

been retained, and is indiscriminately applied to all methods of painting in wax. The durability of wax, and its power of resisting the effects of the atmosphere, were well known to the Greeks, who used it for the protection of their sculptures. As a vehicle for painting it was commonly employed by them and by the Romans and Egyptians; but in recent times it has met with only a limited application. Of modern encaustic paintings those by Schnorr in the Residenz at Munich are the most important. At present there is no general agreement as to which is the best method of using wax for mural painting. Modern paintings in wax, in their chromatic range and in their general effect, occupy a middle place between those executed in oil and in fresco. Wax painting is not so easy as oil, but presents fewer technical difficulties than fresco.

Ancient authors often make mention of *encaustic*, which, if it had been described by the word *inurere*, to burn in, one might have supposed to have been a species of enamel painting. But the expressions "incausto pingere," "pictura encaustica," "ceris pingere," "pictura inurere," used by Pliny and other ancient writers, make it clear that some other species of painting is meant. Pliny distinguishes three species of encaustic painting. In the first they used a stylus, and painted either on ivory or on polished wood, previously saturated with some certain colour; the point of the stylus or stigma served for this operation, and its broad or blade end cleared off the small filaments which arose from the outlines made by the stylus in the wax preparation. In the second method it appears that the wax colours, being prepared beforehand, and formed into small cylinders for use, were smoothly spread by the spatula after the outlines were determined, and thus the picture was proceeded with and finished. By the side of the painter stood a brazier, which was used to heat the spatula and probably the prepared colours. This is the method which was probably used by the painters who decorated the houses of Herculaneum and of Pompeii, as artists practising this method of painting are depicted in the decorations. This method has recently been revived in Italy. The third method was by painting by a brush dipped into wax liquefied by heat; the colours so applied attained considerable hardness, and could not be damaged either by the heat of the sun or by the effects of sea-water. It was thus that ships were decorated; and this kind of encaustic was therefore styled "ship painting."

About the year 1749 Count Caylus, and M. Bachelier, a painter, made some experiments in encaustic painting, and the count undertook to explain an obscure passage in Pliny, supposed to be the following (xxxv. 39):—"Ceris pingere ac picturam inurere quis primus excogitaverit non constat. Quidam Aristidis inventum putant, postea consummatum a Praxitele; sed aliquanto vetustiores encausticæ picture extitere, ut Polygnoti et Nicanoris et Arcesilai Pariorum. Lysippus quoque Æginæ picture suæ inscripsit *ἐνέκαυρον*, quod profecto non fecisset nisi encaustica inventa." There are other passages in Pliny bearing upon this subject, in one of which (xxi. 49) he gives an account of the preparation of "Punica cera." The nature of this Punica wax, which was the essential ingredient of the ancient painting in encaustic, has not been definitely ascertained. The Chevalier Lorgna, who investigated the subject in a small but valuable tract, asserts that the *nitron* which Pliny mentions is not the nitre of the moderns, but the *natron* of the ancients, viz., the native salt which is found crystallized in Egypt and other hot countries in sands surrounding lakes of salt water. This substance the Carthaginians, according to Pliny, used in preparing their wax, and hence the name Punica seems to be derived. Lorgna made a number of experiments with this salt, using from three to twenty parts of white melted wax with one of natron. He held

the mixture in an iron vessel over a slow fire, stirring it gently with a wooden spatula, till the mass assumed the consistency of butter and the colour of milk. He then removed it from the fire, and put it in the shade in the open air to harden. The wax being cooled liquefied in water, and a milky emulsion resulted from it like that which could be made with the best Venetian soap.

Experiments, it is said, were made with this wax in painting in encaustic in the apartments of the Count Giovanni Battista Gasola by the Italian painter Antonio Paccheri, who dissolved the Punica wax when it was not so much hardened as to require to be "igni resoluta," as expressed by Pliny, with pure water slightly infused with gum-arabic, instead of sarcocolla, mentioned by Pliny. He afterwards mixed the colours with this wax so liquefied as he would have done with oil, and proceeded to paint in the same manner; nor were the colours seen to run or alter in the least; and the mixture was so flexible that the pencil ran smoother than it would have done with oil. The painting being dry, he treated it with caustic, and rubbed it with linen cloths, by which the colours acquired peculiar vivacity and brightness.

About the year 1755 further experiments were made by Count Caylus and several French artists. One method was to melt wax with oil of turpentine as a vehicle for the colours. It is well known that wax may be dissolved in spirit and used as a medium, but it dries too quickly to allow of perfect blending, and would by the evaporation of the spirit be prejudicial to the artist's health. Another method suggested about this time, and one which seems to tally very well with Pliny's description, is the following. Melt the wax with strong solution of salt of tartar, and let the colours be ground up in it. Place the picture when finished before the fire till by degrees the wax melts, swells, and is bloated up upon the picture; the picture is then gradually removed from the fire, and the colours, without being injuriously affected by the operation of the fire, become unalterable, spirits of wine having been burnt upon them without doing the least harm. Count Caylus's method was different, and much simpler:—(1) the cloth or wood designed for the picture is waxed over, by rubbing it simply with a piece of beeswax; (2) the colours are mixed up with pure water; but as these colours will not adhere to the wax, the whole ground must be rubbed over with chalk or whiting before the colour is applied; and (3) when the picture is dry it is put near the fire, whereby the wax is melted and absorbs the colours. It must be allowed that nothing could well be simpler than this process, and it was thought that this kind of painting would be capable of withstanding the weather and of lasting longer than oil painting. This kind of painting has not the gloss of oil painting, so that the picture may be seen in any light, a quality of the very first importance in all methods of mural painting. The colours too, when so secured, are firm, and will bear washing, and have a property which is perhaps more important still, viz., that exposure to smoke and foul vapours merely leaves a deposit on the surface without injuring the work. The "encausto pingendi" of the ancients could not have been enamelling, as the word "inurere," taken in its rigorous sense, might at first lead one to suppose, nor could it have been painting produced in the same manner as encaustic tiles or encaustic tesserae; but that it must have been something akin to the count's process would appear from the words of Pliny already quoted, "Ceris pingere ac picturam inurere."

Werner of Neustadt found the following process very effectual in making wax soluble in water. For each pound of white wax he took twenty-four ounces of potash, which he dissolved in two pints of water, warming it gently. In this ley he boiled the wax, cut into little bits, for half an

hour, after which he removed it from the fire and allowed it to cool. The wax floated on the surface of the liquor in the form of a white saponaceous matter; and this being triturated with water produced a sort of emulsion, which he called wax milk, or encaustic wax. This preparation may be mixed with all kinds of colours, and consequently can be applied in a single operation.

Mrs Hooker of Rottingdean made, at the end of the last century, many experiments to establish a method of painting in wax, and received a gold palette from the Society of Arts for her investigations in this branch of art. Her account is printed in the tenth volume of the Society's Transactions (1792), under the name of Miss Emma Jane Greenland. The following is an abstract of her processes:—

Put into a glazed earthen vessel four ounces and a half of gum arabic, and eight ounces or half a pint wine measure of cold spring water; when the gum is dissolved, stir in, over a low fire, seven ounces of gum mastic, continually stirring and beating hard with a spoon, in order to dissolve the gum mastic. When sufficiently boiled the mixture will no longer appear transparent, but will become opaque and stiff like a paste. As soon as this is the case, and the gum water and mastic are quite boiling, without taking them off the fire, add five ounces of white wax, broken into small pieces; stir and beat till the wax is perfectly melted and boils; then take the composition off the fire, as boiling it longer than necessary would harden the wax, and prevent it afterwards from mixing well with water. When the composition is taken off the fire, it should be beaten well whilst hot (but not boiling) in the glazed earthen vessel; mix with it by degrees a pint or sixteen ounces more of cold spring water, then strain the composition, and bottle it. The composition if properly made should be like cream, and the colours when mixed with it as smooth as with oil. Mix with the composition on a china palette any powder colours which may be required to the consistency of oil colours; then paint with pure water. In painting with this composition the colours blend without difficulty when wet, and even when dry the tints may be easily united by means of a brush and a very small quantity of water. The painting being finished, heat some white wax in a glazed earthen vessel over a slow fire till melted, but not boiling; then with a hard brush cover the painting with the wax; when cold take a moderately hot iron, such as is used for ironing linen, and which will not "hiss" when put to the usual test, and draw it lightly over the wax. The painting will appear as if under a cloud, till the wax and the substance the picture is painted upon are perfectly cold; but if then it should not appear sufficiently clear, the wax may be melted by holding a hot iron at a proper distance from it, especially before such portions of the picture as do not appear sufficiently transparent or brilliant; for the oftener heat is applied to the picture the greater will be the transparency and the brilliancy of the colouring; but the contrary effect would be the result were the heat applied too suddenly, in too great a degree, or for too long a time. When the picture is cold, rub it with a fine linen cloth. Plaster surfaces require no other preparation than a coating of the composition.

It would be equally practicable to paint with wax alone, dissolved in gum water. Take three quarters of a pint of cold spring water, and four ounces and a half of gum arabic, put them into a glazed earthen vessel, and when the gum is dissolved, add eight ounces of white wax. Put the earthen vessel, with the gum water and wax, upon a slow fire, and stir them till the wax is dissolved, and when the mixture has boiled a few minutes, take it off the fire, and throw it into a basin, as by remaining in the hot earthen vessel the wax would become rather hard; beat the gum water and wax till quite cold. It is necessary to use some pure water in mixing this composition with the colours. If the ingredients should separate when bottled, they have only to be well shaken together. This composition may be kept for a long time, and be rendered fit for use by putting a little cold water upon it for a short time.

The following is a recent receipt. Place in a large pipkin, half full of hot turpentine, as much gum dammar as will dissolve (½ lb gum makes about 1½ pints varnish); melt from two to two and a half of the wax tablets sold by chemists in a pint of this varnish; when cold the composition should just be consistent enough to stand up on the palette. If too thin, heat it again, and add wax; if too thick add turpentine. This vehicle may be used with ordinary oil colours. Before commencing your work heat the wall, and rub in as much vehicle as it will absorb; after the work is finished it should be re-heated, to secure its adhesion to the wall.

See Lorgna, *Un discorso sulla cera punica*; Pittore Vincenzo Requeno, *Saggi sul Ristabilimento dell' antica Arte de' Greci e Romani*, Parma, 1787; *Phil. Tran.*, vol. xlix., part 2; Muntz on *Encaustic Painting*; Elmes's *Dictionary of the Fine Arts*; W. Cave Thomas, *Methods of Mural Decoration*, London, 1869. (W. C. T.)

ENCAUSTIC TILES. The term "encaustic" as applied to tiles is of modern though somewhat doubtful origin. The art bears no resemblance to the "encaustic painting" mentioned by Pliny and other ancient writers, although the expression (which signifies executed by fire) is perhaps as correctly applied to this manufacture as to the wax-incised pictures of the ancients. The term is, strictly speaking, applied to tiles which are decorated with patterns formed with different coloured clays, inlaid in the tile, and fired with it. This art appears to have had its origin in the latter part of the 12th century, but the culminating point of its excellence and popularity was attained during the 13th; and it was extensively used for the decoration of Gothic buildings in connection with each succeeding change in that style of architecture.

In mediæval times the manufacture appears to have been principally carried on in England and Normandy, but examples of ancient tile-pavements of this description are also to be found in Holland and other Continental countries. The greater number of ancient examples are in squares, varying from 4 to 9 inches, but some striking exceptions occur, from which it has been attempted to trace a connection between this art and that of Roman mosaics. Pavements presenting a kind of connecting link between the two have been discovered at Fountains Abbey, and in Prior Crauden's chapel, Ely, in which the tiles are of great variety of form and size; and, instead of the patterns being wholly inlaid in the tiles themselves, the design is, to a large extent, produced by the outlines of the individual pieces, which, in the latter example, are cut to the forms required to be represented, including the subject of the temptation of Adam and Eve, trees, lions, &c., the tesserae being also enriched with what may be more strictly called encaustic decoration.

Encaustic tiles were almost exclusively used for pavements, but an interesting instance of their employment for wall decoration occurs in the abbey church of Great Malvern, where these tiles have probably been originally used to form a reredos, and bear designs representing Gothic architecture in perspective, having introduced into them the sacred monogram "I.H.S.," the crowned monogram of "Maria," the symbols of the Passion, the Royal Arms, and other devices. This example is also interesting as bearing the date of its manufacture on the margin, "Anno R. R. H. VI. XXXVJ.," that is, the thirty-sixth year of the reign of Henry VI. (1457-8).

Combinations of encaustic tiles forming a cross were frequently used as mortuary slabs; and an example of this kind of monument is in Worcester cathedral *in situ*, whilst the detached component tiles are to be found in other ancient churches.

Many interesting ancient inscriptions are found entering into the designs of encaustic tiles, amongst which is the following, from Great Malvern, which has been deciphered with some difficulty, and rendered into modern English thus—

"Think, man, thy life
May not ever endure;
That thou do'st thy self
Of that thou art sure;
But that thou keepest
Unto thy executor's care,
If ever it avail thee,
It is but chance."

A tile from the same place also bears the following quotation from the book of Job, curiously arranged, and beautifully combined with Gothic ornament: "Miseremini mei, miseremini mei saltem, vos amici mei, quia manus Domini tetigit me." The border of this tile bears the names of the evangelists, with the date A.D. MCCCCLVI. The armorial bearings or noble benefactors, and the devices

of abbots and other church dignitaries, also enter largely into the decorations of ancient encaustic tiles. Amongst the most interesting examples of these pavements, found *in situ*, is that in the chapter house at Westminster, which about the year 1840 was laid open to view by the removal of a wooden floor previously covering it. It is probably of the time of Henry III., in whose reign it is recorded that the king's little chapel at Westminster was paved with "painted tile,"—"mandatum est, &c., quod parvam capellam apud Westm. tegula picta decenter paveari faciat."—Rot. Claus. 22 Henry III. M. 19, 1237-38 A.D. The tiles of this pavement comprise subjects which may be taken to represent the king, queen, and the abbot, also the legend of King Edward the Confessor bestowing a ring, as alms, on St John the Baptist, who appeared to him in the guise of a pilgrim, besides other curious historical designs. The tiles from Chertsey Abbey, Surrey, now in the architectural museum, Westminster, are also amongst the oldest, and, at the same time, the finest and most artistic yet brought to light. They present a remarkable series of illustrations from the English romance of Sir Tristram, and of incidents in the history of Richard Cœur-de-Lion. These tiles were all found in fragments, but have been put together with great care.

Traces of the ancient manufacture of encaustic tiles have been found in several places in England, and the remains of kilns containing tiles in various stages of manufacture have been discovered at Bawsley, near Lynn, in the neighbourhood of Droitwich, as well as in other localities, by which an interesting light has been thrown upon the ancient process of production. In almost every instance these tiles were covered with a yellowish glaze, composed principally of lead, similar to that now used in the commoner English earthenware manufactures.

The modern revival of the art dates from the year 1830, when a patent was granted, with this object, to Samuel Wright, a potter of Shelton, in Staffordshire; but, he having failed to bring his experiments to a profitable result at the expiration of the term, a further extension for seven years was granted him. In the year 1844 his patent right was purchased, in equal shares, by the celebrated china manufacturer Herbert Minton and Mr Fleming St John, the former carrying on the manufacture at Stoke-upon-Trent, and the latter at Worcester, in partnership with Mr George Barr, an eminent china manufacturer of that city. Four years later, the firm of which Mr Minton was the head re-purchased the residue of Mr St John's share of the patent right, who about the same time relinquished the manufacture. In the year 1850 Messrs Maw & Co. purchased the remaining stock of encaustic tiles at the Worcester china works, and, on the expiration of Mr Wright's patent, commenced the manufacture on those premises, from which they removed to the present site of their works, at Benthall, near Broseley, Shropshire, whence the marls, peculiarly suitable for the purpose, had previously been obtained.

The modern manufacture may be described under two heads—viz., the "plastic" and the "semi-dry" or "dust" processes. The former, which was the only one employed up to the year 1863, is in every essential point the same as that used in mediæval times, differing merely in the greater finish and perfection which modern appliances have effected, and probably also in the material of the moulds. It is not known of what those anciently used were made, but conjecture has suggested wood, fired clay, and stone.

The great difficulty of the manufacture consists in the necessity for introducing into a single tile the variety of different coloured clays or "bodies" which together compose the design, it being essential that they should not

only be perfected by the same amount of heat in the process of firing, but that they should possess an equal contractile power during each stage of the manufacture.

The tile is first impressed from a plaster-of-Paris mould, bearing the pattern in relief, and set in a brass frame, upon which fits another frame, the dimensions and depth of which correspond with the size and thickness of the tile; the pattern is thus sunk in the clay to a depth of about one-sixteenth of an inch, in the following manner. The workman first introduces into the mould what may be described as a sheet of refined clay of the desired colour for the ground of the pattern; upon this facing, which forms a kind of veneer, is placed a thicker mass of a coarser kind of clay, and the whole is then subjected to screw pressure, which consolidates the two kinds of clays, and at the same time perfectly impresses the pattern of the mould; the superfluous clay is then removed with a scraper, and a second veneering of fine clay, similar to that used for the face, is placed on the back; the tile being removed from the mould, the depressed parts of the design are filled with clay, of one or more colours, by pouring it in in a "slip" or semi-liquid state. The tile is then set aside for twenty-four hours to stiffen, and when the "slip" inlay has become nearly of the same consistency as the tile itself, the face is brought roughly to an even surface, by "spreading" the soft clay with a pallet-knife. The tile is then further allowed to dry till it attains the stiffness of wax, when it is "finished" by scraping the face with a steel scraper, until the inlaid pattern and ground are developed free from superfluous clay, and the edges are cut true to a square, when it is ready for the drying stove. When the drying, which takes from six to ten days, is completed, the tiles are placed in fire-clay boxes, known as "saggers," containing from eight to ten each, which are then stacked, one upon another, in the kiln or oven. The process of firing occupies four days and nights, and has to be conducted with the greatest care, as not only the exact size and hardness of the tiles are dependent upon it, but also the perfection of the colours, with which object it is necessary to raise the heat very gradually, and to secure a regular circulation of air in the oven, so as to produce the exact degree of oxidization needed to bring out the desired colours in the materials used for this purpose. The pyrometers used in this part of the process consist of long narrow tiles, and the degree of heat is judged both by their colour and the gradual reduction in length which they undergo, each piece, as it is withdrawn from the oven, being measured in a gauge, with this object,—the total shrinkage of the tile, in the drying and firing, amounting to about 1½ inches in the foot. For purposes of paving, most of the modern encaustic tiles are used in the "bisque" or unglazed state, the glaze in the ancient tiles having apparently been employed with the object of covering the soft material of the tile itself, and of adding richness to the colour. Where glazing is found necessary in the modern tiles it is effected by dipping them in a combination of lead, alkaline salts, felspar, and silica, finely levigated in water, which is fused by passing them through a kiln specially constructed for the purpose.

The semi-dry or "dust" process of manufacturing encaustic tiles is an adaptation of an invention patented in the year 1840 by Richard Prosser, by which articles of various kinds are moulded out of pulverized clay, in metal dies, by screw pressure. In the year 1863 Messrs Boulton and Worthington, engineers of Burslem, patented a process by which the use of powdered clay (hitherto only used for tiles of one colour) was applied to the manufacture of encaustic tiles. The design is formed by perforated brass plates,—from one to six or seven being used, according to

the nature of the pattern. Where the whole design can be perforated in the plate without detaching such parts as would represent the ground, only one plate is needed; but where there are several concentric rings or similar forms, additional plates are required. Into the perforations of each plate metal rams, attached to a flat plate of iron, are accurately fitted. The metal die in which the tiles are pressed is composed of a thick block and a square frame or "box;" the latter is connected with levers and a balance-weight, so that it can be raised or depressed, either forming a hollow mould, of which the face of the block above mentioned forms the bottom, or depressed in such a way as to leave the face of the block standing above it, in which latter position it is ready for the commencement of the process. The perforated plates first mentioned are then, in succession, placed upon the face of the block, being kept in position by two pins fixed to the frame of the die, corresponding with holes made in their margin. The perforations of the brass plate being filled with powdered clay of the desired colour, this is so far compressed, by means of the metal ram, as to allow both the ram and the plate to be removed together, leaving the compressed dust (representing the pattern of the tile in relief) on the block or face plate. In cases where a number of plates are necessary, the pattern is thus built up, each adding such a part as can be perforated in a single plate. The frame is then raised, so as to form a mould of the required depth, which being filled with powdered clay, intended to form both the ground of the pattern and the substance of the tile, the whole mould or die is slid, in a groove provided for the purpose, under the screw press, to which is attached a plate covering the mould, and resting on the top of the movable frame; this, on pressure being applied, forces down the frame until the powdered clay is thoroughly consolidated and incorporated with that part forming the design. On the pressure being relieved, the die is drawn from beneath the press, the frame is forced down by means of the levers to which it is attached, and the tile is left resting, face downwards, on the block, when it is ready for the drying-stove, the subsequent treatment being the same as in the plastic process. This process affords the advantage of much greater rapidity in execution than can be effected by the plastic method, and as the tile undergoes little or no shrinkage in the desiccation of the small amount of moisture which is needed to make the particles of the dust combine under pressure, the risk of distortion in the process of drying is reduced to a minimum, but the heavy prime cost of the perforated brass plates necessarily confines this otherwise valuable invention to such designs as are most largely in demand.

The modern application of encaustic tiles is by no means confined to the ecclesiastical purposes for which they were mainly used in mediæval times, although for this purpose many of the ancient designs have been reproduced, and the rough execution of the old examples has been imitated with striking fidelity. Some of the most eminent architects of recent years have exercised their skill in the production of designs more suitable for domestic purposes; and pavements of these tiles, combined with other kindred manufactures (for which see MOSAICS and TILES), have become an almost universal part of the permanent decoration of the better class of public and private buildings, for which purpose they are also largely exported to the colonies and foreign countries, superseding the perishable forms of flooring, and at the same time rendering unnecessary any decorative coverings. (A. M.)

ENCHASING, or CHASING, is the art of producing figures and ornamental patterns, either raised or indented, on metallic surfaces by means of steel tools or punches. It is practised extensively for the ornamentation of gold and

silversmith work, electro-plate, and similar objects, being employed to produce bold flutings and bosses, and in another manner utilized for imitating engraved surfaces. The chaser first outlines the pattern on the surface he is to ornament, after which, if the work involves bold or high embossments, these are blocked out by a process termed "snarling." The snarling iron is a long iron tool turned up at the end, and made so that when securely fastened in a vice the upturned end can reach and press against any portion of the interior of the vase or other object to be chased. The part to be raised being held firmly against the upturned point of the snarling iron, the workman gives the shoulder or opposite end of the iron a sharp blow, which causes the point applied to the work to give it a percussive stroke, and thus throw up the surface of the metal held against the tool. When the blocking out from the interior is finished, or when no such embossing is required, the object to be chased is filled with molten pitch, which is allowed to harden. It is then fastened to a sandbag, and with hammer and a multitude of small punches of different outline the whole details of the pattern, lined, smooth, or "matt," are worked out. Embossing and stamping from steel dies and rolled ornaments are now taking the place of chased ornamentations in the cheaper kinds of plated work.

ENCINA or ENZINA, JUAN DEL, the founder of the Spanish drama, was born in 1468 or 1469, either in the city of Salamanca or more probably in the neighbouring village of Encinas. After studying at the university of Salamanca under the patronage of the chancellor Don Gutierre de Toledo, brother of Don Garcia, count of Alva, he proceeded to Madrid, and became, when about twenty-five years of age, a member of the household of Don Fadrique de Toledo and Dona Isabel Pimental, the first duke and duchess of Alva. In or about the year 1492—the year, that is, in which Columbus added the new world to the dominions of Spain—the poet began to entertain his patrons by the representation of comedies of his own composition, in which he sometimes played the part of the *Gracioso*, or buffoon. In 1496, under the title of *Cancionero*, he published a collection of nine dramatic and numerous lyrical poems, divided into four parts, dedicated respectively to their Catholic majesties, to the prince Don Juan, to the dukes of Alva, and to Don Garcia de Toledo. Some years afterwards he went to Rome, joined the clerical order, attracted the attention of Leo X. by his skill in music, and was appointed his *maestro di capella*. Great praise was bestowed by his contemporaries on a farce, *Placida e Victoriano*, published by him in 1514; but of the justness of their criticism we have no means of judging, since, owing in all probability to its insertion in the *Index Expurgatorius*, all copies of it have perished. In 1519 the poet went to Jerusalem in company with the marquis of Tarifa, Don Fadrique Enriquez Afan de Riberon; but he was again in Rome about the middle of 1520, and in the following year published his *Trabagia o Via Sacra de Hierusalem*, a versified account of his journey, which has since been several times reprinted along with the marquis's narrative (Rome, 1721; Madrid, 1786). Shortly afterwards he was appointed prior of Leon, and returned to Spain. His death took place at Salamanca in 1534, and he was buried in the cathedral of that city. His *Cancionero*, which was reprinted five times in the course of the 16th century (Seville, 1501; Burgos, 1503; Salamanca, 1509, in company with the coplas of Zambardo; Saragossa, 1512 and 1516), is preceded by a prose treatise, among the first of its kind, on the condition of the poetic art in Spain. The dramatic poems, of interest mainly as marking the transition from the purely ecclesiastical to the secular stage, comprise "mysteries," as *The Passion of Our Precious*

Redeemer, The most Sacred Resurrection of Christ, and pastoral plays (Eglogas), as The Knight turned Shepherd, The Shepherds become Courtiers, The Triumph of Love. Seven of the number are reprinted in Bohl de Faber, *Teatro español*, Hamburg, 1832. After the author's death there appeared in 1556 without rubric, *Documento e instrucción para las doncellas desposadas y recién casadas con una justa d' amores.* See Barrera, *Catálogo del Teatro antiguo español*.

ENCKE, JOHANN FRANZ (1791–1865), a celebrated astronomer, was born at Hamburg on the 23d September 1791. He received his early education from his father, who was a clergyman, and he afterwards studied at the university of Göttingen, devoting himself specially to astronomy under the instruction of Professor Gauss. In 1813–14 he served in the Hanseatic legion in the war with Napoleon, and in 1815 he became a lieutenant of artillery in the Prussian service. When peace was concluded he resumed his astronomical studies at Göttingen until 1817, when he was appointed by Lindenau the Saxon minister of state to a post in the Observatory of Seeberg, near Gotha. In 1822–3 he published at Gotha two volumes, entitled *Die Entfernung der Sonne*, in which the various observations of the transits of Venus in 1761 and 1769 were carefully reconsidered, and the calculations verified and corrected. One of the earliest subjects to which his attention was directed was the determination of the orbit of the comet observed by Pons at Marseilles in November 1818. He calculated the period of its recurrence at about three and a quarter years, and conjectured it to be the

same comet that had appeared in 1786, 1795, and 1805. Upon the data he possessed he was able to predict its re-appearance in 1822, and he stated also that it would probably be invisible in Europe. His prediction was almost exactly verified, the comet being observed in New South Wales on the 3d June 1822, and the time of its perihelion passage being within three hours of that which he had computed. From the elements supplied by this observation he was able to foretell more accurately its recurrences in 1825 and 1828, and after the latter of these he determined its exact orbit. After the observation of 1832 he determined the period of its revolution as 3.29 years, with a gradual acceleration which he ascribed to the existence of a resisting medium. The comet is known as Encke's comet. In 1825 Encke was appointed to succeed Bode as director of the Royal Observatory at Berlin, a situation which he filled with great ability until within a year of his death. In 1830 he became editor of the Berlin *Astronomisches Jahrbuch*, to which he contributed a large number of valuable papers. The observations taken under his direction at the Berlin Observatory were recorded and published in a series of volumes, of which the first appeared in 1840. Of his many other contributions to astronomical literature may be mentioned his new method for computing perturbations, his dissertation *De Formulæ Dioptricis* (1845), and his work on the relation of astronomy to the other sciences, which was published in 1846. Encke was one of the foreign members of the Royal Society of London, and in 1840 he was created a knight by the king of Prussia. He died at Spandau on September 2, 1865.

ENCYCLOPÆDIA

THE Greeks seem to have understood by encyclopædia (ἐγκυκλοπαιδεία, or ἐγκύκλιος παιδεία) instruction in the whole circle or complete system of learning—education in arts and sciences. Thus Pliny, in the preface to his *Natural History*, says that his book treated of all the subjects of the encyclopædia of the Greeks, "Jam omnia attingenda quæ Græci τῆς ἐγκυκλοπαιδείας vocant." Quintilian (*Inst. Orat.*, i. 10) directs that before boys are placed under the rhetorician they should be instructed in the other arts, "ut efficiatur orbis ille doctrinæ quam Græci ἐγκυκλοπαιδείαν vocant." Galen (*De victus ratione in morbis acutis*, c. 11) speaks of those who are not educated ἐν τῇ ἐγκυκλοπαιδείᾳ. In these passages of Pliny and Quintilian, however, from one or both of which the modern use of the word seems to have been taken, ἐγκύκλιος παιδεία is now read, and this seems to have been the usual expression. Vitruvius (lib. vi. præf.) calls the encyclos or ἐγκύκλιος παιδεία of the Greeks "doctrinarum omnium disciplina," instruction in all branches of learning. Strabo (lib. iv. cap. 10) speaks of philosophy καὶ τὴν ἄλλην παιδείαν ἐγκύκλιον. Tzetzes (*Chiliades*, xi. 527), quoting from Porphyry's *Lives of the Philosophers*, says that ἐγκύκλια μαθήματα was the circle of grammar, rhetoric, philosophy, and the four arts under it, arithmetic, music, geometry, and astronomy. Zonaras explains it as grammar, poetry, rhetoric, philosophy, mathematics, and simply every art and science (ἀπλῶς πᾶσα τέχνη καὶ ἐπιστήμη), because sophists go through them as through a circle. The idea seems to be a complete course of instruction in all parts of knowledge. An epic poem was called cyclic when it contained the whole mythology; and among physicians κύκλος θεραπεύειν, cyclo curare (Vegetius, *De Arte Veterinaria*, ii. 5, 6), meant a cure effected by a regular and prescribed course of diet and medicine (see Wower, *De Polymathia*, c. 24, § 14). The word encyclopædia was probably first used in English by Sir Thomas Elyot. "In an orator is required to be a

heape of all maner of lernyng : whiche of some is called the worlde of science, of other the circle of doctrine, whiche is in one worde of greke Encyclopædia."—*The Governour*, bk. i. chap. xiii. In his Latin dictionary, 1538, he explains "Encyclos et Encyclica, the cykle or course of all doctines," and "Encyclopædia, that lernynge whiche comprehendeth all lyberall science and studies." The term does not seem to have been used as the title of a book by the ancients or in the Middle Ages. The edition of the works of Joachimus Fortius Ringelbergius, printed at Basel in 1541, is called on the title-page *Lucubrations vel potius absolutissima κικλοπαιδεια*. Paulus Scalichius de Lika, an Hungarian count, wrote *Encyclopædia seu Orbis Disciplinarum Epistemon*, Basileæ, 1599, 4to. Alsted published in 1608 *Encyclopædia Cursus Philosophici*, which he afterwards expanded into his great work, first published in 1620, called without any limitation *Encyclopædia*, because it treats of everything that can be learned by man in this life. This is now the most usual sense in which the word encyclopædia is used—a book treating of all the various kinds of knowledge, and it has become in modern times the common title of such books. Cyclopædia was formerly sometimes used, but is now retained only in English, and is not merely without any appearance of classical authority, but is etymologically less definite, complete, and correct. For as Cyropædia means "the instruction of Cyrus," so cyclopædia may mean "instruction of a circle." Vossius says, "Cyclopædia is sometimes found, but the best writers say encyclopædia" (*De Vitiis Sermonis*, 1645, p. 402). Gesner says, "κύκλος est circulus, quæ figura est simplicissima et perfectissima simul: nam incipi potest ubicunque in illa et ubicunque coheret. Cyclopædia itaque significat omnem doctrinarum scientiam inter se coherere. Encyclopædia est institutio in illo circulo." (*Isagoge*, 1774, i. 40.) In a more restricted sense, encyclopædia means a system or classification of the various branches of

knowledge, a subject on which many books have been published, especially in Germany, as Schmid's *Allgemeine Encyclopædie und Methodologie der Wissenschaften*, Jena, 1810, 4to, 241 pages. In this sense the *Novum Organum* of Bacon has often been called an encyclopædia. But it is "a grammar only of the sciences: a cyclopædia is not a grammar, but a dictionary; and to confuse the meanings of grammar and dictionary is to lose the benefit of a distinction which it is fortunate that terms have been coined to convey" (*Quarterly Review*, cxiii. 354). Fortunius Licetus, an Italian physician, entitled several of his dissertations on Roman altars and other antiquities *encyclopædia* (as, for instance, *Encyclopædia ad Aram mysticam Nonarii*, Patavia, 1631, 4to), because in composing them he borrowed the aid of all the sciences. The *Encyclopædia Moralis* of Marcellinus de Pise, Paris, 1646, fol. 4 vols., is a series of sermons. Encyclopædia is often used to mean a book which is, or professes to be, a complete or very full collection or treatise relating to some particular subject, as Blaine's excellent work, *The Encyclopædia of Rural Sports*, London, 1852, 8vo; *The Encyclopædia of Wit*, London, 1803, 12mo; *The Vocal Encyclopædia*, London, 1807, 16mo, a collection of songs, catches, &c. The word is more frequently used for an alphabetical dictionary treating fully of some science or subject, as Murray, *Encyclopædia of Geography*, London, 1834, 8vo; Lefebvre Laboulaye, *Encyclopédie Technologique: Dictionnaire des Arts et Manufactures*, Paris, 1845–47, 8vo, 2 vols.; Holtzendorff, *Encyclopædie der Rechtswissenschaft*, Leipzig, 1870, &c., 8vo.

The most ancient encyclopædia extant is Pliny's *Natural History* in 37 books (including the preface) and 2493 chapters, which may be thus described generally:—book 1, preface; book 2, cosmography, astronomy, and meteorology; books 3 to 6, geography; books 7 to 11, zoology, including man, and the invention of the arts; books 12 to 19, botany; books 20 to 32, medicines, vegetable and animal remedies, medical authors, and magic; books 33 to 37, metals, fine arts, mineralogy, and mineral remedies. Pliny, who died 79 A.D., was not a naturalist, a physician, or an artist, and collected his work in his leisure intervals while engaged in public affairs. He says it contains 20,000 facts (too small a number by half, says Lemaire), collected from 2000 books by 100 authors. Hardouin has given a list of 464 authors quoted by him. His work was a very high authority in the Middle Ages, and 43 editions of it were printed before 1536.

Martianus Minseus Felix Capella, an African, wrote about 470, in mingled verse and prose, a sort of encyclopædia, which is important from having been regarded in the Middle Ages as a model storehouse of learning, and used in the schools, where the scholars had to learn the verses by heart, as a text-book of high class education in the arts. It is sometimes entitled *Satyra*, or *Satyricon*, but is usually known as *De Nuptiis Philologie et Mercurii*, though this title is sometimes confined to the first two books, a rather confused allegory ending with the apotheosis of Philologia and the celebration of her marriage in the milky way, where Apollo presents to her the seven liberal arts, who, in the succeeding seven books, describe their respective branches of knowledge, namely, grammar, dialectics (divided into metaphysics and logic), rhetoric, geometry (geography, with some single geometrical propositions), arithmetic (chiefly the properties of numbers), astronomy, and music (including poetry). The style is that of an African of the 5th century, full of grandiloquence, metaphors, and strange words. He seldom mentions his authorities, and sometimes quotes authors whom he does not at all seem to have read. His work was frequently copied in the Middle Ages by ignorant transcribers, and was eight times printed from

1499 to 1599. The best annotated edition is by Kopp, Frankfurt, 1836, 4to, and the most convenient and the best text is that of Eyssenstadt, Lipsiæ, 1866, 8vo.

Isidore, bishop of Seville from 600 to 630, wrote *Etymologiarum libri XX.* (often also entitled his *Origines*) at the request of his friend Braulio, bishop of Saragossa, who after Isidore's death divided the work into books, as it was left unfinished, and divided only into titles.

The tenth book is an alphabet of 625 Latin words, not belonging to his other subjects, with their explanations as known to him, and often with their etymologies, frequently very absurd. The other books contain 448 chapters, and are:—1, grammar (Latin); 2, rhetoric and dialectics; 3, the four mathematical disciplines—arithmetic, geometry, music, and astronomy; 4, medicine; 5, laws and times (chronology), with a short chronicle ending in 627; 6, ecclesiastical books and offices; 7, God, angels, and the orders of the faithful; 8, the church and sects; 9, languages, society, and relationships; 11, man and portents; 12, animals, in eight classes, namely, pecora et jumenta, beasts, small animals (including spiders, crickets, and ants), serpents, worms, fishes, birds, and small winged creatures, chiefly insects; 13, the world and its parts; 14, the earth and its parts, containing chapters on Asia, Europe, and Libya, that is, Africa; 15, buildings, fields, and their measures; 16, stones (of which one is echo) and metals; 17, de rebus rusticis; 18, war and games; 19, ships, buildings, and garments; 20, provisions, domestic and rustic instruments.

Isidore appears to have known Hebrew and Greek, and to have been familiar with the Latin classical poets, but he is a mere collector, and his derivations given all through the work are not unfrequently absurd, and, unless when very obvious, will not bear criticism. He seldom mentions his authorities except when he quotes the poets or historians. Yet his work was a great one for the time, and for many centuries was a much valued authority and a rich source of material for other works, and he had a high reputation for learning both in his own time and in subsequent ages. His *Etymologies* were often imitated, quoted, and copied. MSS. are very numerous: Antonio (whose editor, Bayer, saw nearly 40) says, "plures passimque reperuntur in bibliothecarum angulis." This work was printed nine times before 1529.

Herabanus Maurus, whose family name was Magnentius, was educated in the abbey of Fulda, ordained deacon in 802 ("Annales Francorum" in Bouquet, *Historiens de la France*, v. 66), sent to the school of St Martin of Tours then directed by Alcuin, where he seems to have learned Greek, and is said by Trithemius to have been taught Hebrew, Syriac, and Chaldee by Theophilus an Ephesian. In his *Commentaries on Joshua* (lib. ii. c. 5), he speaks of having resided at Sidon. He returned to Fulda and taught the school there. He became abbot of Fulda in 822, resigned in April 842, was ordained archbishop of Mayence 26th July 847, and died 4th February 856. He compiled an encyclopædia *De universo* (also called in some MSS. *De universali natura, De natura rerum, and De origine rerum*) in 22 books and 325 chapters. It is chiefly a re-arrangement of Isidore's *Etymologies*, omitting the first four books, half of the fifth, and the tenth (the seven liberal arts, law, medicine, and the alphabet of words), and copying the rest, beginning with the seventh book, verbally, though with great omissions, and adding (according to Ritter, *Geschichte der Philosophie*, vii. 193, from Alcuin, Augustine, or some other accessible source) the meanings given in the Bible to the subject matter of the chapter; while things not mentioned in Scripture, especially such as belong to classical antiquity, are omitted, so that his work seems to be formed of two alternating parts. His arrangement of beginning with God and the angels long prevailed in methodical encyclopædias. His last six books follow very closely the order of the last five of Isidore, from which they are taken. His omissions are characteristic of the diminished literary activity and more contracted knowledge of his time. His work was presented to Louis the German.