviction with it. But though he has not been able to effect this fully, the trials which he has made may not be found destitute of power to throw some light on this interesting question. The writer is perfectly persuaded that it would have been impossible for him to have kept on the same land nearly such a flock in one parcel with folding. It is not supposed that the fields would have carried three-fourths, so managed. Four drivings in a day make them trample much food, disquiet the sheep, and transfer the choice of their hours of feeding and rest from themselves to the shepherd and his boy. While lambs are young they are injured by this, and the ewes are liable to be hurried and heated; all which are objects that should weigh in the question. When sheep are kept in numerous parcels, it is not only driving to and from fold that affects them, but it is asserted, that they are in fact driving about in a sort of march all day long, when the strongest have too great an advantage, and the flock divides into the head and the tail of it, by which means one part of the sheep must trample the food to be eaten by the other. All this, it is conceived, points the very reverse of their remaining perfectly quiet in small parcels.

It is, however, supposed, that the question chiefly turns on the benefit to be reaped by the fold; for if that be great enough to compensate for the loss by such circumstances, the practice may not be condemned. It is conceived that the reason why farmers are such warm advocates for folding, arises from the power it gives them of sacrificing the grass lands of a farm to the arable part of it. Their object is corn, by which they can carry off a farm whatever improvement they bring to it. Grass improved is profit to the landlord in future, and tenants are too apt to think that this is done at their expence. They do not at all regard impoverishing a grass field in order to improve a ploughed one; and it need not be observed, that every sort of sheep-walk is thus impoverished; so that ancient walks which have been sheep-pastured perhaps for five centuries, are no better at present than they were before; whereas most fields sheep-fed, without folding from them, are in a constant state of amelioration; this, it is said, leads him to remark the effects he observed on several of his own fields. He carefully attended, during the course of a summer, many gentlemen over the fields, with a view to examine whether the sheep had seemed to have rested only on spots to the too great manuring of such, or on the contrary, to have distributed themselves more equally: and it was a pleasure to find, that they seemed generally to have spread in every part, if not quite equally, at least nearly so. The further circumstance of several old leys fed in the same manner, when examined in autumn, convinced him, as well as his bailiff, that the ground had been unquestionably considerably improved. Those fields had carried a very bad appearance for some years, but they were, after sheep-feeding, of a rich verdure, and as full of worn-casts as if they had been dunged. They were heavily rolled in November, but they soon became rough again by worms, and demanded much rolling in the spring. And they had afterwards a greener and more fertile appearance by far than ever they were before. It is added, that the whole of this circumstance, the value of which he shall be able to appreciate in the trials of future years, belongs to this method of dividing flocks, to the exclusion of folding. The fold is valuable, but so is the improvement of the grass land, and may, for what he

knows, nearly equal it when in addition however, the greater number of sheep that can be kept is included, and the favour done to them by letting them alone, there remains in his mind no further doubt of the fact. It is remarked as common to hear flock-farmers in open countries say, they have not the power to manage so. This may be very true, it is supposed, upon the major part of the farms, but such have often many inclosures in which this management might be applied without difficulty. But supposing folding to be the system pursued, it may be remarked that the farmers in those parts of the kingdom which understand it best do not extend it so far as they might: they give over folding in November or December, whereas it may certainly be carried on through the whole winter with profit; even supposing that the practice is necessary. On those farms which have a perfectly dry gravelly pasture or two, it is advisable to fold all winter on such dry grass land. It must not be attempted on moist arable land, nor on moist grass land, but on dry pastures. The safety to the sheep is greater and the benefit to the grass an object.

And it is stated that there is another method of gaining all the benefit of folding quite through the winter, and on all soils, which is that of confining the sheep in the night in proper yards, well and regularly littered with straw, stubble, or fern; by which means the flock is kept warm and healthy in bad seasons, and, at the same time, a surprising quantity of dung raised: so great a quantity, if there be plenty of litter, that the profit will be better than by folding on the land. And a great improvement in this method would be giving the sheep all their food, except their pasture, in such yards, as hay, turnips, &c.: for which purpose they may be brought up, not only at night, but also at noon, to be baited; but if their pasture be at a distance, they should then, instead of baiting at noon, come to the yards earlier in the evening, and go out later in the morning. This is a practice which cannot be too much commended; for to warm a lodging is a great matter to young lambs, and will tend much to forward their growth; the sheep will also be kept in good health; and, what is a point of consequence to all farms, the quantity of dung raised will be very great, as has been already shewn.

It has been remarked by the author of the Synopsis of Husbandry, that the horned or west-country sheep are to be preferred by the farmer, whose chief intention in maintaining a flock is to improve and fertilize his arable land; and that in this respect the sheep forms a very material part of the husbandman's riches: for to so high a degree may land be improved by a proper management of these animals, that, with respect to light soils especially, it is, he contends, scarcely an hyperbole to affirm, that wherever a sheep hath set its foot, some benefit hath accrued to the owner. The virtues of the fold are well known: besides which, the keeping of corn close trodden in the spring, and thereby counteracting the ill effects of the worm, is a matter of such material import to the renter of thin soils, as to be a sufficient inducement to this practice. These facts are so universally known and acknowledged, that in Hertfordshire, where every farmer is in a greater or less degree a maintainer of sheep, it is, he asserts, an established maxim to date the good or ill success of a tenant from the extent of his fold. Whilst the flock is kept up to its original number, and the sale of fat sheep replaced by an equal sale of lean flock, the owner is supposed to be in thriving and prosperous circumstances. On the contrary, when the flock is sold off without being renovated by a fresh supply, the fate of such a renter is anticipated by his neighbours, and too often verifies the truth of their prediction, by a rapid

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rapid declension towards bankruptcy and ruin. Such being the state of the case, it may be no unprofitable inquiry, he thinks, to trace out the several different modes of conducting this business. There are several ways of conducting this economical plan on an arable farm: first, by the maintenance of a folding flock; and this is either of ewes or wethers. In the former instance, the lambs are bred on the farm, and weaned for the purpose of keeping up the flock, as the old ewes become fit for the butcher. In the latter, a proportionable number of stone wethers must be yearly purchased, to make up the deficiency of those which are fattened, or sold to the feeding grazier for that purpose. But if the farm is not sufficiently extensive to admit of the practice of folding, or the local situation be such as to decide in preference of a feeding flock, the turnips and fown grasses may be appropriated towards the purpose of fattening wethers, or the raising lambs for the butcher, either in pens or in the field; the one distinguished by the name of house, and the other by that of grafs lambs. Whichever of these methods is pursued, it is obvious that a proportionable quantity of ground must be yearly allotted for turnips, tares, rye, clover, &c.; without which it would be a vain attempt to set about the maintaining a flock of sheep. But since it is generally in the option of the farmer, with proper management, to raise a quantity of food equal to the support of his sheep, we will suppose that these matters have been properly attended to, and now proceed to enlarge on each of the methods above enumerated. And first, of an ewe flock kept for the purpose of folding. In order to conduct this plan of husbandry to advantage, a large tract of ground seems to be required. In farms where a due proportion of pasture is united with the arable land, and these pastures lie contiguous to the uplands, to wean lambs for the purpose of folding is a very judicious method. But where there is neither meadow nor pasture land attached to the farm, the business of an ewe-fold cannot be so conveniently practised. On many farms in the neighbourhood of Gravesend, in Kent, this plan is observed to be very advantageously pursued, from the circumstance of each of these farms having a quantity of marsh land annexed to it, at the rate of fifty acres of marsh to one hundred and fifty of the arable. The method which these farmers pursue is to buy in a number of ewes, equal to the size of their farms. If this purchase is made at the Michaelmas fairs, the ewes are then pregnant; if they are bought at the spring markets, they probably have lambs by their sides, which may go to fold with their dams, and the ewes be turned to the ram in the autumn. In order to obtain lambs at a proper season, let the rams be turned among the flock in October, at the rate of one ram to fifty ewes. Here they are to remain for a month, by which time the greatest part of the flock will be impregnated: and to ascertain this fact, it is a custom with many people to besmear the fore bows of the ram with tar and ochre, which easily leads to a discovery. The breeding ewes may continue to go to fold every night, till towards the third month of gestation. But it is to be observed, that in folding either ewes or wethers, but more especially the former, a field of turnips should be provided near the close where they are to lodge in the winter nights, that the flock may not have too long a drift; for these animals are but sorry travellers at best: and in the winter time, when the roads are become deep and miry, and the ewes begin to be heavy in lamb, a long drift would be highly prejudicial to them. Where such a turnip field does not lie handy to the fallow, it will be improper to prosecute this business with an ewe flock, after the wheats have been sown in November. When the folding is discontinued, the

ewes should be driven into a pasture, where they may be quiet and undisturbed, and be often visited by the owner, to watch with a careful eye any accident that may befall them; for sheep, at all times an helpless race, are liable to a variety of misfortunes in the time of gestation, peculiar to that condition. Towards the latter end of February, the ewes will be come near their time for lambing, and should then be removed from the marshes or low pastures, and driven into the turnip field, or turned on a piece of dry upland pasture. If the farm hath produced a quantity of turnips sufficient to fatten the wethers, a portion of which will be yearly turned out of the fold, in this mode of conducting business, the ewes, for four or five weeks previous to the time of lambing, may be lodged on that part which the fattening sheep have gone over, where they will find an ample sustenance from the shells which were left by their predecessors; as these females do not require so full an allowance of meat as will be necessary for them after they shall have yeaned; and too great a plenty would be very detrimental to them. But this is to be observed, that proper care should be taken to prevent the wethers from breaking into the part destined for the ewes, which at this period require the most diligent attendance from the shepherd, not only to watch the disorders and accidents which may befall them, but to maintain the fences in good repair, and to see that the hurdles are kept tight in the ground; and to prevent the inroads of swine or dogs, both of which would be apt to seize the lambs as they fall.

Summer folding.—This should commence early in the spring season, and as soon as the lambs are in a state fit for it. The lambing season generally commences about the first week in March, when the shepherd will find ample scope to exert his skill and diligence. As the weather at this season of the year is generally unsettled, and the cold often more severe than in any former part of the winter, the lambs, as well as ewes, frequently perish through the inclemency of the season. As the ewes have lambed down, it will be proper to remove them, with their lambs, into a piece of turnips, fenced off for the purpose, where they may neither be annoyed by the lambing ewes, the fattening wethers, or the store sheep, if there are any in the same field; and which, as has before been observed, should be kept separate from the ewes. In this field, with the daily allowance of a small portion of turnips, the ewes will continue to yield abundance of milk; and, in consequence thereof, the lambs will grow fat, especially if the weather shall prove warm and sunny. When the lambs become ten days or a fortnight old, the hurdles should be placed in such a manner as to leave a vacancy at bottom, in different parts of the drift, where the lambs may creep through, and take their range among the standing turnips. By this management they will enjoy a free air, and a licence to nibble on the turnip tops; both which circumstances will greatly contribute towards their future growth. When the sheep and lambs shew by their bleating and uneasiness that they require a change of food, which they will pine after when the turnips have advanced far in growth, and the stalks are become sapless, and the bottoms void of nourishment, they should no longer be confined on the turnip field. In forward springs, the turnips will be found to be of little use for couples (sheep and lambs) after the middle of April, at which time the lambs will be six weeks old: let them, therefore, be removed out of the turnip field, and driven on the rye, a few acres of which should, in every autumn, be sown on farms where there is maintained a large flock of sheep. Indeed the rye often affords a good bite early in the month of February, in which case
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the blade should be eaten down, and a second crop will have sprung up at the time he is now speaking of. Let this rye be parted into divisions of two or three acres each; observing the same caution, with respect to the openings at the foot of the hurdles, as was mentioned in the feeding of the turnips. In very backward springs, it frequently happens that the turnips are all eaten off, as well as the first bite of rye, before the grafs has made an effort to shoot, and the farmer is under the necessity of turning his couples into the marshes by the latter end of March. In order to be provided with a remedy against this untoward event, it is a prudent measure to lay in a piece of grafs in the autumn, wherein there is a large quantity of old *tare*, and to suffer it to be flocked during the winter: by this regulation, the young grafs will shoot much earlier in the spring among this old *rowell*, than in those marshes that have been taken off more closely by the scythe, or depasturing, and will in all probability afford an early bite for the ewes and lambs; when the winter seed of the uplands shall be exhausted; and as a shift of wind and change of weather may shortly be expected, this will cause the rye to send forth a fresh shoot, and furnish a variety in the pasture, which, with occasional shiftings into the marshes, and perhaps on a piece of forward wheat, will generally lengthen out a supply of food for the couples, and maintain them in tolerably good heart, even in those springs which are the most backward, till the winter tares become fit for their reception. In a kindly time, the grafs in the marshes will have attained to a decent length, so as to afford a good bite for the sheep by the first week in April, to which time the turnips and rye will have been competent to the maintenance of the ewes and lambs. Towards the latter end of April, or beginning of May, or perhaps the middle of that month, as the season has been more or less favourable, the winter tares will have got to a sufficient height for feeding. Those who have been accustomed to this mode of husbandry will easily conceive the necessity of suffering the tares to grow to the period when they shall be nearly fit for the scythe, before they be fed off; namely, that at this time they yield the greatest and most lasting quantity of pasture. To this end, the field should be parted with hurdles according to its size, and the number of sheep to be grazed thereon: and let the ewes and lambs be brought out of the marsh when their bellies are full, and driven into the tares; observing that this be not done at a time when there is any moisture hanging on the haulm, either from dew or rain; for, as the pasture arising from these pulse is exceedingly succulent, the sheep would run great hazard in feeding on it when replete with moisture, as he has more than once experienced to his cost: this animal, like all others of the ruminating tribe, being very subject to a disorder from repletion, termed *horning*; and on this account, likewise, the folding flock, when first driven on the tares, ought to go thither with full bellies, to prevent their feeding on them with too great eagerness and avidity. At this time, the lambs will have gained sufficient strength to admit of their being folded with their dams, if it should be found necessary to the farmer's occasions to pursue this method. But in this case, it is to be supposed that the field which is to have this dressing be at no great distance removed from the close of tares; otherwise the drift will prove highly prejudicial both to the ewes and lambs. The summer fold is generally pitched on a fallow, intended to be sown with turnips in the course of the season; and this business usually commences in May. A fold for three hundred ewes and lambs may be made to inclose eight rods of ground; and if the *trundles* shall not seem to be dropped sufficiently thick from one night's dressing, the

sheep may lie a second night in the same place, rather than incur the hazard of injuring the health of the couples by confining them in too narrow a compass. The time when the sheep and lambs should go to fold is about eight o'clock in the evening, and to be released at five in the morning. Such wether lambs as are intended to be fattened, or double couples, where the ewes do not give a quantity of milk equal to the demand of the lambs, or any others which may be observed to sink in flesh, may, with their dams, be taken out of the fold, and maintained in a separate pasture, where the grafs has attained a sufficient head; and such of the folding ewes as appear to be weakly, or distempered, may, from time to time, be removed to the same pastures above mentioned, and suffered to lie in quiet, till they are judged able to return again to the fold.

It is added, that as it is likely that there will be some dry sheep in the farm, consisting of the two yearling wethers and tags, these are to be kept on more ordinary pasture than the ewes and lambs; and as they have hitherto followed them in the turnips, so they must likewise succeed them on the clover and tares. The couples are to be allowed the first bite, and the store sheep are then to be turned into the field. In the marshes likewise the same method should be taken, of reserving the most forward growths for this part of the folding flock: by such management there will be two folds at work in the same instant, and the shepherd will find ample employment throughout the day.

After the tares are eaten off, the clovers and trefoil will be ready to receive the flock, and here the sheep and lambs are to precede the dry flock; and the fields, if extensive, should be parted with hurdles, that the sheep may not *straggle* the whole piece before they have eaten half the field, which would inevitably be the consequence if they were permitted to range over a large close; for it is the nature of this animal, when turned at first into a field, to take a range over the whole superficies before it will settle on its feed. It follows, therefore, that a division of large pastures will lengthen out their abode in them; small inclosures do not require it, which, by the bye, shews the advantage of these contracted pieces over those of wider extent; for in these small fields the sheep lie much warmer in the winter, and a considerable space is saved in hurdles, which in great fields are required in great abundance, besides the labour of setting them, and the necessary delay of time when the horse must be taken off from other work to draw them to and fro. For these reasons, small fields, to a farmer who places much dependence on his flock, are far more commodious than large ones; but for corn the preference is to be given to those of wider domain. A good shepherd will be careful that his flock be driven late to fold in an evening, and released early in the morning from their confinement, in order that they may enjoy the coolest parts of the day on the food. He will be cautious that they are allowed a sufficient time to graze in the uplands previous to their being driven into the fold, that they may retire to rest with their bellies full, by which the quantity of dung and urine will be considerably augmented. He will likewise be careful in reviewing the hurdles, and provide that these are fixed tight in the ground, lest by any accident they should be thrown down during the night, and the flock by these means get into mischief, or intermix with other sheep; he will count his sheep regularly every evening when he drives them to fold, and take a fresh *sale* in the morning when he turns them to their feed; he will, previous to dismissing them from the fold, worry them gently round the same, in order to cause them to dung and stale plentifully, that the manure may be left in the field, otherwise

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wife the greatest part of the trundles will be dropt on the road, or carried on to the marsh, where, lying thin, this dressing can do but little service, and where it is not wanted in any degree.

After the sheep have been shorn, as they are very tender for some little time, it will be advisable to keep the flock out of the fold for a week, and, during that time, not to turn them on any pasture where there are thistles or other annoyances. If the weather should prove hot and dry at this season of the year, the natural grasses and clovers are generally short, and the farmer is at a loss for a baiting-place whereon to turn his flock previous to their going into the fold, unless he hath had the foresight to raise a piece of spring tares for this use. At this time, likewise, the fallow ground works like ashes, and, by the heat of the sun, a great part of the invigorating juices arising from the dung and urine of the sheep is evaporated, so that it may be well questioned whether it be productive of any material advantage to fold the sheep at this season. That the sheep are greatly injured from being folded under these circumstances, especially if their drift is at any distance, with the intervention of a dusty turnpike-road, for a quarter of a mile or more between the marsh and the fold, as is frequently the case, he is fully convinced: it would, therefore, perhaps, be prudent to discontinue the folding till the rains about Midsummer, when a day's work may be ploughed, on a lay intended to be sown with wheat in November, and the fold immediately set on that part, and so to proceed on the ploughed ground; and thus the folded surface, although the sun should still continue hot, and quickly exhale the moisture of the dung and urine, will nevertheless enjoy an exclusive benefit of being closely pressed by the tread of the sheep, which will prove of infinite service, and which could have been of no use on the turnip fallows, where the fold had hitherto been set. After weaning the lambs, by continuing the fold at work on the lays in the manner before noted till November, a flock of two or three hundred sheep will have dressed a considerable breadth of new lay ground, and the wheat may then be harrowed in. But now commences a method of folding, which is of more importance than any which has preceded it. This is, to fold on the wheat when sown, the method of which is as follows: first, sow a day's work on a lay that has been ploughed ever since the Midsummer rains, and the seed being harrowed in, pitch the fold, and let the sheep lie on the new sown furrows; and so continue every night till the whole is completed, unless there should fall so heavy a glut of rain as to make it unadvisable to lodge the sheep on the damp ground; otherwise there will be no fear of treading the surface too close after sowing; for on light soils, a firm texture is absolutely necessary towards the future welfare of a wheaten crop, especially when this grain is sown on lays, which, if not well trodden, is subject to be much eaten by the worm; but there need be no doubt of the corn forcing its blade through the hardened surface, although from its appearance a person unacquainted with this business would deem it impracticable. When the fold shall have gone over this first drift, let another day's work be ploughed, sown, and harrowed in, and the fold continue to run over the same in like manner as before directed, and so proceed till the wheat season is finished, and the corn begins to germinate, when it will be proper to discontinue this practice as quickly as possible, as injury would be done to the crop.

Winter folding.—At this period the flock may commence their winter folding, the manner of which is thus explained. And first, it is supposed that the farmer has taken care to pro-

vide a due allowance of meat for his sheep on the uplands, as likewise a sufficient stock of hay or pea-straw for them to browse on whilst in the fold, during the long brumal nights; for at this season they will require some sustenance in the night, which at the summer folding was not necessary to be given to them. Let the fold be then pitched on a stubble, intended to be ploughed up in the spring for a fallow, and let it be made considerably larger than the summer folds. A flock of three hundred sheep ought not to be limited to a less space of ground than forty rods, which is a quarter of an acre, in which there should be placed a sufficient number of racks, filled with hay or pea-straw; and in this fold they may lie two or three nights, at the option of the owner. Whilst the weather continues mild and open, and is not attended with too considerable a proportion of moisture, the sheep may run in the marshes during the day-time, and be baited in the uplands, on a piece of young clover or other succulent food towards the evening, previously to their going into the fold; but when the weather becomes cold and wet, with sharp winds, they must no longer be driven into the marsh, but be maintained altogether on turnips near to the field where the folding is carried on; and if it does not suit the farmer to apportion any of his winter food for his folding flock, the business must be altogether relinquished, since it would be highly improper that the sheep should have so long a drift in the depth of winter. Whilst the business of the fold is going forward on the stubble in the night, as before mentioned, the sheep may be employed during the day in treading the wheat, a practice of great utility both in the autumn and spring, and which in some degree answers the end of the fold, to that part of the land which had not partaken of this advantage. In the winter folding, the lambs ought not to share in any degree, though they are sometimes penned in the fold with the sheep after weaning-time. Towards Christmas, it will be proper to discontinue the ewe fold entirely, as the ewes then get heavy in lamb, and might be greatly injured through a longer continuance of this practice. At this time, therefore, the breeding ewes should be turned into the marshes, to lie quietly during the time of gestation; and if the folding be any longer continued, let it be with the young wethers and ewe tags, which are the least liable to injury by it.

Thus the winter folding being finished, suppose the feeding wethers to be on turnips, and the lambs and young sheep on the *grattens*, with occasional shiftings on the shells of the turnips, left by the fattening sheep, and the breeding ewes quietly lodged in the marshes or low pasture lands.

We now come to the method of conducting a folding flock of wethers, which is generally adopted by those farmers only who possess not the advantage of breeding land, as from what has been mentioned on that head, and what remains to be said on this, it will appear, on a comparison, that the balance is much in favour of the breeder, where the situation of the farm will allow of the practice. But in order to maintain a folding flock where there is no marsh land or natural grass attached to the farm, it will be necessary that the arable land be sufficiently extensive to admit of raising annually a quantity of turnips, rye, tares, clover, and trefoil, in proportion to the exigencies of the flock; and if the farm lies in the neighbourhood of an extensive common, the business of folding may be carried on to a much greater advantage. The sheep which are best adapted to this purpose are those of the large Wiltshire or Hampshire breeds. But these are not calculated for the purchase of the farmer who wishes to profit by his fold, and

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and afterwards to fatten his flock on turnips; since it is great odds if he will be able to provide them with meat, equal to maintaining them in the condition wherein he bought them, and by consequence he must either discontinue his fold, or be content to see his flock dwindle, and become of less value the longer they are kept on the farm. But where the purchase is made with a view of penning them immediately on turnips, to fatten for the butcher, such large wethers may be very proper. Hampshire wethers are somewhat less than those of Wiltshire, and either these, or the inferior kind of Wiltshire, are best adapted for folding.

It is added that wethers are purchased by the husbandman at different ages, according as the economy of his farm may direct his views. If lambs are preferred, these are to be bought at the autumnal fairs, and will require to be kept a twelvemonth before much benefit can be expected from them, as the folding them at this early age, during the winter, might prove highly prejudicial to their growth. Four-tooth sheep, or two-yearlings, are likewise laid in at the autumn, and will come into work immediately. As to the six-tooth, or three-yearlings, and full-mouthed-sheep, these are rarely if ever bought with a view to keep as stores; for being arrived at their full growth, the profit to be expected from them, except for immediate fattening, will not be considerable; and when fold off in the succeeding winter, the owner must again have recourse to the like expedient of renewing his fold, which would occasion a considerable drain of ready money, and not fully answer his purpose. Whereas, by purchasing young flock, either lambs or tags, the original price is lower, and the loss of those which die by casualty will consequently be less severely felt; besides that these sheep, having been inured to the soil, will be found to go through their work with greater facility, and the hazard of their dying will be lessened in proportion to the time they have been resident on the farm. For these reasons, the farmer who keeps a wether flock should make purchase either of lambs or tags. These tags, or two-tooths, are to be met with at the spring fairs, and may be folded after having rested a few nights to recover themselves from the fatigue of the dust. A good shepherd is equally useful to a person who keeps a wether fold at work, as to the breeding farmer.

And now supposing the winter fold to commence at Michaelmas, the sheep at this time are to be driven to and from the fold, at the same hours as was directed for the ewes, and when released in the morning should be turned to graze on the common, where they are to continue till two or three hours before the time of folding, when they are to be brought home and baited on a piece of clover or other pasture, where there is plenty of herbage, that they may enter the fold with full bellies. As the grass on the common falls off, it will be proper to relinquish this pasture, and take the flock into the inclosures; such as old lays, clovers, &c. of which by proper management, there will be always great store remaining on farms of any extent, where this mode of husbandry is pursued; and where there is not a large tract of arable land, that sheep feed may be yearly raised in abundance, it will be useless to attempt it. These pastures then, by favour of the autumnal rains, we will suppose, have thrown out a tolerable bite of grass by the time the flock is taken off the common; and from hence the sheep may be folded, till the state of the weather renders it necessary to remove them on the turnips, of which the writer likewise presumes there is no deficiency. From the turnip field they may be driven every night into fold, till the further progress of the winter renders it ne-

cessary to discontinue this business. In folding wethers, it is prudent to take in a large compass of ground in the winter time, as hath been before observed in speaking of the ewe fold. Racks tilled with hay and pea haulm should be standing at this season within the fold. As there will be annually a number of the full-mouthed sheep drafted off for fattening, and as such forward wethers will have been some time at turnips before it is necessary to turn on the store sheep, these latter may succeed the former wethers, and be made to eat up the hulls which they had left behind. As to the lambs, these should be always kept to a good and plentiful diet during the winter; by which management they will probably gain a larger size than they could have possibly reached if they had not been allowed a great plenty of meat whilst they were young. The same rule holds with colts, calves, and other young animals, which, if stinted in aliment during their growth, will always carry with them sufficient marks to denote this improper management throughout the remaining part of their lives. This being the case, it is evident that some of the best pasture and most prolific grattens should be allowed for the lambs till the turnips are ready for feeding, when this young stock ought to come in for their share of that root. By this mode of treatment they will make large tags in the next year, and prove a valuable addition to the fold. In buying lambs, which are hereafter intended to compose a folding flock, the purchaser will do well to be directed more by the size of the young creature than by its corpulency. As the spring advances, the fat sheep will continue to be fold off, which will enlarge the circuit for the store wethers, so that on land in any degree kindly for the cultivation of turnips, a sufficient quantity of this root may be raised for the winter support of the folding flock. As to those sheep which are intended to be fattened, it must never be permitted for them to entrench too far on the provision of the flock; therefore, when the turnips are slight, it is found to answer better the interest of the farmer to sell the full-mouthed wethers out of the fold at Michaelmas, than to suffer them, on the expectation of bringing in some ready money towards the spring, to devour the meat which ought to have been reserved for the flock, and without which the store sheep will sink in flesh, and the farmer in the end will be considerably out of pocket in the prosecution of this scheme. When the turnips are eaten off, the flock may be turned on the rye; or if this feed hath got to a good bite in the month of February, which frequently happens in mild winters, and on land that is in tolerably good heart, the folding wethers may be occasionally shifted from the turnips to the rye field, and when they have eaten down this latter, be removed back on the turnips, and afterwards driven again on the rye when the blade shall have arisen to a second bite; observing that this food should never be allowed to stand till it begins to be on the spindle, for after that time it soon loses its succulency, and becomes unfit for this use. It is therefore in the early part of the spring, only whilst it continues in its herbaceous state, that rye is for any use for sheep feed; as in a forward spring it forms its spindle towards the beginning of April, it should seem that no material benefit can be derived from it after those winters which have been attended with a considerable length of frost, so as to prevent it from growing to a head for sheep feed in the months of February and March; for it is in these two months when rye is of the greatest advantage. In very backward springs, however, rye may continue to be fed much later than the period here mentioned, and be found very useful at such times, when, from the ungenial

weather in these late springs, the tare and clover fields are sluggish in their vegetation and growth.

The whole of the fields of rye and turnips having been fed off, the rye grafs will by this time have formed a shoot, and will afford a wholesome food, on which, with alternate removals to the old lays and young clovers, the flock will find sufficient pasturage till the time advances for turning them on the common, when the summer folding will commence. The lambs which were bought in at the last spring fairs are now become tags or two-tooths, and those which were bought in tags at Michaelmas are become four-tooths, or two-yearlings. These will now all of them go to the fold together, and feed in the same pasture, that is, on the common during the day time, and in the evening, previous to the time of folding, are to be baited on the clover, &c. that they may go into the fold with full bellies. At the spring fairs tags may be bought to supply the place of those old sheep which were fold off, and these may conveniently go to fold with the rest; and if at Michaelmas it should be found necessary to increase the number, either lambs or two-yearlings may then be purchased, at the option of the farmer; and by this management, if the master is cautious in laying out his money, and the shepherd diligent in his office, a wether stock may be maintained to great advantage on those farms where there is a considerable tract of land, and an adjoining common. And thus by observing to lay down the most sterile part of the land, and that which is at the farthest distance from home, with rye-grass, and when worn out to plough it up, and after having reaped one crop of corn, to sow it again with rye-grass, and by folding on such part of the land as will admit of being kept in tillage, with alternate growths of clover, trefoil, &c. the poorest soils may be made to answer the purposes of the husbandman. And it is by the prosecution of this mode of agriculture alone, that such poor, thin, and hungry ground can be cultivated to any good account; for if the reater, either from want of money, or through ignorance, should neglect to keep a folding flock on these barren farms, and place his whole dependence on the plough and the feed-crop, a few years would convince him of his error, and, unless his resources were very ample, bankruptcy and ruin would inevitably ensue.

It has long since been remarked in the third volume of his "Essays on Agriculture and Rural Affairs," that much amelioration and improvement may frequently be effected in bringing waste land into cultivation, by the folding of sheep, provided it be conducted with proper attention to the season, the nature of the land, the course of crops, and the having a sufficient number of folds, according to the extent and situation of the land.

FOLDS, in the *Manufactures*. See **CLOTH**, &c.

FOLDS of the *Drapery*, in *Painting*. See **DRAPEY**.

FOLENGIO, or **FOLENGIUS**, JOHN BAPTIST, in *Biography*, was born at Mantua in the year 1490, and at the age of sixteen he entered into a Benedictine monastery in his native city, where his talents and industry obtained for him a high reputation for proficiency in literature, and sacred criticism, while the excellence of his disposition rendered him an object of general esteem. He was selected to fill the most important and distinguished stations in his order, and he was afterwards chosen by pope Paul IV. as visitor of the Benedictine foundations in Spain. When he had performed this task he had returned to his native country, and devoted himself almost wholly to theological studies. His mind was liberal, and he was desirous of reforming the church, and of uniting Catholics and Protestants in one communion. After a life spent in the service of his fellow

creatures, he died in 1559, in his seventieth year. He left behind him many theological works, of which the principal were "Commentaries upon the Epistles of St. James, St. Peter, and the first epistle of St. John," published in 1555 in 8vo.; also, a "Commentary upon the Psalms." These works were distinguished for erudition, piety, and liberality, and were soon prohibited by the church of which he was an ornament. The latter was reprinted at Rome by order of pope Gregory XIII. in 1585, being first revised, and curtailed of some offensive passages. Dupin, speaking of the labours of Folengio, says, that he "writes purely and nobly, and Thuanus had reason to say, that no man will ever repent the reading of his commentaries." Moreri.

FOLENGO, **THEOPHILUS**, known in the poetical world by the name of "Merlin Coccaze," is celebrated for the species of poetry called macaronic. He was born at Cipada, near the lake of Mantua, about the year 1491. He was, in early life, initiated in the studies of polite literature and philosophy, and at the age of sixteen entered the order of St. Benedict, and changed his name of Jerome to that of Theophilus; but his passions were ill adapted to the confined limits of a monastery, and he passed eleven years, after he quitted the cloister, in a rambling kind of life, during which he composed and published at Venice his macaronic verses. This mode of writing, which has not very frequently been imitated with success, consists in interweaving with Latin verse a number of words and phrases in the vernacular tongue, thrown in at random, and made to fit the metre by Latin terminations. Folengo, if not the inventor of macaronic verse, was the first who brought it into vogue. He was, however, capable of a higher species of composition, and would probably have excelled in pure and elegant poetry, had not the love of novelty led him into this extravagance. The late learned Dr. Geddes, the translator of the early books of the scriptures, wrote, about the year 1790, two or three macaronic poems, which he circulated among his friends. Folengo returned to a religious life in the year 1526, and published the "Chaos del Triperuno," which is descriptive of the various incidents of his life, ending with his conversion. He then retired to a small monastery, where he endeavoured to expiate the fault of his looser writings, by composing a poem entitled "La Umanita del Figlio di Dio." After this, we find him at Palermo, where he composed a kind of drama representing the creation, the fall, &c., and some religious tragedies. He died in 1544, in the monastery of S. Croce de Campese, in Padua, and was interred with great pomp. The estimation in which he was held was exhibited in the erection of a magnificent tomb, on which were inscribed several epitaphs in various languages. Moreri.

FOLEYKUNDA, in *Geography*, a town of Africa, in the country of Kantor.

FOLIA, in *Botany*, is used for the leaves of plants, and also of flowers, but particularly the former; the leaves of flowers being more properly called *petala*.

FOLIACEUM EXPANSUM, in *Anatomy*, is that extreme of the Fallopiian tube next the ovary; and which is expanded like the mouth of a trumpet, and invironed with a sort of fringe.

FOLIAGE, a cluster or assemblage of flowers, branches, leaves, &c.

FOLIAGE is generally used for representations of such flowers, leaves, branches, rinds, &c. whether natural or artificial; used as enrichments on *capitals*, *frizes*, *pediments*, &c.

FOLIANUS, **LUDVICUS**, of Modena, in *Biography*, a writer on the theory of music, published a Latin treatise,

in 1522), at Venice, folio, with the following title; "Musica Theorica, Ludovici Fogliani Mutinienfis: doctè simul ac dilucide pertractata: in qua quamplures de Harmonicis intervallis, non prius tentata, continentur speculationes." "The theory of music by Luigi Fogliani of Modena, in which are contained and learnedly elucidated many harmonic speculations relative to the intervals of music, never before attempted." This work is divided into three sections: in the first the author treats of musical proportions; in the second of consonances; and in the third of the division of the monochord. In the second section a foundation seems to have been laid for a musical controversy, which was afterwards agitated with great warmth; this author, contending for the doctrine of Boethius, from whom two-thirds of his book are taken, for the distinction of *greater and less tone* in the diatonic tetrachord. The title of one of his chapters being, "De utilitate toni majoris et minoris." Harmony now began to be felt, and was improving and refining, and as there was no melody till the lyric theatre was established, and solo songs, fine voices, and refined singing were cultivated, it alike occupied professors and dilettanti, philosophers and mathematicians. We know not what rank Fogliano held in society; if he was a professor, he adhered too exclusively perhaps to mathematics, and the science of harmonies, to be much used to practical music; and if a mere mathematician, the real beauties and refinements of the art must be unknown to him. However, to Fogliano is ascribed the first idea of introducing a *temperament* into modern harmony. Boethius, Guido, and Franchinus, were silent on the subject. The organ was tuned in such a manner as rendered a few keys perfect at the expence of all the rest. There was no instrument that could make occasional temperaments but the violin, and that was wholly unknown in concerts at the beginning of the 16th century. Wind instruments, and all keyed and stringed instruments, in which one note was obliged to serve different purposes, were forced to submit to false intonation, and the exclusion of all tempered keys, till temperament gained ground, and the doctrines of Didymus and Ptolemy were adopted, which were in favour of major and minor tones, and semi-tones; and those who enjoy the harmony of thirds, which, without temperament are intolerable, owe their pleasure to Foglianus for recommending them, and to Zarhino for seconding his endeavours. See DIDYMUS, PTOLEMY, and TEMPERAMENT.

FOLIATE, in the *Higher Geometry*, a name given by some to a curve of the second order, expressed by the equation $x^2 + y^2 = a xy$, being one species of defective hyperbolas, with one asymptote, and consisting of two infinite legs crossing one another, and forming a sort of leaf.

FOLIATING of *Looking-glasses*, is the spreading a composition of something which will firmly adhere to the back of the glass, and there reflect the image.

This composition is called the *foil*, and is usually made with quicksilver, mixed with tin, and some other ingredients. For the method of foliating looking-glasses, both plain and globular, see LOOKING-GLASS.

FOLIATION, in *Botany*, &c. is used by Dr. Grew to express the assemblage of the *folia*, or *petala* of a flower.

The foliation is the most conspicuous part of flowers, being that collection of fugacious coloured leaves, which constitutes the compass, or body of the flower.

It is of great use in the generation and preservation of the young fruit, or seed; it filtrates a fine juice, to nourish it in the uterus or pistil.

In some species, as apricots, cherries, &c. it likewise serves to guard the young tender fruit from the violence of

wind, weather, &c. For this being of a very tender and pulposus body, and coming forth in the colder times of the spring, would be often injured by the extremities of weather, if it were not thus protected, and lodged within the flowers.

Before the flowers open, the foliation is curiously and artfully folded up in the calyx or perianthium.

Dr. Grew enumerates several varieties of these foldings, viz. the *close couch*, as in roses; the *concave couch*, as in the blattaria flore albo; the *single-plait*, as in pea-blossoms; the *couch and plait*, as in marigolds; and the *rowel*, as in the ladies bower.

FOLIES, Fr. *Follia*, Ital. a Spanish dance, formerly in high favour. It is composed on a ground with variations, and danced by a single person *a pas seul*. Corelli's twelfth solo, consisting of 24 variations on a tune called "Farinel's ground," which is said to have been composed at Hanover on purpose for Corelli to exercise his fancy upon, by a German musician of the name of Farinel; but unluckily, Corelli never was at Hanover, and this ground, on which he worked, was an old Spanish dance, long before Corelli was born.

FOLIGNO, or FULIGNO, in *Geography*, a town of Italy, in the province of Umbria, the see of a bishop: built on the ruins of the ancient *Forum Flamini*. According to its old constitution, it was governed by seven magistrates, called "Septemviri," who are changed every two months. It contains eight churches, and many convents, and though it has some good streets, it has neither squares nor town-houses: its chief business is confectionary, paper making, and manufacture of silk. In 1796 it was taken by the French; 10 miles N. N. W. of Spoleto. N. lat. 42° 55'. E. long. 12° 36'.

FÖLINGRE, a town of Sweden, in Jamtland; 30 miles N. of Osterfund.

FOLIO, or rather *Folium*, in books of account, &c. signifies page.

Thus folio 7, written abridgedly F^o 7, denotes the seventh page, &c.

Folio recto, or F^o R, expresses the first side or page of a leaf.

Folio verso, or F^o V, the second or back-side of the leaf.

The word is Italian, and literally signifies *leaf*.

FOLIO, among *Bookjillers*, a book in folio, or simply a folio, is that where the sheet is only folded in two, each leaf making half a sheet.

Beneath the folio are the quarto, octavo, duodecimo, sixteens, twenty-fours, &c.

FOLIS, or FOLLIS, anciently signified a little bag or purse: whence it came to be used for a sum of money, and very different sums were called by that name: thus the scholiast, on the *Bathes*, mentions a follis of copper which was worth but the twenty-fourth part of the minarensis; the glossæ nomicae, quoted by Gronovius and others, one of a hundred and twenty-five minarenses, and another of 250 denarii, which was the ancient tertium; and three different sums of eight, four, and two pounds of gold, were each called follis. According to the account of the scholiast, the ounce of silver, which contained five minarenses of sixty in the pound, was worth a hundred and twenty follis of copper. The glossographer, describing a follis of two hundred and fifty denarii, says it was equal to three hundred and twelve pounds six ounces of copper; and as the denarius of that age was the eighth part of an ounce, an ounce of silver must have been worth a hundred and twenty ounces of copper; and, therefore, the scholiast's follis was an ounce

ounce of copper, and equal to the glossographer's *nummus*. But as Constantine's copper money weighed a quarter of a Roman ounce, the scholiast's *folles* and the glossographer's *nummus* contained four of them, as the ancient *nummus* contained four *asses*. See *Phil. Transf.* vol. *lx*. p. *ii*. p. 515, &c.

FOLIUM, in *Botany and Vegetable Physiology*. See L. F. A. F.

FOLIUM *Branchiarum*, the leaf of the gills, a term used by some of the ichthyologists, to express that part of the gills which looks red and fringed. The gills of fish are composed of certain bony circles, which are formed on the convex side with a great number of laminae; these serve to receive the ramifications of the arteries, and are called the *folium* or leaf of the gills. The aorta or great artery reaches no farther than this part in fish. It has no descending trunk, but every part of the body is supplied by a large venal trunk, formed by the joining of the several smaller trunks of the several circles of the gills.

FOLIUM *Indicum*, or *Indum*, called also *tamalapatra*, and *malabathrum*; a leaf brought from the Indies, growing chiefly about Cambaye, produced by a tree not unlike the lemon-tree; used in the composition of Venice-treacle.

FOLKES, MARTIN, in *Biography*, an eminent philosopher and antiquarian, was born in Westminster in the year 1692. He was educated under Mr. Cappel, formerly Hebrew professor at Saumur, but at the age of 17 he was sent to Clare-hall, Cambridge, where he pursued the studies peculiar to that university with so much assiduity and success, that he was elected member of the Royal Society before he had completed his twenty-third year. His communications to this learned body were so much esteemed, and his understanding so highly appreciated, that he was frequently chosen into its council. He was in habits of friendship with the illustrious Newton, at that period president of the society, and by his influence Mr. Folkes was elected one of the vice-presidents in 1723; and at the death of that great man in 1727, he was candidate for the vacant chair, but the superior interest of Sir Hans Sloane rendered his application unavailing. The contest was probably carried on without that bitterness and animosity which occur too frequently on occasions of this sort, for we find Mr. Folkes still in the council, and vice-president till the year 1733. During this and the two following years he resided for the most part in Italy, improving himself in the knowledge of classical antiquities. Here he laid the foundation of his works on ancient and modern coins, having by his situation ample opportunities of ascertaining their weight and value; the result of which he laid before the Royal Society on his return from the continent. He likewise read before the same body memoirs upon the measurements of Trajan's and Antonine's pillars, together with other remains of antiquity. A table of all the English gold coins, drawn up by Mr. Folkes, was afterwards printed at the request of the Royal Society, before whom he laid his "Remarks on the Standard Measure preserved in the Capitol of Rome," and a model of an ancient sphere preserved in the Farnesian palace. A representation of this sphere was published in Dr. Bentley's edition of *Manilius*. Mr. Folkes visited Paris in 1739, where he was received with great respect, and was introduced to the company, and obtained the friendship of the most eminent literary characters in that metropolis. On the resignation of Sir Hans Sloane in 1741, he was elected to the honourable office of president of the Royal Society, and in a very short time he was nominated to succeed Dr. Halley as one of the eight

foreign members of the Royal Academy of Sciences at Paris. In 1745 he published in a thin quarto volume, printed at the expence of the society of antiquaries, his very valuable "Table of English silver coins, from the Norman conquest to the present time, with their weights, intrinsic values, and some remarks on the several pieces." In an appendix to this work we have an account of the "Coins minted in Scotland since the Union of the two Crowns:" and "A table of English gold coins from the eighteenth year of king Edward III. when gold was first coined in England, to the present time." He intended to have illustrated these with plates, which he had prepared, but which he did not live long enough to publish. They were, however, purchased by the Antiquarian Society, and published some years after his death. Mr. Folkes, in addition to his many other honours, had conferred on him the title of doctor of laws by both universities, and he was also chosen president of the Antiquarian Society. He died in the year 1754. Dr. Birch collected materials for a life, which are preserved in the anecdotes of Bowyer. He was a man of very extensive and accurate knowledge, and he was distinguished in private life for politeness, generosity, and friendship. *Biog. Brit.*

FOLKINGHAM, in *Geography*, though a market town in the hundred of Aveland and division of Kesteven, in the county of Lincoln, distant from London 107 miles, is but a small place, situated on the side of a hill, abounding in springs, containing 99 houses, and a population of 531. The church is a well built structure, having at the west end a handsome lofty tower surmounted by eight elegant light crocketed pinnacles. The sessions-house has lately been rebuilt, and the houses in general have a commanding view over the extensive adjacent fens. It possesses little trade, and the small market is held weekly on Thursdays. Folkingham was included in the *one hundred and thirty-one* manors in the county of Lincoln only, which formed part of the immense possessions belonging to Gilbert de Gaunt, who accompanied the conqueror from Normandy, and afterwards it was granted, in the reign of Edward I. to Henry de Bellamonte, or Beaumont, who it is supposed erected the castle, which having been defended for king Charles I. was destroyed by Cromwell. In this vicinity are the remains of the monastery of Sempringham, remarkable for having been the first *double house* in England, for the singular and ridiculous order of recluses that comprized both monks and nuns under the same roof, called, from their founder, Gilbertines. Gough's *Camden's Britannia*, and *Beauties of England and Wales*.

FOLK-LAND, a term which in the ancient Saxon customs signified *copyhold lands*. And in opposition to these, charter lands were denominated *book* or *boe lands*.

FOLKMOTE, FOLEMOTE, or FOLKESMOTE, among our Saxon ancestors, signified any popular or public meeting of all the folk or people of a place, district, or the like; *e. gr.* of all the tenants at a court-leet, or court-baron; or of all the freemen of the county; or of all the barons of a kingdom.

The word, says Stow, is still in use among the Londoners, and signifies "celebrem ex omni civitate conventum," an assembly of all the citizens. Manwood says, it is the court holden in London, wherein all the folk and people of the city did complain of the mayor and aldermen for any misgovernment.

Sommer, in his Saxon dictionary, makes *folemote* to denote a general assembly of the people, for doing fealty to the king, and considering and ordering matters of the common-wealth; whence some date the origin of parliaments.

"Omnes

“Omnes proceres regni, & milites & liberi homines universi totius regni Britanniae, facere debent in pleno sole mote fidelitatem domino regi, coram episcopis regni. In Leg. Edw. Confess. cap. 33. Et amplius non fit in hustinga, miskeninga, *i. e.* speaking amiss; neque in folkesmote, neque in aliis placitis infra civitatem.” Charta H. I. pro London. Du-Cange.

When such assembly is made in a city it may be called a *burghmote*: when in the county, a *shiregemote*.

“Cum aliquod vero inopinatum & malum contra regnum vel contra coronam regis emerferit, statim debent, pulsatis campanis, quod Anglice vocatur motbel, convocare omnes & universos, quod Anglici vocant folkmote, &c.” Leg. Alfred.

FOLKSTONE, in *Geography*, a town of England, in the county of Kent, situated in the English channel, and a member of the Cinque port of Dover, irregularly built along the cliff, nearly opposite to Boulogne. It was formerly a large town, containing five parish churches (now only one); but the greater part of it has been carried off by the sea. There was an ancient station on Castle-hill, which is a small oval of about two acres, double-ditched on the east, and triple on the north and west. Some vestiges of walls remain, and Roman bricks have been found. This town is a corporation, governed by a mayor, 12 jurats, and 24 commoners. It is populous, and contained, in 1801, 3257 inhabitants, who chiefly subsist by fishing, and employ a great number of smacks in this trade. Before the town there is good anchorage in 8 or 10 fathoms' water. Two hoys sail alternately every other week to London, when wind and weather permit. It is distant seven miles S. W. from Dover, and 72 E. S. E. from London, N. lat. 51° 5'. E. long. 1° 10'. To the westward of the town is Sandgate-castle, built by Henry VIII.

FOLLICLE, **FOLLICULUS**, in *Botany*, a kind of pericarp or seed-vessel, consisting of one valve and one cell, bursting longitudinally, and bearing the seeds on or near its edges, or on a receptacle parallel therewith. Its substance is usually coriaceous and tough, in some instances approaching to woody. Examples of this sort of fruit are found in the Peony, Periwinkle, *Sterculia*, and some others. Linnæus esteemed the follicle distinct from a capsule, but Gærtner, more properly perhaps, comprehends it under his idea of the latter. (See **CAPSULE**.) The capsules of *Helleborus*, *Delphinium*, *Aconitum*, &c. come very near the idea of a follicle, except that they appear to be formed of two valves, but this is rather in appearance than reality, and if true, would, on the other hand, bring them to the definition of a *legume*; but the latter is always solitary, which the said capsules are not, except in the anomalous instances of some species of *Delphinium*, in which their true nature is nevertheless evident from analogy.

FOLLICULUS, in *Anatomy*, a name sometimes given to small glandular bodies; it means a little bag. The parts described under this name have an opening in their centre, through which the secreted fluid is discharged. They are frequently termed mucous follicles, as they generally produce a mucous secretion.

FOLLINUS, **HERMAN**, in *Biography*, was born at Frison, and during several years was physician to the chief magistrate of Bois-le-Duc, until he was elected professor of medicine at Cologne, where he was equally distinguished as a public teacher and as a practical physician. He died of the plague near the middle of the seventeenth century, and left some works of repute. The titles of these are, 1. “De Luis pestiferæ fugâ, deque remediis ejusdem, libri duo, &c.” Antwerp, 1618, 8vo. 2. “Orationes duæ; de natura et

curatione Febris peticularis; de studiis chymicis conjungendis cum Hippocraticis,” Colonia, 1622, 8vo. His son John, born at Bois le Duc, was also distinguished by his practice and his writings.

FOLLIUS, **CÆCILIUS**, was born at Modena in 1615, after the death of his father, and was educated at Venice, under the care of his uncle, who held a distinguished station among the physicians of the council of health. His medical education was completed at Padua, where he received the degree of doctor in physic. He returned to Venice, where his talents were rewarded by the senate with the honour of knighthood, and an appointment to the professorship of anatomy, which he long held. He published the following works. 1. “Sanguinis à dextro in sinistrum cordis ventriculum defluentis, faciliis reperta via,” Venetiis, 1639, 4to. He erroneously supposed that a communication between the cavities of the heart subsisted through life, by means of little collateral apertures which supplied the place of the foramen ovale, as soon as it was closed after birth. 2. “Della generazione e uso della pinguedine,” Venise, 1644, 4to. 3. “Nova auris internæ delineatio,” Venetiis, 1645, 1647, 4to. This little work of six pages is esteemed on account of the accuracy of the figures.

Another author, Francis Follius, published a work at Florence in 1665, under the title of “Recreatio Physica, in qua de sanguinis et omnium viventium analogâ circulatione differitur,” 8vo.

FOLLOWERS, in *Rural Economy*, is a term employed to signify such lean or store cattle and sheep as follow the fattening bullocks or other live stock in the pastures or other grass lands. It is only in this way that such lands can be fed down in the most effectual manner, and with the greatest profit to the grazing farmer.

FOLLOWFIELD, in *Geography*, a township of America, in Washington county, Pennsylvania; containing 1635 inhabitants.—Also, E. and W. Followfield, are two townships in Chester county, Pennsylvania, the former having 1522, and the latter 839 inhabitants.

FOLLY, according to Mr. Locke, consists in the drawing of false conclusions from just principles; by which it is distinguished from madness, which draws just conclusions from false principles.

But this seems too confined a definition; folly, in its most general acceptance, denoting a weakness of intellect or apprehension, or some partial absurdity in sentiment or conduct.

FOLPAGO, in *Geography*, a town of Italy, in the Trevisan; six miles N. W. of Treviso.

FOLSELLI, a town of Africa, in the country of Barca; 18 miles S. E. of Derna.

FOMAHANT, or **FOMALHAUT**, in *Astronomy*, a star of the first magnitude, in the constellation Aquarius. See **AQUARIUS**.

FOMANO, in *Geography*, a river of Naples, which runs into the Adriatic, N. lat. 42° 40'. E. long. 14° 5'.

FOMENTATION, a liquid medicine, applied to any diseased part, to resolve, discuss, soften, assuage, fortify, or constringe the same.

Fomentations are either *simple* or *compound*.

FOMENTATIONS, *Compound*, are decoctions of roots, leaves, flowers, and seeds, made in common water, or other proper liquor, to which are sometimes added salts, axungia, oils, &c.

To use, or apply them, they dip a hot linen cloth, or flannel, in the liquor, and spread it on the part affected. There are also fomentations made another way, *viz.* by boiling

boiling certain drugs in linnen bags, and then applying them, bags and all, on the part.

There is also a sort of dry fomentations, being bags filled with medicines, but not boiled, only sometimes sprinkled with a little wine or brandy.

FOMENTATIONS, *Simple*, are those made with luke-warm water, milk, oil, oxycerate, or the like liquors.

Fomentations are also called *local baths*, or partial bathings; because, being applied on a diseased part, they have much the same effect as a bath, or half-bath, has on the whole body.

Fomentations have different names, according to the preparations of which they consist, and the uses to which they are applied. Thus, the anodyne fomentation, used for relieving acute pain, is composed of white poppy-heads, two ounces; elder flowers, half an ounce; which are boiled in three pints of water till one pint is evaporated, and then the liquor is strained out: the aromatic fomentation is prepared by boiling half an ounce of Jamaica pepper, in a pint of red wine for a little while, and straining out the liquor: this is used both for external and internal complaints. Colics and disorders of the bowels are often abated by fomenting the abdomen and region of the stomach with this warm liquor. The common fomentation is made by slightly boiling the dried tops of wormwood and camomile flowers, of each two ounces, in two quarts of water, and pouring off the liquor; to which may be added such quantities of brandy or spirit of wine as the particular case may require. The emollient fomentation consists of one ounce of camomile flowers; elder flowers, and sweet-fennel seeds, of each half an ounce; boiled for a little while in two quarts of water, and strained, with the addition of spirit of wine, &c. The strengthening fomentation is prepared of oak bark, one ounce; granate-peel, half an ounce; alum, two drams; and smith's forge-water, three pints: the water is boiled with the bark and peel till one third is consumed, and in the remaining decoction, strained, the alum is to be dissolved. This astringent liquor may be applied to foment weak parts, and also used internally.

FOMENTATIONS, in *Veterinary Science*, are commonly made by boiling wormwood, southernwood, camomile flowers, and bay-leaves in water, so as to make a strong decoction, which, being strained off, are to be applied as hot as possible, without giving pain to the animal, by means of large flannel cloths. The efficacy of fomentations depends in great measure on their use, being continued for a considerable time, and their being frequently repeated.

FOM-HOAM-TOUKA, in *Geography*, a town of Chinese Tartary, near a mountain of the same name; seven miles N. W. of Tam-fan.

FOMHIO, a town of Italy, in the department of the Adda; 15 miles S. S. E. of Lodi.

FOM-UL-SICH, a town of the Arabian Irak, on the Tigris; 20 miles N. of Valit.

FONAMI, a town of Japan, in the island of Ximo; eight miles S. of Taifero.

FONCEAU, in the *Manege*, is the bottom or end of a cannon-bitt mouth; that is, the part of the bitt that joins it to the banquet. See BITT and CHAPTERON.

FONCQUEVILLERS, in *Geography*, a town of France, in the department of the straits of Calais; 12 miles W. of Bapaume.

FOND DE L'ISLES DE VACHE, a town of the island of Hispaniola; 80 miles W. of Jaquemel.

FOND des Negres a town on the S. coast of Hispaniola; 40 miles W. of Jaquemel.

FOND, *le Petit*, a town of the island of Hispaniola; near the W. coast; 15 miles N. E. of St. Mark.

FONDAIMENTALE, *Pr.* See BASSE FONDAIMENTALE, where the history of this term has been given; but the abbé Feytaud having prohibited the calling any base fundamental except the generator of a common chord with a sharp third, has awakened new reflections on the subject.

In teaching thorough-bass, or counterpoint, the rule, that every base carrying a common chord or chord of the seventh, with a major or minor third, was the fundamental of such chord in every stage or inversion, was clear, comprehensive, and easily retained; but when a student is told that F is the fundamental base to the chord of A minor, it proves that the term fundamental, though useful in harmonics, is not admissible in practice without occasioning confusion. The term principal, as *l'asso principale*, used by the Italians, from the time of Zarlino to that of Padre Martini, would be more clear and less liable to objections, and to this use we shall continue in practice to apply the term fundamental base.

The system of *la basse fondamentale*, which Rameau proposed in his "Nouveau Systeme de Musique Theorique," in 1726, he presented to the Academie des Sciences in 1737, under the title of "Generation Harmonique." The members of the academy appointed to examine it, report that "the work is founded on a physical hypothesis, of which the first idea was reported in the History of the Academy by M. Micran, in 1720, upon a known experiment, that every sounding body, when struck, produces, besides the principal sound, the octave, its fifth, and the tierce above the double octave," &c. But this M. Rameau had forgotten; though that early period was more than 100 years subsequent to Galileo's discovery.

In 1752, Rameau's system was thought so great a discovery, that mathematicians, as well as musicians, interested themselves in its general adoption. M. d'Alembert, at the height of his fame as a geometrician, undertook to arrange and explain it; and "those (says Rousseau in his *Dict. de Mus. art. Systeme*) who wish to see the system of Rameau, so obscure and diffused in his own numerous writings, exhibited with a clearness of which it was not thought susceptible, will have recourse to the "Elements de Musique" of M. d'Alembert.

In 1757, d'Alembert gave offence to Rameau, by some doubts of the validity of his system; for some parts of which d'Alembert himself had been attacked by the great geometrician Dan. Bernouilli in the *Mem. de l'Acad. de Berlin* 1753. And d'Alembert, in 1762, published a new edition of his Elements, in which he pointed out several defects in Rameau's system, changed the chord from which he had derived the minor mode, and threw out several reflections on his pretending to have demonstrated the principle of harmony. This occasioned a breach between Rameau and his commentator, that was never repaired. And at the end of his "Code de Musique," 1760, he inserted a letter to d'Alembert, full of asperity and complaint. Upon which the great geometrician made several alterations in his Elements, which were now hostile to many of Rameau's principles, and in the notes, defended his alterations, as well as himself, against the reflections of Rameau in the letter which he had addressed to him.

Rameau defended his system (as Fontenelle did the *Tourbillons* of Descartes) to the end of his life, in 1767; and had established it in France almost universally; but since his death, Italian and German music growing into favour, and by degrees superseding his operas, which had been the delight and pride of France during 30 years, the

nation

FONDAMENTALE.

nation began to find that Gluck, Piccini, and Sacchini, could produce good music without the assistance of his *basse fondamentale*: his system has at present but few abettors.

Such is the history of this famous system of the fundamental base.



See *BASSE FONDAMENTALE*, in which article we have explained a curious discovery in natural philosophy, and the use that has been made of it in practical harmony. Though M. Rameau's system will not alone enable a student to compose good music, it will help to facilitate his studies, give him the etymology of chords, and of innumerable passages in melody, and regulate his harmony on a sure foundation. And though it would be dull music indeed that had no other base than the fundamental, as the harmony and modulation of no music is so simple as to be wholly confined to common chords; the fundamental base will therefore teach their warrantable succession, perhaps suggest a melody, or at least guide its progress.

Nothing more seemed necessary to be said on this subject; but in looking into the *Encyclopedie Methodique*, we find that it has furnished matter for an article of such enormous length, as to occupy 30 4to. pages, 26 of which have been scientifically filled by M. l'Abbé Feytaud, with an elaborate attempt at confuting all that has been said by previous writers on the subject. We have heretofore frankly confessed, that after frequent perusals and consultations of Rameau's theoretical works, and a long acquaintance with the writings of his learned commentator d'Alembert, and panegyrists the Abbé Roussier, M. de la Borde, &c. if any one were to ask us to point out what was the *discovery* or *invention* upon which his system was founded, we should find it a difficult task.

The base to a common chord has been known ever since the first attempts at counterpoint; and it only seems as if Rameau had given new names to old and well-known combinations, when he calls the key-note, with $\frac{5}{1}$, *generateur*, *basse-fondamentale*. But the Italians, ever since the time of Zarlino, have distinguished this lowest found by calling it the *first base*, *1mo. basso*; and the other parts of the chord, when made the base, *basso rivoltato*, or *2do. basso*. But Brossard in his *Musical Dictionary*, published 1702, in defining *Trias harmonica*, or the three sounds of a common chord in its first state, calls the under-note *basse*, or *son fondamentale*; and afterwards remarks that among the three sounds that compose the *Triade harmonique*, the gravest is called *basis*, or *sonus fundamentalis*. And what has Rameau told us more, except that the *harmoniques* produced by a string or pipe, which he does not pretend to have first discovered, are precisely the third and fifth in question. This is the practical principle of the fundamental base; the theoretic was surely known, of harmonical, arithmetical, and geometrical proportion and ratios of found, with which so many books have been ostentatiously filled ever since the time of Boethius.

The Abbé Roussier, his most learned apostle and able champion, candidly confessed in his first work, that "the system of a fundamental base ought not to be regarded as

one of those principles which precedes the consequences to be deduced from it." "Le mérite de cette découverte consiste, à avoir réduit en un système simple, commode, et facile à saisir, toutes les opérations des grands maîtres de l'Harmonie." *Traité des Accords*, 1764.

Rameau's system, as compressed and arranged by d'Alembert, is perhaps the shortest, clearest, and best digested, that is extant; and yet, from the geometric precision with which it has been drawn up by that able mathematician, many explanatory notes and examples are wanting to render Rameau's doctrine intelligible to musical students, in the first stages of their application; and even after that, the work, to be rendered a *complete theory*, would require many additions of late discoveries and improvements, both in the theory and practice of harmony.

About the year 1760, the System of a Fundamental Base, by Rameau, gave occasion to much discussion in Germany. By some it was adopted there as well as in Italy, by others disputed. It seems, however, as if this system, ingenious as it is, were somewhat over-rated by French theorists, who would persuade the world that all music not composed on Rameau's principles should be thrown into the flames—"Jusqu'à mon système," says Rameau himself; and M. de la Borde says, that "Music, since the revival of arts, was abandoned to the ear, caprice, and conjecture of composers, and was equally in want of unerring rules in theory and practice—Rameau appeared, and chaos was no more. He was at once Descartes and Newton, having been of as much use to music as both those great men to philosophy." But were Corelli, Geminiani, Handel, Bach, the Scarlattis, Leo, Caldara, Durante, Jomelli, Perez, &c. such incorrect harmonists as to merit annihilation, because they never heard of Rameau or his system? Indeed, it may be further asked, what good music has been composed, even in France, in consequence of Rameau giving a new name to the base of a common chord, or chord of the seventh? The Italians still call the lowest found of music in parts the *basse*, whether fundamental or derivative; but do the French imagine that the great composers above-mentioned, and the little composers who need not be mentioned, were ignorant whence every supposed base was derived? The great harmonists of the sixteenth century seldom used any other than fundamental bases. And the fundamental base to the hexachords has always been the key-note, and the fifth above and fifth below, just as Rameau has given it in his theoretic tracts.

The rules, however, which Rameau has given, with d'Alembert's commentary, were tolerably clear for composing according to his system; but are now "explained till all men doubt them;" and the editor of the long article, or rather treatise on the subject, seems only to have puzzled the cause. The definitions and nice distinctions in this article appear to us more ingenious and subtle than useful, at least in practice. The nature of our harmony, like the nature of man, is so imperfect, that all the calculation and reasoning which enable us to discover their imperfections, can never supply us with the means of cure.

If by study and labour we can somewhat diminish these imperfections, and approximate that perfection at which we aspire, it is all that our nature and the nature of things will allow. We can only counterfeit perfection, as a painter or sculptor can counterfeit a man. On our keyed instruments we can have but one key or mode perfectly in tune; and on wind instruments not even that. Temperament, and a deviation from the laws of nature, which our modulation and mixture of keys require, give our auditory organ pleasure, as it accommodates itself to the slight bearings and

imperfections in our intervals and scales. Many think the character and beauty of keys depend on these false intervals in the old temperament.

We shall not here give our readers all the problems to solve, or metaphysics to study, on the fundamental base, with which the *New Encyclopedie* abounds; but where it is said, p. 150, that the fundamental base produces the diatonic genus only as long as it confines its movements to the octaves, 5ths, and 4ths: when it moves by 3ds it gives the chromatic genus; and the enharmonic genus when it moves diatonically; to the two first assumptions we can readily subscribe, but deny the last. A fundamental base, moving diatonically, would only produce major 17ths to all the sounds; that is, the notes in the stop of the organ called the tierce, moving in the key of E major, while the base moves in C♯. See *Plate VI. Music, N. II.*

It is very perplexing to young contrapuntists to find theory and practice so frequently at strife: they are told that though the fundamental base may rise diatonically, that is, two bases, carrying common chords by contrary motion, it never must descend. The student, however, if he has read much music, must recollect, that in Corelli's XIIth solo, called "La Follia," on Farinel's ground, or better known by the first line of a song written to the melody, "All Joy to great Cæsar," bar the 4th, the modulation is from D minor to C major; and the effect, which at first surprizes, from being so uncommon, is pleasing. In the second bar of Pergoleli's "Stabat Mater," the fundamental base moves diatonically, from F to E♭. How is a *tiro* to reconcile these contradictions? Nature gives harmonies to every sound, which are never heard but from very low and very slow notes, and are we never to have a moving base, or an elegant passage in melody, because every sound has latent harmonics, which, though we cannot hear, (any more than with the naked eye we can see the satellites of Jupiter,) who but the utterly ignorant doubt of their existence!

Let us now forget that practical music is wholly a work of art. We are very proud to find that there subsists in nature any thing on which to build our theory. It is true that with great difficulty we can discover from the resonance of a single string, or great bell, the sounds of a common chord rise in the following succession: 8th to the principal sound, 5th to the 8th, and major 3d to the 15th or double octave, as trebles to the fundamental sound. But these are mere indications, of which none but cultivated, curious, and nice ears, can ever be convinced. The system built on these phenomena is very defective; it extends our ideas of nature, but contracts those of art. Whatever melody or harmony has been found, or may be found, that is grateful and pleasing to the ear, may surely be admitted in practice, though not consonant to mathematical demonstration, or the speculations of mere theorists. The philosopher, Euler, says that time, in music, is a silent arithmetic; and we may add, that harmonic intervals are an arithmetical geometry, best measured by a strong hand and good ear.

M. l'Abbe Feytaud, who has furnished so many scientific articles in music to the *Encyclopedie Methodique*, thinks so differently from all other writers on every musical article which he treats, that his readers have every thing to learn, which they knew tolerably well before. He neither gives the students, nor their masters, credit for knowledge of any kind. And when in the new edition of the *Encyclopedie*, he takes up an article after the editors who have preceded him, it is not to explain more clearly what they have advanced, but totally to overturn their reasoning, and neutralize their precepts and opinions. He seems to speak like the first inventor of every thing pertaining to the

musical science. Of practical music he knows but little, and seems to feel less.

He sets off, in speaking of the fundamental base of Rameau, and the third sound of Tartini (see *TERZA Suona*), by saying, that "their inventors were ignorant of the nature, the product, and movements of the sounding bodies or fundamental sounds; they did not know the law of preparing, resolving, syncopating, &c.; nor the principle of measure, nor that of the pause at an harmonic phrase, nor the character of a mode or key in general, nor the distinction of different keys, nor the origin of chords, nor the formation of different parts, nor the difference between a continued and fundamental base; and that they have substituted, without necessity, numberless abstract relations to those experiments which the vibrations of the sounding body offered to their investigation." And yet these were the greatest composers of their time in France and Italy: the one for the opera, and the other for the violin!

The Abbé F. gives some amusing experiments in harmonics in confirmation of Galileo's discovery, who is, however, never mentioned in a French book on the subject of music, except by Merfennius. The experiments given by the Abbé are ingenious and curious illustrations of Nature's propensity to give a perfect chord to every single sound; but in composing music for imperfect instruments, till better are invented, we must content ourselves with such an approximation to perfect harmony as we can acquire by tuning and perfect execution; the rest, we fear, is impracticable.

The Abbé shews the imperfection of our intervals and keys, when every fixed sound in the course of modulation must necessarily serve for two or three purposes. This had been very clearly and ingeniously done in our own country twenty years ago, in a tract called "An Essay on Tune." The disease has been long discovered; but where, with our present instruments, is the cure? See HARMONICS.

Still disputing the principles of Rameau and Tartini, M. Feytaud clearly shews, what had been long known by speculative musicians before, that we have no true base to the scale or octave of C: but this accounts for the Italians singing in their solfeggio only the hexachords of each key. (See SOLFEGGIO and HEXACHORD.) Of the two tetrachords in C, whether we suppose the first in F, as the Abbé has done, or in C, as in practice, there still must be two fundamental bases rising diatonically, as

CD EF | G ABC | or CDEF | G ABC
 F E♭ CF | CD GC | CACF | CF GC

But as there is no necessity for these fundamental bases in practice, which can be avoided by innumerable expedients, why regard them as such evils? In fact, the octave, as the Abbé observes of the key of C, has three generators, or fundamental bases, FCG, or CFG. It is only the violin and its kindred that can give every sound its true intonation in all keys; as D♭ and C♯, D♯ and E♭, &c.

We are obliged to mitigate these wants by temperament, which makes all keys imperfect to a certain degree; though the suffering is not great, when the music and execution are perfect. And, till new instruments are invented, what can we do? Must we burn the old, drive music from the company of the fine arts, nor longer allow her to rank in the circle of the sciences till perfectibility in all instruments is attained? which will probably be when that perfectibility of man is acquired that shall exempt him from all the infirmities "which flesh is heir to," and enable him, "unless he chuse it," to escape death itself.

M. l'Abbé deduces every thing of importance in practical music from the fundamental base. Not only the most perfect chord in harmony, the most pleasing notes in melody, but clofes, measure, genera, preparation and resolution of discords, keys, and modulation. The only thing in which he allows Rameau to be right in explaining his own system, is the terming the fundamental base the magnet, compass, sovereign guide of the ear.

The making the F. B. the regulatrix of time in music is new and fanciful; but, we fear, visionary and impracticable in the unbridled range of modern music, which is so desultory, wild, and often capricious, comic, and whimsical, as well as solemn and pathetic, that if regulated in its measures and phraseology by any new restraints, there would be an outcry against the invasion of a musician's rights, and "la liberté de la musique;" a subject which M. d'Alembert has treated with great gravity. See d'Alembert.

Besides the experiments in harmonics, we have musical problems, which manifest much ingenuity and meditation. In speaking of the genera, the learned Abbé was naturally led to the subject of Greek music. He regards the notes of the hypaton, or lowest tetrachord, B C D E, as the original four strings of the Mercurian lyre; and gives Ptolemy's ratios of those sounds. He has nothing new on this subject, except that it is not a subject of dispute. He therefore gives the ratios of the three genera from the Greek writers in Meibomius, which others have often done before. But that the fundamental base may have a share in the honour of Greek inventions, he informs us that the scale of the conjoint tetrachord in the diatonic genus is derived from the F. B. of two keys, C and F, and the modern octave scale from three. (See TETRACHORDS and SCALE) But we have long observed, that there is no ascending more than three notes gradually without a change of key.

Notwithstanding the extreme length and labour of this article in the Encycl. Meth. the Abbé F. has left many of its constituent parts where he found them, with respect to practice: such as the scale, cadences, measure, modulation, enharmonic, &c. (which see under their several heads.) He neither allows Rameau nor Tartini to know the gammut; he disputes with them the intervals of the scale, and the base to those intervals. Indeed nothing has ever been advanced by a musical writer, that has fallen in his way, of which he does not set about the refutation. To have a new gammut to learn, new technica, and to accustom the ear to new sounds, is a task to which great musicians will not submit, and the little ones will follow them, not the advice of speculative theorists, which indeed they are not likely to read.

We cannot help supposing that the ears of modern musicians are as well organized by nature, and as highly polished by art, as those of the ancients; and that the present gammut, and laws of harmony, are as perfect and refined as the present construction of our instruments will allow; and if ever better should be invented, that they will soon be universally adopted, piano fortes being preferred now to harpsichords, as harpsichords were to spinets, and spinets to virginals. But till the improvement and refinements in our scales, intervals, and consonances are rendered practicable by new instruments or corrections of the old, music will not be bettered by these speculations, though they may point out incurable evils to the ignorant, and make them more unwilling to be pleased than before they were told of these, and which they never could have found out or suspected. And after the bold assertions concerning the ignorance of two men of such great professional abilities as Rameau

and Tartini, we had a right to expect the abbé Feytaou's rules to be illustrated by examples of composition on his own principles, or at least readed so evident, that all musicians, and the public ear would be benefited by them; but alas! after shaking the student's faith in the rules which so long guided him to the means of delighting the musical world by what were then thought admirable productions; it appears, according to this learned Abbé, that we are all in the wrong, to be pleased; for all the music hitherto composed has proceeded from false principles: neither the scale, melody, nor harmony, with which we have been delighted, was genuine and pure; discords nor discords properly treated, accents rightly placed, nor measure correct. The nice distinctions, refinements, and scientific paradoxes, with which they are laid down, give them an imposing appearance; but when examined, and we consider what has been done, and is still doing without them, and that nothing has yet been achieved with them; that many are unintelligible, and others impracticable; it seems as if we had better *en* go on in explaining the old established rules upon which Corelli, Handel, Vinci, Pergolesi, Jomelli, Piccini, Sacchini, the Bachs, Haydn, and Mozart, have been formed; nor till we are sure of the effect, can we conscientiously recommend young subjects to be inoculated by matter taken from this learned and elaborate article.

FUNDAMENTALIS, *Sonus*, Lat. is the principal sound of the harmonic triad. Walther.

FONDAMENTS, Ital; *Fondament*, French; *Fundamentum*, Lat. is the lowest and most important note in the harmony of the common chord, the *ground* or foundation upon which the chords in thorough base are built. Walther. See BASSE FONDAMENTALE.

FONDE, ISLES DE. in *Geography*, three small islands in the Southern Indian ocean, near the S. coast of Kerguelen's land. S. lat. 49° 51'. E. long. 68° 39'.

FONDEROY, a town of America, in Virginia, situated on the Rappahannock; ten miles S. E. of Leeds. N. lat. 38° 2'. W. long. 76° 54'.

FONDI, a town of Naples, in Lavora, near a lake to which it gives name; the see of a bishop, suffragan of Capua. This was anciently a municipal town, and afterwards a prefecture; which stood on the Appian way. At the extremity of the town is a castle, of no great strength. It was erected by Ferdinand, king of Naples, into a dukedom, in favour of Prosper Colonna. In 1534, Barbarossa, the famous corsair, wishing to teize the beautiful Julia of Gonzaga, widow of the son of Colonna, for the purpose of carrying her off, and presenting her to the Grand Signior, but disappointed by her escape, took vengeance on the town, which, as well as the inhabitants, he treated with the utmost barbarity. The story of the havock, which he committed, is painted in the church of the Annunciade. Fondi is situated on a plain, surrounded on one side with hills, having the appearance of an amphitheatre; most of these hills are covered with olive-trees, and the whole plain is interspersed with orange, lemon, and other fruit-trees, the verdure of which forms a perpetual spring; 56 miles E. of Rome. N. lat. 41° 20'. E. long. 13° 30'.

FONDO, or SCOGGIO FONDO, a small island in the gulf of Venice, near the coast of Istria. N. lat. 45° 14'. E. long. 13° 40'.

FONG, the name of several towns of China; one in Quang-tong; another in Hou-quang; and a third in Kiang-nan.

FONG-CHAN, a town in the island of Formosa; 25 miles S. of Tay-ouan.

FONG-CHANG, a town of Corea; 11 miles S. of Hoang-tcheou.

FONG-HOA, a town of China, in the province of Tche-kiang; 11 miles S.S.W. of Ning-po.

FONG-HOA-TCHING, a large and commercial town of Chinese Tartary, in the province of Chen-yang, on the borders of Corea; the chief manufacture is paper of cotton, which is white and transparent, and used for windows instead of glass. N. lat. $40^{\circ} 31'$. E. long. $123^{\circ} 42'$.

The adjacent country contains many mountains, some of which abound with metals and wood fit for building; the land is in general fertile, and produces wheat, millet, leguminous plants, and cotton. Immense herds of oxen, and flocks of sheep feed in the vallies. The inhabitants sow little rice; but fruit-trees of almost every kind are found here.

FONG-KIEOU, a town of China, of the third rank, in Honan.

FONG-SIN, a town of China, of the third rank, in Kiang-li.

FONG-TCHING, a town of China, of the third rank, in Pe-tcheli.

FONG-TCHUEN, a town of Corea; 57 miles W.S.W. of Hoang-tcheou.—Also, a town of China, of the third rank, in Quang-tong.

FONG-TEN, a town of Corea; 24 miles N.N.W. of King-ki-tao.

FONG-TSIANG, a city of China, of the first rank, in Chan-fi. N. lat. $34^{\circ} 36'$. E. long. 107° .

FONG-YANG, a city of China, of the first rank, in the province of Kiang-nan; situated on a mountain, which hangs over the Yellow river, and inclosing within its walls several fertile little hills. Its jurisdiction is extensive; comprehending 18 cities. This was the birth-place of the emperor Hong-vou, who formed a design of rendering it a famous and magnificent city, as the seat of empire. After having expelled the Western Tartars, who had taken possession of China, he transferred his court hither, and named the city Fong-yang, *i. e.* the place of the eagle's splendour. But several objections occurring in the further view of the situation, he abandoned his design, and established his court at Nan-king. Of his design three monuments were executed, which, now remaining, sufficiently shew how magnificent the city would have been, if the emperor's plan had been completed. The first of these monuments is the tomb of the father of Hong-vou, called "Hoang-lin," or the Royal tomb. The second is a tower built in the middle of the city, of an oblong form, 100 feet high, and said to be the most lofty in China. The third is a magnificent temple erected to the god Fo. This was at first a pagoda, to which Hong-vou entered when he had lost his parents, and where he found an asylum in his distress; but after he had been elevated to the throne, in consequence of a succession of vicissitudes, he caused this temple to be constructed, in testimony of his gratitude to the Bonzes; assigning them a revenue sufficient for 300 persons, under a chief of their own sect, whom he constituted a mandarin. At present here are only about 20 priests, who being neglected are almost reduced to beggary.

FONGA, a town of Japan, in the island of Niphon; 65 miles S.E. of Meaco.

FONIA, a kingdom of Africa, on the borders of the river Gambia, near the sea.

FON-JUN, a town of China, of the third rank, in Pe-tche-li.

FONS PULSATILIS, in *Anatomy*, a name given to the fontanel, in consequence of the pulsation felt there, which

arises from the influx of blood into the arteries of the brain.

FONS, in *Geography*, a town of France, in the department of the Lot; 12 miles S. of St. Céré. N. lat. $44^{\circ} 40'$. E. long. $2^{\circ} 2'$.

FONS, Cape, a cape on the S. coast of Minorca. N. lat. $39^{\circ} 40'$. E. long. $4^{\circ} 10'$.

FONSECA BAY. See **AMAPALLA**.

FONSECA, PETER DE, in *Biography*, a learned Jesuit, was born about the year 1528. He entered the society at the age of twenty, and became distinguished by his talents, learning, and address. He was the first who was appointed professor of philosophy in the university of Coimbra; afterwards he undertook the professorship of theology in the university of Evora, where he was admitted to the degree of doctor, in the year 1570. From this period he filled, with high reputation, several very considerable posts belonging to his order. He was also in high favour with Philip II. king of Spain and Portugal, and with pope Gregory XIII.; by both of whom he was employed in different important negotiations. He died at Lisbon, in the year 1559, at the age of 71. He was author of many publications, chiefly philosophical, which have been printed in three volumes, folio. Moreti.

FONSECA, GABRIEL DE, was born at Lamego, in Portugal, and became a public teacher of philosophy at Pisa, and of medicine at Rome, where he was appointed physician to Innocent X. He survived that pope, and died in 1668, under the pontificate of Clement IX. He left some writings under the titles of "Economia Medici;" "Consultationes;" "Convivia Medicinalia." It is believed that he was likewise the author of some of the works, which bibliographers have attributed to his cousin Roderic.

FONSECA, RODERIC DE, was a native of Lisbon, and the reputation which he had obtained in that city, by the practice of his profession, induced the university of Pisa to invite him to the chair of professor of medicine. He accepted the invitation, and filled the office with considerable distinction for a number of years; but at length relinquished it, in 1615, in order to become the principal of the faculty of Padua: an office which he adorned by his talents until the period of his death, in 1622. The following are the titles of the numerous works which are attributed to him: 1. "In Hippocratis Legem Commentarius," Romæ, 1586, 4to.; 2. "De Remediis Calculorum qui in Renibus et Vesica gignuntur," *ibid.* 1586, 4to.; 3. "De Venenis eorumque Curatione," *ibid.* 1587, 4to.; 4. "In Hippocratis Aphorismorum Libros Commentaria," Florent. 1591, Venet. 1596, &c. 4to.; 5. "Opusculum quo Adolecentes ad Medicinam facile capeffendam instruuntur," Florent. 1596, 4to.; 6. "In Hippocratis Prognostica Commentaria," Patavii, 1597, 4to.; 7. "De tuenda Valetudine et producenda Vita Liber singularis," Florentiæ, 1602, &c.; 8. "De Hominis Excrementis Libellus," Pisis, 1613, 4to.; 9. "Consultationes Medicæ, quibus accessit de consultanti Ratione," Venetiis, 1618, and 1620, folio; afterwards published at Franckfort, in 2 vols. 8vo. with, 10. a treatise, "De Virginum Morbis qui intra Clausuram curari nequeunt," 1625; 11. "Tractatus de Febrim acutarum et pestilentium Remediis Dieteticis, Chirurgicis, et Pharmaceuticis," Venet. 1621, 4to. Eloy. Dict. Hist.

FONSOMME, in *Geography*, a town of France, in the department of the Aisne, near the source of the Somme; 5 miles N.E. of St. Quentin.

FONSSAY, a town of France, in the department of the Vendée; 6 miles N.E. of Fontenay le Comte.

FONT, in *Ecclesiastical History*, is now applied to designate

signate the vessel used in churches to hold the water consecrated for the purposes of baptism. The term font was early adopted among the fathers of the primitive church. It was originally applied to the lake, river, or stream, where persons, in the dawn of Christianity, received initiation into the congregation of Christ, by the ceremony of immersion. At that period, it was a matter of indifference, as Tertullian states, whether a person were baptized in the sea, or a lake, in stagnant or running water; and the validity of the ordinance was alike acknowledged in those who had received it at the hands of St. Peter in the Tiber, and in Jordan by St. John. As the gospel was extended, and the number of converts increased, this practice, from local circumstances, must in a variety of instances cease; and an artificial fountain, or basin of water, be adopted in place of the natural stream. During the first period of the church, and while Christians laboured under the disadvantages of persecution, the sacraments could be performed in no stated place; but when once established, and places of public worship erected and sanctioned by law, it is reasonable to suppose that some proper place would be chosen, and an appropriate structure built for the performance of the baptismal rites. This was a principal building among what were termed the *exedrae* of the early churches. Eusebius, describing the church of Paulinus at Tyre, says, when that curious artist had finished his famous structure, and completed the internal decorations, he then commenced the *exedrae*, or buildings annexed to the church, and which, he observes, were chiefly for the use of such persons as needed purgation by ablation of water, and the Holy Ghost, *viz.* the *baptistery*. Hence it is evident, contrary to the opinion of Dr. Beveridge, and other learned writers, this building was a distinct place from the church; and that the font, or lavatory, was not originally placed in the narthecium, or western part of the church, as at present; but in a place peculiarly appropriated for its reception. This opinion is supported by positive evidence. Paulinus, bishop of Nola, displaying the great munificence of his friend Severus, observes, that he erected two churches, and a baptistery between them. And Cyril, bishop of Jerusalem, in describing one, represents it as a separate building, which had first its *παραυλιον οικου*, porch or ante-room, where the catechumens or noviciates delivered their renunciation of Satan, and confession of faith; and its *εσωτερικον οικου*, or inner apartment, where the sacrament of baptism was performed. Sidonius Apollinaris also speaks of it as a separate building; and St. Augustin intimates that there were distinct apartments for the accommodation of male and female converts. These baptisteries were anciently very capacious, because, as Dr. Cave justly observes, the stated times of baptism but seldom occurring, immense multitudes usually attended at the appointed season; and the manner of baptizing by immersion, and many of the subjects adults, rendered it requisite to have a very large reservoir or font for water. Accordingly Venantius Fortunatus styles the baptistery "*aula baptismatis*," the grand hall of baptism. So capacious indeed were some of them, that it is reported councils have held their sittings in such structures; as Du Fresne clearly evinces from the acts of the council which sat at Chalcedon. Suicerus also mentions, that in the acts of the council of Carthage, a recapitulation is made of transactions which occurred in one, held in the baptistery of Constantinople. These answered the purposes of schools also, where the catechumens received instruction previous to their being baptized; and from this circumstance, and the consequent illumination derived from the sacrament, the baptistery also obtained the appellation of *φωτισηριον*, or place of divine illumination. The distinction,

then, between the baptistery and the font is now apparent: the one comprehending the whole building, dressing rooms, and other apartments; and the other, the receptacle for the water used in the solemn rite. The latter, in Greek writers, is usually denominated *Κολυμβηθρα*, in the Latin *piscina*, and is frequently distinguished from the baptistery, as a part from a whole; for Socrates expressly styles font the baptismal pool. The Greek name, Dr. Beveridge supposes, was given to the font in allusion to the salutiferous pool of Bethesda; and Optatus furnishes a more mystical reason for the Latin appellation. He observes it was called *piscina*, in allusion to our Saviour's name, more technica, *ιχθυσ*, an acrostic composed of the initial letters of his several titles, Jesus Christ, the Son of God, our Saviour. But these are remarks unworthy of criticism, and derogatory to the dignity of antiquarian research. Both terms are common names for fountains, pools, or baths, in Greek and Latin authors. And the font appears to have been originally, in these baptisteries, a kind of bath in a separate room from that where the vestments were deposited, while the ceremony was performed: for Cyril describes the catechumens as being unclothed in an inner apartment, and thence conducted to the laver of regeneration, where, after having made a profession of their faith, they were immersed three times in the water, in allusion to the doctrine of the trinity.

Respecting the form of the ancient baptisteries, little can be collected from early writers. Leo III. who, according to Du Pin, was elected pope A.D. 795, is stated to have erected one, probably agreeable to the ancient model, which is thus described: "*Iisdem præful a fundamentis ipsum baptisterium in rotundum, ampla largitate construens in meliorem statum, atque sacrum fontem in medio largiori spatio fundavit.*" What was the form of the font, or of what materials constructed, little satisfaction can be obtained. In a canon of the council at Lerida it is observed, the font should be *lapideus*, made of stone. What Damascus relates, in the pontifical, of a font made of porphyritic marble, richly ornamented with gold and silver imagery, and other elegant decorations, in which the emperor Constantine was baptized, and by him presented to the church of St. Sophia at Constantinople, is a mere fabulous legend, unworthy of the smallest credit.

Thus did the use of baptisteries, as structures distinct from the church, continue till about the sixth century: though Mosheim observes, "baptismal fonts were now, (in the fourth century,) erected in the porch of each church, for the more commodious administration of that initiatory sacrament." But in this observation he is only borne out by the brief hint of Du Pin, in his remarks on the life and writings of Athanasius. "As to what concerns discipline in his time, one may observe in his works that there were fonts in churches, and that oil, wine, and bread for offerings were kept for the use of the font." Staveland, in his History of Churches, observes the first fonts were set up in private houses, and after those professing Christianity had recovered from persecution, they were placed in more conspicuous situations at a small distance from the church; afterwards they were removed into the church porch; and subsequently into that part of the nave where they usually stand at present. The learned are generally agreed that anciently there was but one baptistery in a city, and that at or near the bishop's church; which usage Durandus informs us was continued down to his time at Pisa, Bononia, Orvieto, Parma, and Florence, in Italy. And the church of St. Jean le Rond at Paris was the place for the general baptistery of that city. In these, which

were called baptismal churches, baptism was administered during the vigils of Easter and Whitsuntide, with lighted tapers burning, by the bishop, and the presbyters by him commissioned for that purpose; and it was only in cases of extreme urgency that a faculty could be obtained for the administration of this sacrament, but at these two solemn seasons of its administration. In after ages, however, the inconveniences were found to great from this restriction, that baptisteries were allowed to be set up in many parochial churches. For in the council of Auxerre, baptizing in villages, by allowance from the ordinary, is formally recognized. This privilege, however, was not granted to every place, but only to those the bishop appointed; and where the necessity of the case seemed to require such extension; whence the churches at such places obtained the distinction of *mother-churches*, because the rest depended upon them for receiving the ceremony of regeneration, as they had previously done on the episcopal church. After the establishment of Christianity in states, subjects following the example of their sovereigns, almost universally became professing Christians; and as they would early devote their offspring to a participation of the same faith, adult baptism would seldom be found necessary. For notwithstanding the unsupported assertion of Mr. Robinson in his history, that infant baptism did not become an established custom till the fourteenth century; yet Bingham and Wall have incontrovertibly proved that it was a practice generally prevalent in the latter end of the first, or beginning of the second centuries. Indeed the existence still of fonts only calculated for the immersion of infants, made so early as the Saxon period of our own annals, would be sufficient to refute the allegation.

On increasing the number of baptismal churches, the general adoption of infant baptism, and the necessity of a capacious bath for the immersion of adults no longer existing; a large basin of stone was substituted for the spacious bath, and the baptistery exchanged for the Lapidarian font: which afterwards retained the original appellation.

Respecting fonts in England, they are mentioned by Bede in his Ecclesiastical History, under the name of *Lavaca*: for he mentions king Edward having received the "*lavacrum sanctæ regenerationis*:" and observes, that in the year 689, "*Rex Cadwalla venit Romam ut ad limina beatorum apollolorum fontem baptismali ablueretur.*" Though the privilege was early extended to certain parochial churches, yet the erection and use of fonts, in conventual churches, occasioned as strong contentions as the setting up conventual mills under the feudal system. An author in the Gentleman's Magazine, (Mr. Denne,) is of opinion, that few cathedrals were ornamented with fixed fonts, at a much earlier period than the date of one set up in the cathedral at Canterbury, in the year 1636; unless in instances where they had also parochial altars for the use of the lay-people of some contiguous district: which was the case at Salisbury, and probably also at Winchester and Lincoln. Yet Edmund, archbishop of Canterbury, in the constitutions promulgated by him in the year 1236, directs that a stone font should be provided in every baptismal church; which, according to Lynwood, was a church having the city connected with it. "*In qualibet ecclesia baptismali, talis quæ habet populum, five cathedrali, five conventuali.*" In the history of Sherborne monastery, a contention is noticed between the monks and the parishioners, in which dissension the former complained, that though there had been from the foundation of the monastery a font in the nave of the conventual church, where the children of the parish had usually

been baptized; yet the inhabitants had set up another in that part of the church in which they were accustomed to hear divine service.

Fonts were generally formed of stone, yet some instances occur of their being made of lead; and Staveland mentions a most magnificent one of solid brass, that was placed at St. Alban's. This, in which the children of the kings of Scotland used to be baptized, had on it an inscription, indicating that Sir Richard Lea, knight, master of the pioneers, took and brought it home among the spoils, and presented it to this church. The general adoption of stone for the composition of fonts, say Daravidus and other Romish ritualists, was, because, as water issued out of the rock, as a type of baptism, so Christ, who is the fountain of living water, is also a rock, and the chief corner stone of the spiritual church.

A description and detail of the architecture, sculpture, and designs, displayed in all the fonts subsisting in this kingdom, would be an interesting work. To attempt to class them under system at first sight appears impossible. The route ensemble puts on such a Protean shape, and assumes such a confusing variety, as seemingly to defy all attempt at arrangement. Upon a closer survey, however, they appear to separate, and fall within certain epochs: and although some anomalous cases may occur, and some fanciful instances may be produced; yet when properly ranged they will be reducible perhaps to three periods, *viz.* Saxon, Anglo-Norman, and English: no monument of this kind appearing so decidedly British, as to be referable to that period.

After the conversion of the Saxons to Christianity by the missionary, St. Austin, they appear to have had a close connection and intercourse with Rome. And in their ecclesiastical buildings and ornaments they would naturally imitate the practices of the church, from whence they had imbibed their faith; and indeed it is recorded that for a considerable period their architects and other artists were brought from Italy. These would of course imitate such ornaments as they had been accustomed to admire in the magnificent temples, and other structures in that country. Thus some of the most ancient fonts are in their forms evidently taken from vases, urns, votive altars, &c. Some, for instance, are simply excavated stones, placed upon plain pedestals, consisting of one, two, or more steps; others altar shaped, and ornamented with pilasters.

Under this early, or *first period*, may be classed the font at Wimpole in Cambridgeshire, consisting of a simple stone of an hexagonal shape, having a circular cavity in the centre, and placed on a flat square base. The one at Stukeley Bucks is a vase, in the shape of a truncated hollow cone, inversely fixed upon two circular steps. Another of dark grey marble, in which, as Camden was informed, princes had been baptized, of a similar shape, is at Prestute in Wilts; the columns of which church are clearly assignable to a Saxon era. Rotherfield-Grays, Oxfordshire, is of an oblong form, with a circular hollow, and has a pilaster at each angle, and the base and upper part surrounded with ogee mouldings. The font in the upper church of Lewes in Sussex is barrel-shaped, the convex part ornamented with fretwork, and round the top and bottom runs a fascia, composed of rings and quatre-foils. Newick in Yorkshire is a cylinder, ornamented with numerous slender pilasters, surmounted with interlaced arches: and a similar one may be seen at Ancaster, in the county of Lincoln.

Next to these, in point of antiquity, appear to be those of a quadrangular or circular form, placed upon a single central shaft, encompassed with pillars; or having a small column at

each

each angle of the font, which they apparently support as an entablature. Of the first kind is the font at Berkley in Gloucestershire, which has four massy round columns with simple capitals, standing on a plain pedestal, and a scroll moulding round the lower edge of the font. Under this division range the fonts at Boxbourne, Herts; Sudburn, Suffolk; Roydon, Essex; Hendon, Middlesex; and Albury and Stevenage, Herts. One at Ilsey, Oxfordshire, has the columns devoid both of base and capital, and ornamented with divers fanciful circumscriptions. Of the second, or circular kind, are those of Hempstead and Ozleworth in Gloucestershire. Other instances occur, where the central shaft is wanting. The one at Bowes, in Yorkshire, is a circular basin, supported by three columns; one at Weedon, Bucks, by two; and the one at Easby, in Yorkshire, is round, and stands on a shaft, formed by a circular arcade. In point of time it is difficult to decide which of these two kinds justly claims precedence. But,

The next in antiquity seem to be those decorated with historical or emblematical bas-reliefs. At Everingham, in Yorkshire, is a very antique font, ornamented with Saxon carving; and one at Althilton, in the county of Devon, is charged with interlaced arches and a fascia, comprising the figures of birds, beasts, sportsmen, &c. emblematic of hunting. One at Eastbourne, Suffolk, is still more singular and rude in the designs; and a similar one is in the church of Davent, Kent. The font of Burnham Depedale, in Norfolk, is deserving of particular notice. The sculpture is so mean, and the figures so rude, as clearly to evince it to be a work of remote antiquity: and notwithstanding Mr. Pegge has assigned some reasons in the *Archæologia* for referring both the church and font to a later than the Saxon or Danish periods, yet they are very far from being satisfactory. The steeple, far more antiquated than the body of the church, is one of those round towers supposed to have been erected by the Danes, which give almost an exclusive peculiarity of features to the ecclesiastical structures in the counties of Norfolk and Suffolk. The rudeness of the figures, and the nature of the subject they were meant to represent, militate also against Mr. Pegge's conjecture. The font is of a quadrangular shape, supported by four clustered columns, each composed of three pillarets. Of the square form resting upon four pillars, devoid of the central shaft, the one in Sharnbourn church, in the county of Norfolk, presents a curious instance. The body of the font rests upon four massy clustered columns, the capitals ornamented with grotesque heads, and a fanciful border extends round the edge of the font. This, though rude, is a rich piece of sculpture. The whole is placed against one of the pillars of the nave, for which position it was originally designed, one of the sides having been left blank. The three others are ornamented with figures in basso-relievo, representative of agricultural subjects. The compartments are twelve, and the emblems were designed to depict the labours of husbandry through the different months of the year. January represented by a figure seated with a drinking horn in his hand; February, by a figure sitting in a quiescent posture, emblematical of the inactivity of that season; March, by a husbandman in the act of digging; April, by a man with a pruning-hook in one hand, and a branch in the other; May, by a female figure with streaming hair, displaying a banner; June, by an uncouth figure holding a weeding implement; July, by a man mowing; August, by a person gathering and binding corn; September, by a man threshing; October, by a person casking liquor; November, by a man carrying wood; December, by a group feasting. A font decorated with rude and emblematic sculpture in Fincham church, Norfolk,

which was misunderstood by the historian of that county, is by some supposed of equal antiquity. Such were, probably, many of the first fonts in the early dawn of Christianity among the Saxons, while heathenism was strongly mixed with Christian rites; but as the genius of the gospel was better understood, it would be natural to decorate their temples, and ornament their sacred utensils, with Christian emblems. Such appear the fonts of Lincoln, Winchester and East Meon, in Hants. The latter two, which are very similar, are probably as ancient as the time of Brutus, the first bishop of Winchester; and the emblems by which they are enriched are supposed allusive to the conversion of the West Saxons from idolatry. An engraving of the former has been given in that splendid work, the "*Vetusta Monumenta*." The latter is a square block of black marble, having a central excavation, and resting on a shaft, formed of three single stones, with a circular column at each angle of the font, devoid of bases, and capitals composed of foliage. At two of the angles are two doves, represented as putting their beaks into bottles, surmounted by a cross. Two faces of the square are ornamented with arches, supported by alternate double and single pillars, and the incumbent frieze is charged with various birds and beasts. On the alternate two are represented, in the rudest style of relief, on one the creation of man, the conformation of Adam, and Eve taken from his side, and the temptation by the serpent; on the other, their expulsion from paradise by an angel driving them, with an uplifted sword, through the portal of a palace; and the other scene represents Adam with a spade, Eve with a distaff, and an infant placed standing between them.

The next, in respect of time, are probably such as are ornamented with figures of the apostles, as the one at Kiddington, in Oxfordshire, removed from Islip, in the same county. This is said to have been the identical font in which Edward the Confessor was baptized. The font at St. Peter's, Oxford, which was charged with figures of the twelve apostles, Hearne erroneously supposed coeval with the one at Winchester. One at Ambrebury is a long hollow vessel set upon a massy shaft, containing niches, which appear formerly to have contained figures. The second period comprises such as are of divers angular shapes, decorated with scriptural emblems and armorial bearings. This fashion was probably introduced from Normandy soon after the conquest. The fonts at Bredon, Kirkby Belers, and Market Bosworth, in Leicestershire, are of an hexagonal shape, and the sides charged with shields of arms. Of a like description Burbach, Great Shepey, and Ufford, in Suffolk; St. Olyth, Essex; Maltravers and Winterbourne, Dorset; and numerous others in various parts of the kingdom. About the time of Henry III. this mode of introducing heraldic devices, to emblazon the deeds of magnificence or piety performed by great families, became extremely prevalent; and was not only made a subject for sculpture, but also of painting, when what was at first in relievio and miniature on fonts or monuments, was transferred on an extended scale to the windows of churches, and gave rise and encouragement to the elegant art of staining glass. To this period are assignable such as are ornamented with armorial bearings, and those also having borders of quatre-folles, initials, &c. supported in divers instances with figures of animals couchant, rampant, and in other attitudes. To a succeeding period may probably be referred those bearing the symbols of the evangelists, instruments of the passion, with the shafts supported by figures of the apostles, and other saints. Of this kind are Fluxton, in Suffolk; St. Clement's, at Hattings; and Sittingbourne, in Kent. The font at Luton,

in Bedfordshire, is of an octagonal shape, raised upon a flight of octangular steps. Over it is a canopy supported by eight columns, about twenty-five feet in height, forming a kind of piazza, under which might stand eight people. This may be considered a baptistery on a small scale, and is the only thing of the sort in the kingdom. In the centre of the roof is a lion O., and a griffin V., rampant.

The *last period* comprehends a portion of our history for about two centuries anterior to the reformation; and is the more remarkable, because the change which occurred in the mode of ornamenting fonts is connected with that event, it having been one of the jesuitical tricks made use of by the strenuous abettors of the Romish tenets to support their tottering faith against the tremendous blows it was then receiving from the formidable attacks of Lollardism. The controverted doctrine respecting the seven sacraments, powerfully opposed as antisciptural, must be defended, and every art was had recourse to likely to accomplish the desirable measure. Not only were they embodied, but so represented in painting and sculpture. They were depicted on glass in the windows of churches, delineated in stone on the baptismal fonts; and the emblems of actual events and real personages of scripture were superseded by figures representative of the superstitions and errors in the Romish church. No people better understood the mode of working upon the minds of men, and bringing adventitious objects to assist the powers of persuasion, than the priests in general of that communion. The effects produced upon the mind by objects represented strongly to the sight by the fascinating arts of sculpture and painting, they had well studied for centuries, and now had recourse to them for rivetting the doctrine, and fixing the vacillating minds of the multitude on the occasion. Appeals were made to Rome for artists, usages, &c., and no expence was spared to combine elegance of design with exquisiteness of execution. The octagonal form was adopted, not only because it exhibited sufficient sides for the requisite exhibitions, but because it was sanctioned by a custom of high antiquity. It is thus recommended in lines, written by St. Ambrose, placed over the font of St. Tecla, at Milan, in Italy, prior to its having been adorned with modern magnificence.

“Octachorum sanctos templum surrexit in usus,
Octagonus fons est munere dignus eo,
Hoc numero decuit sacri baptismatis aulam
Surgere, quo populis veræ salus rediit
Luce resurgentis Christi, qui claustra resolvit
Mortis a tumulis fusciter examines.”

During the period in question, some most costly structures were erected. The florid Gothic, as it has been termed in architecture, was carried to its height; and the mode of enriching fonts with elegant sculpture, as well as decorating various parts of the building, seemed to keep pace with each other. Numerous fonts erected at that time are objects of laudable curiosity, and worthy of peculiar investigation, as serving to mark the progress and advancement in the art of sculpture, and how much it appears to have derived improvement from the cultivation of the sister art. To point out all, or to describe even a few of those worthy of notice, which fall under this division, would extend this article too far. A description of one still in high preservation at Walsingham abbey church, in the county of Norfolk, unnoticed by writers on this subject, may be acceptable; as it is, perhaps without exception, the finest and most perfect specimen in the kingdom. The base is an octagon, decorated with roses and quatre-foils; the plinth, of the same shape, has in it four steps, the fronts and sides

of which are enriched with divers ornaments. The octagonal shaft is decorated with various tabernacle-work, and the pilasters concentrating from niches with crocheted pinnacles, in which are placed statues of the apostles. The lower border of the font also is fludded with emblematic heads and devices; and the eight sides have the seven sacraments, and the crucifixion, executed in bold relief. Among other fine specimens of this kind may be briefly enumerated East Dereham, Norfolk; Melton, Suffolk; and Grantham, in Lincolnshire. The covers seem generally to have been made to correspond with the work exhibited in the font: the simpler fonts having plainer covers, and *vice versa*. These generally consisting of wood were of a pyramidal shape, crowned with a cross patee fitchee; and in some instances over it was placed the figure of a dove. In some cases the covers were curiously carved, and decorated in the pointed style with rich tabernacle-work. Such is the one at Sudbury in Suffolk, made of oak, variously carved in the pointed style, the sides adorned with the figures of four lambs, as agni dei, over which are the symbols of the evangelists; and between these, angels presenting shields charged with different family arms. This is conjectured to be coeval with the time of Richard I. Mr. Vertue also mentions his having seen several fonts in Norfolk, which had for covers “high pinnaced wooden spires,” richly ornamented with elaborate carvings.

It may at first seem paradoxical that fonts should have gradually come into disuse, so far as respects the original purpose of them, as vessels for containing the consecrated water, from the time of the Reformation; especially when, among the canons promulgated in 1571, one particularly directs the providing a *font*, and prohibits the substitution of a *basin*. But the reason will be found in the variety of superstitions connected with the use of fonts previous to the time in question; the effects of which remained long after, and are not even at the present day eradicated from the minds of the common people. In the ancient fonts there was a hole in the bottom of each, provided with a stopple, for letting out the water, after the ceremony was over; which was conveyed away under ground by means of a pipe, included in the shaft. This was done to prevent a superstitious use being made of such consecrated water: persons frequently taking it to the houses of those afflicted with divers diseases, in order to perform miraculous cures. Two others also are alluded to in one of the before-mentioned canons: “whether any useth to *halloo* the font on Easter even? and, whether the water in the font be changed every month?” Upon the abolishing of the liturgy, and the substituting the directory in its stead, an order was issued by the parliament for the removal of all fonts out of the churches, and to adopt the use of basins in their stead. Many were then sold, turned into horse-troughs, and consecrated to other ordinary uses; and though, at the Restoration, many were repurchased, and again set up in the respective churches, yet numbers never were replaced. From the coldness of our climate operating on that timidity of parents, arising from luxury, which obtained the optional privilege of aspersion instead of immersion, and gradually introduced the use of sprinkling altogether in the baptismal ceremony, large fonts became unnecessary, and basins were found much more commodious: so that now, in most of our modern churches and chapels, the vessel for this purpose consists simply of a small marble bowl, placed upon a slender column or stand of the same material; so that, in no distant period, fonts will become, not only respecting their age, and as specimens of art, but also as to their designation and use, a subject of curious inquiry and antiquarian

quarian research. Bingham's *Origines Ecclesiasticæ*, or the Antiquities of the Christian Church. Mosheim's *Ecclesiastical History*. Durandus de *Ritualibus*. Various Papers in the *Archæologia*, published by the Society of Antiquaries, &c. &c. &c.

Font, in the *Art of Printing*, denotes a complete assortment of letters, accents, &c. used in printing. See FOUNT.

FONTABELLE, in *Geography*, a fort on the west coast of Barbadoes; 1 mile N.N.W. of Bridge-town.

FONTAINEBLEAU, a small town of France, in the department of the Seine and Marne, and chief place of a district; situated on the left bank of the Seine, 13 leagues south of Paris. The place contains 7,429, and the canton 10,231 inhabitants, on a territory of 162½ kilometres, in 6 communes. The royal palace in this town, which was the birth-place of Henry III., is one of the largest and most elegant structures which belonged to the kings of France. It is an assemblage of four palaces, having five courts of different architecture, and containing about 900 apartments. Each palace has a garden. One of the galleries is 100 feet long, and covered with paintings. The adjacent country exhibits no pleasant scene, when the trees have lost their verdure. The palace is surrounded by a forest, containing about 25,000 English acres, and abounding with deer. The gardens are neat and extensive; and besides the grand fountain, which from the excellent quality of its water gave name to the place, there is a great number of others, which serve to adorn this royal residence. The town of Fontainebleau consists of one principal street of considerable length, and several smaller streets. The principal trade depends upon the palace, and on its situation in the high road from Paris to Lyons, and also on its manufacture of thread lace.

FONTAINE, JOHN DE LA, in *Biography*, was born at Chateau-Thierry, in the year 1621. He received the usual rudiments of learning at Rheims; and at the age of 19, he placed himself under the fathers of the oratory, in which situation he remained about a year and half. Soon after this, he was so much impressed with hearing one of the odes of Malherbe recited, that he began instantly to study that author, to commit his works to memory, and finally to imitate them. He entrusted to a relation his first efforts as a poet; but in connection with his poetical studies, he did not fail to unite a steady attention to more serious authors. He soon became conversant with the works of Plato and Plutarch, and so thoroughly imbibed their moral and philosophical maxims, as to introduce them in all that he composed. It is said that he had little inclination for the matrimonial state, but married to please his family; and being incapable of strong attachment, he made little difficulty in quitting his wife. He went to Paris with the dukes of Bouillon, who excited him to write his "Tales." Here he found a relation in the service of the superintendent Fouquet, by whom he was patronized and perused; but on the fall of Fouquet, who had been the liberal friend to men of letters, Fontaine was almost the only person who publicly lamented his fate, which he did in a pathetic elegy. He next entered the service of Henrietta of England, and whose death he found protectors in the princes of the blood, and other persons of distinction. At Paris he had the cares of domestic life taken from him by Madame de La Sabliere, who took him into her house. Here he was on terms of strict intimacy with all the principal wits and writers of the age, among whom was Boileau, Molière, Racine, and Chapelain. By these, and by all who were

acquainted with him, he was highly esteemed. In his character he exhibited the simplicity of a child: he was mild, gentle, timid, credulous, sincere, and void of envy and ambition. He was singularly content in the concerns of life, and readily submitted himself to the guidance of others. He obtained the appellation of "le bon-homme." In company he was usually silent, and seldom shone in society, unless with a few intimate friends. La Fontaine was not in favour with Lewis XIV., and was almost the only considerable writer who did not partake of that prince's bounty. The king even hesitated to confirm his election to a seat in the French academy, and would probably never have given his consent, but to compromise the matter in respect to Boileau, who was elected to please the sovereign, though much against the wishes of the majority of the academy.

After the death of Mad. de la Sabliere, with whom he had lived 20 years, La Fontaine was invited to take up his abode in England; but the difficulty which he found in the attempt at acquiring the language made him abandon the design. In the year 1692 he was taken seriously ill: a priest was introduced to him for the purpose of ascertaining his faith. The sick man began the conversation: "I have," says he, "lately taken to read the New Testament. I assure you, it is a very good book; but there is one article to which I could not accede: it is that of the eternity of future punishments. I cannot comprehend how this eternity is compatible with the goodness of God." The priest, it is said, explained the doctrine to the entire satisfaction of the poet, who, probably to free himself from the controversy, acknowledged that he was perfectly satisfied. As an effect of his conversion, he threw into the fire a theatrical piece which he had begun, confessed his sorrow for his offences against morality and decorum, and gave up the profits of a new edition of his tales, then printing in Holland. The fact being related to the young duke of Burgundy, he very considerably observed, that it was unreasonable that he should become poorer for having done his duty, and sent him a purse containing 50 louis d'or. La Fontaine survived this illness, and passed about two years in the house of Mad. d'Hervart, who supplied the place of his former friend. He now undertook to translate some pious hymns, but did not succeed in this new species of composition. He died at Paris, in the year 1695, at the age of 74; and when he was undressed for interment, a hair-cloth was found next his head. The best editions of his "Tales" are those of Amsterdam, 1685, and Paris, 1702. His "Fables" have passed through a vast number of impressions. Splendid editions of them with engravings, in 4 vols. folio, were published in 1755 and 1759. La Fontaine was author of many other works, as, "Les Amours de Psyche," a romance; "L. Florentin," a comedy; "L'Évaque," another comedy; "Anacroniques;" "Lettres;" and "Poems." D'Alembert has given his literary character in the following words: "If among the celebrated writers of the age of Lewis XIV. La Fontaine is not the greatest, he is at least the most singularly original, the most an object of despair to imitators, and the writer whom it would cost nature the most pains to reproduce." His verses, though negligent, have the charms of nature, which none of his contemporaries could acquire. They appear to flow from his pen spontaneously, and abound in grace and delicacy. His manner of narration is enlivened with all the little touches which render description animated and interesting; and his reflections are just, natural, and appropriate. His memory was so highly respected by his country, that when his widow was molested for the payment of taxes that bore

hard upon her, an order was given that the family of La Fontaine should be for ever exempted from all public burthens: a privilege which has been granted to them ever since. Moreri.

FONTAINE, NICHOLAS, a considerable French writer, the son of a scrivener, was born at Paris, in the year 1625. He lost his father when he was twelve years of age, and was entrusted to the care of a relation, who was desirous of bringing him into public life by placing him under the patronage of cardinal Richlieu. The youth did not relish the proposal: he felt a stronger inclination for retirement and study, than for mixing in the hustle of the world; and resolved, if possible, to enter into the society of the Jesuits. At the age of 20 he accomplished his plan, and by a sedulous attention to the studies which were prescribed to him, and by the excellence of his character and urbanity of his manners, he acquired the esteem, friendship, and confidence of the most respectable members of the society. He was, in a short time, appointed one of the tutors to the young persons sent to the seminary, of which he was a member, for education. His leisure hours, and all that he could redeem from sleep, he devoted to theological studies. When M. Arnauld was expelled from the Sorbonne, and withdrew into privacy, M. Fontaine, already attached to him by the closest ties of friendship, readily followed his fortunes, and those of M. Nicole, for whom he acted as their secretary. He was also the friend and companion of M. Sacy, the disciple and nephew of Arnauld, and accompanied him into places of concealment, where he took refuge from the persecutions of the Jesuits. In one of these they were discovered, and committed prisoners to the Bastille, where they were confined two years. After their liberation in 1668 or 9, their intimacy became stronger than ever, and continued unbroken till the death of M. Sacy in 1684. From this time Fontaine was obliged frequently to change his place of retirement, until he removed to Melun, where he died in 1709, when he had completed the eighty-fourth year of his age. He was the author of numerous works, published chiefly without his name, and sometimes with fictitious titles. The most important that are considered as belonging unquestionably to him are, "Illustrations of the New Testament," first published in 2 vols. 8vo., and afterwards in 2 vols. 4to.; "An Abridgment of St. Chryostom on the Old and New Testament;" "The Lives of the Patriarchs, Prophets, and Saints," in several octavos. M. Fontaine was distinguished for great integrity, for the simplicity and innocence of his manners, and for unaffected modesty, humility, and piety. Moreri.

FONTAINE, in *Geography*, a town of France, in the department of the Upper Rhine, and chief place of a canton, in the district of Besort. The place contains 261, and the canton 7,134 inhabitants, on a territory of 140 kilometres, in 29 communes.—Also, a town of France, in the department of the Vendée; 6 miles N.E. of Fontenay-le-Comte.—Also, a town of Canada, on the S.E. bank of the lake St. Pierre. N. lat. 46°. W. long. 72° 40'.

FONTAINE *le Bourg*, a town of France, in the department of the Lower Seine; 9 miles N. of Rouen.

FONTAINE *le Dun*, a town of France, in the department of the Lower Seine, and chief place of a canton, in the district of Yvetot; 12 miles S.W. of Dieppe. The place contains 382, and the canton 10,448 inhabitants, on a territory of 105 kilometres, in 22 communes.

FONTAINE *l'Evêque*, a town of France, in the department of Jemappe, and chief place of a canton, in the district

of Charleroy; 3 miles W. of Charleroy. The place contains 2,468, and the canton 11,245 inhabitants, on a territory of 100 kilometres, in 12 communes.

FONTAINE *Francoise*, a town of France, in the department of the Côte-d'Or, and chief place of a canton, in the district of Dijon; 10 miles E. of Is sur Tille. The place contains 1,050, and the canton 5,460 inhabitants, on a territory of 157½ kilometres, in 14 communes.

FONTAINE *Guerin*, a town of France, in the department of the Mayne and Loire; 13 miles E. of Angers.

FONTAINE *sous Jouy*, a town of France, in the department of the Eure; 60 miles N.E. of Evreux.

FONTAINE *sur Somme*, a town of France, in the department of the Somme; 5 miles S.E. of Abbeville.

FONTAINE *de Vaucluse*, a town of France, in the department of the Vaucluse, formerly the residence of Petrarch and Laura; 15 miles E. of Avignon.

FONTAINES, PETER FRANCIS DES, in *Biography*, a celebrated French critic, was born at Rouen in the year 1685, where his father was a counsellor of parliament. He received his education under the Jesuits, and obtained admission into that order; but at the age of thirty, disliking the restraint attached to a clerical character, he quitted the society, and at the same time a cure he possessed in Normandy. Having excited some attention by his critical writings at Paris, the Abbé Bignon, in 1724, committed to him the conducting a distinguished periodical publication, entitled "La Journal des Sçavans." While peaceably enjoying the fame and emolument of his literary labours, his numerous enemies, whom he had excited by the severe strictures on their works contained in that publication, determined on revenge; and they cruelly retaliated by accusing him of having been guilty of an unnatural crime; which aspersions on his character occasioned his imprisonment. He however procured his liberty after fifteen days, and a justification of his conduct, in a letter from the magistrate, addressed to the Abbé Bignon, which tended to re-establish him in his former credit. The Journal having been suppressed by authority, he obtained permission to publish, in 1731, a similar work, under the new title of "La Novelliste du Parnasse, ou Reflexions sur les ouvrages nouveaux." But this only proceeded to two volumes, when the imprimatur was also withdrawn, on account of the numerous and loud complaints of the various authors, lampooned, and held up to ridicule by the severity of its criticism. In 1735 he again entered the theatre of literary dissection, and by assurances of more candour, and less personality, he procured a licence for another periodical publication, entitled, "Observations sur les ecrits modernes;" which, after running to the protracted length of thirty-three volumes, was by order of government silenced. But unterrified by menaces, and undismayed by disasters, in 1744 the critic appeared again in the paths of science, and published his remarks in a weekly paper, called "Jugemens sur les ouvrages nouveaux," which proceeded to the eleventh volume under his direction; and the last two, thirteen, and fourteen, of that work were performed by some other hand; he having been attacked with a disorder in his chest, that occasioned his death in 1745; on which occasion his enemy, Piron, wrote this satirical epitaph,

"Sous ce tombeau git un auteur
Dont en deux mots, voici l'histoire
Il étoit ignorant comme un predicateur,
Et malin comme un auditoire."

Besides his avocations in the voluminous periodical publications, he found leisure to execute a variety of other works,

of which his biographer enumerates seventeen; some critical, some historical, and some translations. He published a prose translation of Virgil with plates by Cochin in four volumes, 8vo., in which some critics have decided Virgil is either travestied or murdered in every line. In 1754 a translation of Horace's odes appeared from his pen, and at different times from the same prolific source, sacred poetry, in imitation of the Psalms; Dictionnaire Neologique; a new Gulliver, in two volumes; a translation of Swift's Gulliver's travels; and portions from his other works, and those of Pope, Fielding, &c.

Feron, who has drawn up his character, observes, that he was born a sentimental person, a philosopher in conduct, as well as principle; exempt from ambition, and of a free and noble spirit, which would not stoop for titles or preferments. In common conversation he appeared only a common man; but when any thing out of the ordinary way occurred, he discovered great discernment, force of imagination, depth of humour, and brilliancy of wit. The Abbé de la Port published in 1757, "L'Esprit de l'Abbé des Fontaines," with a life annexed; and a catalogue of his writings, and those who wrote against him, in four volumes, 8vo. which see, and Nouveau Dictionnaire Historique.

FONTANA, PROSPERO, a painter of history, born at Bologna in 1512. Vasari mentions him as having been employed in 1556 to finish works left incomplete by Innocenza da Imola at Bologna, and he appears more as the servant and assistant to others, than as the inventor of great works. He is introduced here principally, as having had the honour of ushering into the world of art those two brilliant luminaries Annibal and Ludovico Carracci. It is not known when he died.

FONTANA, LAVINIA, daughter of Prospero, practised portrait painting with very considerable success, under the patronage of Pope Gregory XIII. She died in 1602, at the age of 50.

FONTANA, DOMINIC, an eminent architect, was born in 1543 at a village on the lake of Como. Having acquired the elements of geometry, he went to Rome, where his elder brother John was a student in architecture. Here he applied himself most diligently in studying the works of antiquity, and at length was employed by cardinal Montalto, afterwards pope Sixtus V. Montalto had already begun to display the magnificence of his character, by undertaking the construction of the grand chapel of the manger in the church of St. Maria Maggiore. The pope, Gregory XIII. jealous of the munificence of his cardinal, took from him the means of his designs, and thus put a stop to the works. Fontana, with a spirit worthy of a great man, went on with the building at his own expence, which he gratified the cardinal, that when he was raised to the popedom, he created Fontana his architect. The chapel and palace were finished in a splendid style, but this was a small part of the vast designs projected by Sixtus. Besides completing the dome of St. Peter's, he resolved to contribute to its grandeur by conveying in front of its piazza the obelisk of a single piece of Egyptian granite, which had formerly decorated the circus of Nero. This design had been contemplated by some of the predecessors of Sixtus, but none had actually attempted it. Sixtus summoned the architects and engineers from all parts, to consult on the best means of effecting the business. Fontana's plan obtained the preference, and he was able to perform in practice what he had advanced in theory. This was regarded as the most splendid exploit of the age, and rewards and honours the most magnificent were bestowed upon Fontana and his heirs. He was afterwards

employed in the elevation of other obelisks, and in the embellishment of the principal streets of Rome. He built the Vatican library, and began considerable additions to that palace, which were interrupted by the death of Sixtus. One of Fontana's great works, was the conducting water to Rome from the distance of fifteen miles, in a channel supported upon arcades. The successor of Sixtus, Clement VIII., was prejudiced against the papal architect, and dismissed him from his office, but his reputation caused him to be engaged by the viceroy of Naples as architect to the king. He accordingly removed to Naples in 1592. Here he undertook and executed many works of consequence. His last efforts were directed to a new harbour for Naples, which he did not live to finish. He died at Naples in 1607 in his sixty-fourth year. Gen. Biog.

FONTANA *Furus*, in *Geography*, a town of Naples, in the province of Capitanata; 14 miles S.W. of Salpe.

FONTANAMORA, a town of France, in the département of Dora; 18 miles E.S.E. of Aosta.

FONTANAROSSA, a town of Naples, in Principato Ultra; 14 miles N.W. of Cozza.

FONTANELI, in *Anatomy*, called also bregma; the vacancy left between the two portions of the frontal and the parietal bones, before the ossification of the skull is completed. The parietes of the cranium are made up here by the dura mater. Two of these vacancies are found in the head; one in front and the other at the back part of the parietal bones. The former is the largest. They are gradually lost as the bones approach each other. See FONS and CRANIUM.

FONTANELLA, in *Geography*, a town of Italy, in the department of the Upper Po; 8 miles N.E. of Crema.

FONTANELLA, in *Surgery*, an issue. See ISSUE.

FONTANELLO, in *Geography*, a town of France, in the department of the Sesia; 7 miles E. of Crescentino.

FONTANESIA, in *Botany*, so called by M. La Billardiere, in just commemoration of his amiable friend M. René Louiche Desfontaines, the able author of the *Flora Atlantica*, and of several learned botanical and physiological essays. The late M. L'Heritier had, with the same intent, published a *Louichea*, which proved to be the *Pteranthus* of Forskall, *Camporofina Pteranthus* of Linnaeus.—Billard. Syr. fasc. 1. 9. t. 1. Wild. Sp. Pl. v. 1. 52. Vahl. Enum. v. 1. 37. Mart. Mill. Dict. v. 2. Lamarek. Illustr. 77. t. 22.—Class and order, *Diandria Monogynia*. Nat. Ord. *Separiæ*, Linn. *Jasmineæ*, Juss.

Gen. Ch. Cal. Perianth inferior, very small, in four deep, ovate, equal, permanent, bluntish segments. Cor. of two, much larger, inversely-heartshaped, deeply cloven, obtuse, concave petals, deciduous. Stam. Filaments two, inserted into the base of each petal between its lobes, thread-shaped, longer than the petal; anthers roundish-oblong, with two furrows. *Pist.* Germen superior, ovate, compressed; style short, compressed, permanent; stigmas two, acute, incurved. *Peric.* Capsule elliptical, emarginate, compressed, membranous, of two cells, not bursting; very rarely of three cells. *Seeds* solitary, oblong, pendulous.

Eff. Ch. Calyx in four deep segments. Petals two, deeply divided. Capsule superior, membranous, not bursting, of two cells. Seeds solitary, pendulous.

Obt. The character of this genus comes very near *Fraxinus*, to which Billardiere adverts, saying that it is distinguished "by its fruit being of two cells;" but in that it actually agrees with *Fraxinus*, the latter differing only in the leaty elongation of its capsule. We do not mean that the two genera are not perfectly distinct. The petals indeed

are not so indubitable a mark as could be wished, being in all this tribe very uncertain, and according to Billardiere himself, occasionally united into a tube in the plant under consideration.

The only known species is

1. *F. phillyrioides*. Billard. as above.—A shrub, native of Syria, about twelve feet high, smooth, bushy, and evergreen, but not remarkable for beauty, the flowers being small, greenish and inconspicuous. They are copiously produced in small axillary clusters. The ripe fruit looks somewhat like that of the Elm. This shrub stands our winters in the open ground, and is kept in some of the English gardens, but rather for curiosity than ornament. The leaves are opposite or scattered, stalked, simple, ovate, acute and entire, of rather a dull green.

FONTANGES, in *Geography*, a town of France, in the department of the Cantal; 10 miles N.W. of Murat.

FONTANINI, GIUSTO, in *Biography*, a learned Italian, was born in the duchy of Friuli in the year 1666. Having gone through his preparatory studies, he was ordained priest at Venice in 1690. Here and at Padua he studied very hard, improved himself in literature of various kinds; and in 1697 he was invited to Rome as librarian to cardinal Imperiali. From this period he became known and celebrated by many learned publications; and he acquired the notice and friendship of the most learned people of the age. He was patronized by pope Clement XI., who made him his own chamberlain, and gave him a pension and preferment in the church. He died in the year 1736 in the seventieth year of his age. His principal work was a discourse on Italian eloquence, entitled "Dell' eloquenza Italiana." This went through several editions during the author's life; but the best and most correct is that printed at Venice since his death in two volumes 4to., with notes &c. by Apollolo Zeno. Fontanini contended, in this work, that the Italians wrote in the French language before they used Italian, which gave much offence, and excited a warm controversy among the literati of the country. Moreri.

FONTANKA, in *Geography*, a navigable river of Russia, which goes from the Neva, on the right of the Neva, flowing as a slow morass brook, first towards the south, then westward parallel with the Neva, to the Cronstadt gulf, into which, with the Neva, it formerly fell in two arms. In the former reigns it had been deepened and lined with sides of timber; but gradually filled up again, and in summer was partially dry. By order of her late Majesty it was dug afresh, to a bed of one fathom in depth, and in breadth ten or twelve, and its sides faced with hewn granite raised on piles to the height of a fathom above the water's level, with an iron balustrade; and without-side of this, a pavement five feet broad of granite flags, for the accommodation of foot-passengers. Its banks are now full of fine flowing Neva-water; it is navigable for barks of burden, and constitutes one of the chief ornaments of the imperial residence. The length of this river is nearly 3000 fathoms.

FONTARABIA, in Spanish *Puerta Rabia*, and in Latin *Fons rapidus*, is a fortified town in the province of Biscay and district of Giupuscoa, and one of the keys of Spain. It is situated in a small peninsula on the sea-coast, and upon the left bank of the Bidassoa, and has the title of a city. It is small, but well fortified both by nature and art. On the land side it is protected by high mountains, by the Sierras of Jaquevel, and on the sea-side it is defended by a good fortress.

Its harbour would be a good one, if the tide, which is generally very high there, did not leave it dry, when it retires.

The town is built in the form of an amphitheatre, upon a hill which faces the sea, and in the south angle of the gulf of Gascony. It has a governor, a king's lieutenant, or major, an aide-major, and a garrison, more or less numerous at different times. N. lat. 43° 23'. W. long. 1° 55'.

FONTELLO, a town of Portugal, in the province of Beira; 4 miles N.E. of Lamego.

FONTENAY, PETER CLAUDE, in *Biography*, a French Jesuit, was born at Paris in 1683, and entered on his novitiate in the order when he was fifteen years of age. Having completed his initiatory studies, he was employed some time to furnish extracts and remarks on books relating to religion and ecclesiastical history in the "Journal de Trevoux." He was engaged for some years in collecting materials for writing a history of the popes, in which however he made but small progress. His attention to ecclesiastical history did not prevent him from pursuing the lighter studies of polite literature, in which he excelled, and as the result of these pursuits, he published various small poems in the collections of the day. His talents and learning pointed him out as a fit person for rector of the Jesuits' college at Orleans, where he continued till the year 1735, when he was recalled to Paris, and appointed to continue, Longueval's "History of the Gallican church." Eight volumes of this work had been already published, and father Fontenay proceeded with it till the eleventh, when he was incapacitated for further progress in the undertaking by a paralytic stroke. He survived the stroke but twelve months, and died at the college La Flèche in the year 1742, in the fifty-sixth year of his age. Moreri.

FONTENAY, in *Geography*, a town of France, in the department of the Two Seves, and chief place of a canton in the district of Niort. The place contains 1,235, and the canton 6,183 inhabitants, on a territory of 142½ kilometres, in 10 communes.

FONTENAY-le-Comte, a town of France, and chief place of a district, and capital of the department of Vendée, situated in a fertile valley on the Vendée. The place contains 6,600, and the canton 15,003 inhabitants, on a territory of 147½ kilometres, in 13 communes. The chief articles of commerce of the inhabitants are cloth, woollen stuffs, and cattle, of which they sell a great number at the three annual fairs. N. lat. 46° 30'. W. long. 0° 24'.

FONTENELLE, BERNARD LE BOVIER DE, in *Biography*, a man of letters, was born at Rouen in 1657. He was educated among the Jesuits, and became, at a very early age, distinguished for the progress which he made in polite literature. He studied the law as a profession, but losing his first cause in the courts, he renounced the bar, and devoted himself entirely to literature and philosophy. In 1674 he visited Paris, and became known as a poet; and in 1683 he published "Dialogues of the Dead," in two volumes. These were well received, and proved a happy specimen of his talent of combining morality and literature with the graces of elegant and ingenious writing. Three years afterwards he published his most popular work, entitled, "Entretiens sur la Pluralité des Mondes." In this little piece, which has been translated into all languages, science and philosophy are united with vivacity, gallantry, and delicate humour. The next production of Fontenelle was "The History of Oracles," which appeared in 1687, and which exposed the author to the suspicion of infidelity, because he opposed certain dogmas held by the clergy as sacred. He published, in the year 1688, "Pastoral Poems, with a Discourse on the Eclogue," and in 1689 and the following year the operas of "Thetis and Pæon," and "Æneas and Lavinia," which met with a considerable share

of popularity. In 1690 he was admitted into the French academy; and in 1699 he was elected secretary of the academy, a post which he occupied forty-two years. In this situation he wrote a history of that body, of which he published a volume annually, containing extracts and analyses of memoirs, and eulogies of deceased members. Fontenelle was author of many other pieces, of which the principal are, "L'Histoire du theatre Francois jusqu'à Corneille;" "Reflexions sur la Poetique du theatre, et du theatre Tragique;" "Elemens de Geometrie de l'Infini;" a tragedy, and some comedies. His constitution was originally and naturally delicate, yet he reached the great age of fourscore years and ten, with no other infirmity than that of deafness. After this his sight began to fail him; but he lived till he had nearly completed a century. A short time before he expired, he was asked by his physician if he felt any pain, "I only feel," he replied, "a difficulty of existing." He died January 9, 1757. Fontenelle, says his biographer, "as a poet, did not rise beyond elegance and ingenuity: as a man of science, he excelled more in elucidating the inventions of others, than in discovering new truths. In the commerce of life he was truly a philosopher; studious of his own happiness, yet without sacrificing the duties of a man of honour and virtue. In his conversation he was guarded; in his actions firm and decided. He often gave an honest vote in a minority at the academy, and was the only one who had the courage to vote against the exclusion of the abbe St. Pierre from its meetings, when he had been declared guilty of treating the memory of Louis XIV. with disrespect. He had many friends; and, in the latter part of his life, scarcely an enemy." The works of Fontenelle, with the exception of those on geometry and physics, have been collected in eleven volumes, 12mo. under the title of "Œuvres Diverses." Moreri.

Fontenelle, the most pleasing and alluring writer on subjects of history, criticism, and philosophy, was so totally insensible to music, that, like our Pope, he wondered how its votaries could be so delighted with it. Pope ascribed all the pleasure expressed by the admirers of the art to affectation; while Fontenelle, ignorant of its object, concerning which his ears afforded him no information, cried out, "Sonate, que veut tu?" and this humble question has passed for a *bon mot* among scoffers ever since. The sonata personified might have answered, "I would have you listen with attention to the sweetness of the harmony, the grace, spirit or pathos of the melody, and the ingenuity of the composition." But it is wonderful that so intelligent an author should write dramas for music, without knowing what music meant; yet, when no more than twenty years of age, he produced *Pêche*, and *Bellerophon*, two serious operas for the lyric theatre, and which were set by Lulli in 1681; *Peleus* and *Thetis*, another serious opera for what he could not understand; in 1689, *Æneas* and *Lavinia*; and in 1731, *Endymion*; and all these dramas were to be translated into melody, a language of which he knew not the alphabet. He used to say that the ancient music of the Greeks could never be recovered, or similar effects produced by the moderns, unless the poet and musician were united in one and the same person, for he had read that Sophocles and Euripides set their own dramas to music. Metastasio was more modest and more reasonable; for, upon being asked if he had ever set any of his own dramas to music, he answered in the negative, assigning as a reason, that music was now become so difficult and complicated a study, that a man of letters had not leisure sufficient for its cultivation; as it is necessary now not only for an opera

composer to be possessed of genius, taste, invention, and knowledge of counterpoint, but he should know the peculiar cast and power of different voices, the scale and genius of different instruments, and sing in good taste, though without a voice. Pope, whose auricular organs were too obtuse to vibrate in unison with musical tones, wrote a beautiful ode for music on St. Cecilia's Day, and Addison not only wrote an ode, but an opera for music, both as ignorant of its meaning as Fontenelle. These admirable writers, who, on subjects within their competence, seem beings of a superior order, only degrade themselves to a level with the common mass of mankind, in condemning what they neither feel nor understand. No one is ashamed to own that he is near-sighted; none will allow that their apathy and contempt for music arise from an imperfect organization. There is an ear for music, an eye for painting, and a voice for song, with which those who hear, see, and talk well enough for the common purposes of life, are not gifted. Dr Johnson, who had no ear for music, and used to have some pleasure in humbling those whom he thought vain of their musical talents, seeming to hang over the harpsichord as if he were listening to the sounds, being told by the performer that he hoped he would grow fond of music at last, the great philologist said, "Sir, I shall be glad to have a new sense given me!" which was candidly ascribing his contempt for music to its true cause. Fontenelle, whose style in his prose writings was the most ingenious, elegant, playful, and correct, of any author who contributed to embellish the splendid and literary reign of Louis XIV., was nephew to the great Corneille.

FONTENOY, in *Geography*, a village of France, in the department of Jemappe, famous for a battle which was fought near it between the French and the allies, in May 1745; the allies and English were commanded by the duke of Cumberland, and the French by marshal Saxe. The allied army left 12,000 on the field of battle, and the loss of the French was not much less; 4 miles S. E. of Tournay.—Also, a town of France, in the department of the Meurte; 4 miles N. E. of Toul.—Also, a town of France, in the department of the Aisne, on the Aisne; 5 miles W. of Soissons.

FONTES, a town of France, in the department of the Herault; 13 miles N. E. of Beziers.

FORTEVRAUD, a town of France, in the department of the Mayne; famous for an abbey, in the church of which several kings and queens of England were buried; 6 miles E. of Saumur.

FORTEVRAULT, in *Ecclesiastical History*, an heremaphrodite order of monks and nuns, in which, contrary to others of a similar complexion, the weaker sex is allowed the pre-eminence. It was founded soon after the celebration of the council at Poitiers, in the year 1100, by Robert d'Arbrissel; who was first archdeacon of Rennes, and then received a particular mission from pope Urban II. to become an itinerant preacher, for the better instruction of profane Christians. Having been very successful, and persuaded numbers, both men and women, to devote themselves to a monastic life, he erected for their accommodation cells in the woods of Fortevault, three leagues from Saumur, on the confines of Poitiers, in France. After lodging the women in separate apartments, and subjected the men to the controul of the abbess, in honour of that portion of sacred history written by St. John, in the 19th chapter of his gospel; he placed the whole order under the rules of St. Benedict, only adding some particular constitutions; and appointed this house to preside over the whole. Pope Pas-

chal

chal approved of the institution, and its privileges were confirmed and extended by succeeding pontiffs. Previous to the French revolution, there were about sixty of these monasteries in France. The nuns wear a black robe, with a white veil; and the monks are habited in black, like secular priests, with the addition of a camail on their cassolet.

FONTICULUS, in *Surgery*, an issue. See **ISSUE**.

FONTINALIA, or **FONTANALIA**, in *Antiquity*, a religious feast, held among the Romans, in honour of the deities who presided over fountains or springs. Varro observes, that it was the custom to visit the wells on those days, and to cast crowns into fountains. Scaliger, in his conjectures on Varro, takes this not to be a feast of fountains in general, as Festus insinuates, but of the fountain which had a temple at Rome, near the Porta Capena, called also Porta Fontinalis; he adds, that it is of this fountain Cicero speaks in his second book *De Legib.* The fontinalia were held on the 13th of October.

FONTINALIS, in *Botany*, from *fons*, a fountain or rivulet, alluding to its place of growth. Water-moss. Bauh. Hist. v. 3. 770. Dill. Musc. 254. Linn. Gen. 562. Schreb. 761. Mart. Mill. Dict. v. 2. Sm. Fl. Brit. 1336. Hedw. Fund. v. 2. 96. t. 9. f. 53—55. Juss. 11. Class and order, *Cryptogamia Musci*. Nat. Ord. *Musci*.

Gen. Ch. Male in axillary scaly buds. Female lateral. Sheath of numerous, imbricated, close scales. Capsule oblong, smooth, on a short bristle-like fruit-stalk, enveloped in the sheath. Veil awl-shaped, deciduous. Lid awl-shaped. Fringe double; the *outermost* of sixteen teeth, broadest at their base, at length recurved, brittle and deciduous; the *inner* conical, mostly red, beautifully reticulated, having sixteen upright bristles, and numerous transverse fibres, deciduous.

Ess. Ch. Capsule oblong, lateral, enclosed in a scaly sheath. Outer fringe of sixteen teeth, dilated at the base; inner reticulated.

One of the most natural genera of Mosses, though only four species are known. The character derived from the red reticulated inner fringe, is no less striking than certain; but the fragility of the fringes altogether renders a careful examination necessary, when the lid is just ready to fall. All the species are of a dark hue, and grow on rocks, stones or posts in fresh water, floating with the current, their stems being much branched, and tufted.

1. *F. antipyretica*. Great Water-moss.—Leaves pointed, folded so as to form a keel, disposed in three ranks. Scales of the sheath obtuse. Lid awl-shaped.—Linn. Sp. Pl. 1571. Sm. Fl. Brit. 1336. Engl. Bot. t. 359. Hedw. Sp. Musc. 298. Hudf. 467. Turn. Musc. Hib. 199. (*F. triangularis major complicata, e foliorum alis capsulifera*; Dill. Musc. 254. t. 33. f. 1.)—Frequent about mill pools, and in flow deep waters, growing far below the surface, and rarely producing fruit. The roots are strong and perennial. Stems wiry, often a foot long, irregularly branched, leafy. Leaves of a deep transparent green, scarcely shining, often encrusted with calcareous earth, deposited by the water, in the manner of *Chara vulgaris* and *hispida*; see **CHARA**. Capsules scattered along the main stem, nearly sessile, elliptical, closely covered with the imbricated scales of the sheath, except the lid, which is awl-shaped, short, prominent, covered with a veil rather exceeding its own length. The structure of the fringe is not shown in *Engl. Bot.* but may be seen in Hedwig's *Fundamenta* as above. Linnaeus relates, in his *Flora Suecica*, that the Swedes “stuff in this moss between their chimneys and wooden walls, to guard

the latter from fire.” Hence he has given it the name of *antipyretica*, and hence some have supposed it incombustible, for which there is no foundation, except perhaps when it is thickly encrusted all over with earth. Its use can be accounted for sufficiently, by its being a bad conductor of heat, and excluding the passage of air.

2. *F. squamosa*. Shining Scaly Water-moss.—Leaves imbricated, lanceolate, pointed, concave. Scales of the sheath blunt, as well as of the lid.—Linn. Sp. Pl. 1571. Sm. Fl. Brit. 1337. Engl. Bot. t. 1861. Hedw. Sp. Musc. 299. Crypt. v. 3. 32. t. 12. Hudf. 467. Turn. Musc. Hib. 199. (*F. squamosa tenuis sericea atro-virens*; Dill. Musc. 258. t. 33. f. 3.)—Found in alpine rivulets, in Wales, Scotland, Ireland, and the north of England. Smaller than the preceding, as well as more shining, with a yellowish cast. Leaves taper-pointed, usually in three rows, but not folded, though furnished with a plait in their lower part which looks like a rib. Capsule projecting a little beyond the sheath, with a blunt conical lid.

3. *F. capillacea*. Bristly Water-moss.—Leaves linear-bristle-shaped, spreading. Sheaths and fruitstalks elongated, thread-shaped; the scales acute, reaching beyond the capsule.—Dickf. Crypt. fasc. 2. 1. Sm. Fl. Brit. 1337. With. 789. Hull. 275. (*F. capillacea, calycibus styli instar cuspidatis*; Dill. Musc. 260. t. 33. f. 5.)—Native of the alpine rivulets of Scotland, where it was discovered by Mr. Dickson. The celebrated John Bartram sent it to Dillenius from Pennsylvania. This is of a dull olive green, scarcely shining, and is known by its long leaves with capillary points, which spread nearly equally in all directions. The long fruitstalks, invested with the close slender sheaths, are also remarkable, and readily distinguish it from both the foregoing.

4. *F. falcata*. Sickle-leaved Water-moss.—Leaves ovate, lanceolate, taper-pointed, in three rows, curved to one side. Fruitstalks elongated, half naked.—Hedw. Sp. Musc. 299. Crypt. v. 3. 57. t. 24. Swartz. Musc. Succ. 72. (*F. capillacea*; Linn. Fl. Succ. 379. Ehrh. Crypt. 205.)—Found in mountainous rivulets in Sweden. Euhart gathered it near Upsal. Much less slender than the last, from which it is essentially distinguished by the sickle-shaped leaves, curved all one way, and the nakedness of the upper part of the fruitstalks, whose sheaths seldom reach further than their middle. Linnaeus mistook this for the plant of Dillenius, quoted under our last species, on which, without seeing a specimen, he had previously founded his own *F. squamosa*. He tells us in the *Flora Suecica*, ed. 2, he had not the plant at hand when he wrote that book, but adopted it from Olaus Celius.

The *F. pennata* of Linnaeus is *Neckera pennata*, Hedw. Crypt. v. 3. 47. t. 19, a most elegant moss, erroneously supposed to have been found in England.

Concerning *F. minor*, Linn. Sp. Pl. 1571, there has been much doubt and controversy. The plant of Dillenius and of British writers, from which the Linnaean specific character, of the terminal fructification, was taken, is *Trichotomum fontinalioides* of Hedwig, and of *Fl. Brit.* 1248. This is what grows at Oxford and in the Thames, and is figured in *Engl. Bot.* t. 557. But the herbarium of Linnaeus contains a specimen, gathered at Upsal, marked by him *minor*, which is certainly different, though probably only a variety of *F. antipyretica*. This is what he described in the second edition of *Species Plantarum*, “leaves folded so as to form a keel, two together on the thicker branches.” There are no capsules on the specimen, but some appearance of axillary male flowers. As the acute and active cryptogamists of Sweden have not since detected this plant

at Upsal, we must conclude it to be an evanescent variety of the first species. The Swiss botanists have been no less puzzled than Linnæus about *F. minor*. What Favrod and others have taken for such, and which they contend is Haller's *Hypnum*, n. 1795, appears to us not different from *Hypnum ruscifolium*, Fl. Brit. 1292. Possibly, from his quotation of Dillenius, Haller might mean our *Trichostomum fontinalioides*, but on this little dependance can be placed, as under his very next species, n. 1796, which is *Aniſtangium aquaticum* of Hedwig, *Hypnum aquaticum* Jacq. Austr. t. 290, (as the late Mr. Davall first suspected), Haller quotes the synonym which belongs to *Fontinalis squamosa*, a

widely different moss. The synonyms of this eminent writer indeed require much correction, even in his *Nomenclator*, where he is supposed to give only the most obvious and indubitable. S.

FONTINELLE, in *Geography*, a town of Walachia, on the Danube; 18 miles E. of Nicopoli.

FONTIVEROS, or HONTIVEROS, a town of Spain, in Old Castile; 10 miles N.N.W. of Avila.

FOOD. For the substances capable of affording nutriment to man, see DIGESTION; and for information relative to the quality and quantity of those substances to be taken with a view to the prevention and cure of diseases, see DIET.

END OF VOLUME XIV.

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