analogous to distearin or monostearin substantiated with certainty, bodies of these classes being either formed synthetically by reversing the reactions of saponification, or being produced by the partial saponification of substances analogous to tristearin.

Glycerin is also a product of certain kinds of fermentation, especially of the alcoholic fermentation of sugar; thus it is a constituent of many wines and other fermented liquors, being formed together with small quantities of various other substances by reactions subsidiary only to the main change taking place, and hence varying in their nature and extent with circumstances. According to Pasteur, about $\frac{1}{36}$th of the sugar transformed under ordinary conditions in the fermentation of grape juice and similar saccharine liquids into alcohol and other products becomes converted into glycerin. In certain natural fatty substances, *e.g.*, palm oil, it exists in the free state, so that it can be separated by washing with boiling water, which dissolves the glycerin but not the fatty glycerides; but how far its occurrence in this form is due to the breaking up of the glyceride by a spontaneous saponification is open to some question.

Properties.—In a state of purity glycerin is a viscid, colourless liquid of sp. gr. 1·264, possessing a somewhat mawkish sweet taste; when exposed to a high degree of cold for a long time it sometimes solidifies to a crystalline mass, which then melts at about 7° C. The crystals when once melted often do not resolidify again readily, even when in contact with the solid substance, although sometimes contact with a crystal of the solid at a temperature of about 0° suffices to produce solidification of the whole. This solidification of glycerin is, however, a very exceptional phenomenon, only occurring with extremely pure substance under certain conditions not thoroughly understood, and then only after long continued exposure to a low temperature, as during a cold winter. When containing a minute quantity of water glycerin never solidifies, and to this circumstance several of its useful applications are due. A weak aqueous solution, when chilled sufficiently, allows crystals of ice to form, the glycerin accumulating in the unfrozen portion as alcohol does when a mixture of spirit and water is partially frozen. When heated alone it partially volatilizes, but the greater part decomposes; by reducing the pressure to about $\frac{1}{12}$th of an atmosphere, it can, however, be readily distilled unchanged, boiling under a pressure of 50 millimetres of mercury at about 20° C. In an atmosphere of steam, also, it distils without decomposition under ordinary barometric pressure. In water and alcohol it dissolves readily in all proportions; in ether it is insoluble. Under certain conditions, such as prolonged contact with poor cheese and chalk at about 35° to 40° C., it can be made to ferment partially, becoming changed into alcohol; but under any circumstances, only a small fraction, almost a tenth, becomes thus transformed, the rest remaining unaltered. It possesses remarkable solvent powers on many substances, whence it is employed for numerous purposes in pharmacy and the arts. Its viscid character, and its non-liability to dry and harden by exposure to air, also fit it for various other uses, such as lubrication, &c., whilst its peculiar physical characters, enabling it to blend with either aqueous or oily matters under certain circumstances, render it a useful ingredient in a large number of products of varied kinds. Applied to the living skin (and similarly to untanned leather) it produces a remarkable softening effect, whence it is largely employed as a cosmetic, either by itself or in admixture with other substances. Taken internally it is alleged to be valuable as a substitute for cod-liver oil for phthisical patients, not possessing the disagreeable fishy flavour of that valuable food, and having a fattening tendency. When it is given in moderately small repeated doses to the lower animals, it does not appear to possess any marked injurious action peculiar to itself; when, however, large doses of glycerin are subcutaneously injected into dogs, amounting to from 8 to 10 grammes per kilogramme of animal operated on (0·8 to 1·0 per cent. of the weight of the dog, corresponding to from 1 lb to 1½ lb of glycerin for the weight of an average man), death ensues within twenty-four hours, accompanied by symptoms analogous to those of acute alcoholism (Dujardin, Beaumetz, and Audigé). Like sugar it possesses antiseptic qualities, so that meat, albumin, &c., immersed in it do not for long periods of time undergo putrefactive changes.

Manufacture.—The simplest modes of preparing glycerin in a state of purity are based on the saponification of fats, either by alkalies or analogous basic substances, or by superheated steam, and on the circumstance that, although glycerin cannot be distilled by itself under the ordinary pressure without decomposition, it can be readily volatilized in a current of superheated steam; in this way the glycerin formed is separated from the non-volatile substances present. It was by means of saponification of olive oil or lard with litharge (lead oxide), whereby a lead soap insoluble in water, or nearly so, is formed, together with glycerin, that the existence of glycerin was first demonstrated by Scheele, who obtained it as a bye-product in the formation of the "lead-plaster" of pharmacy made from lard and lead oxide. For a long time this was the only known method of preparing glycerin, the aqueous solution obtained being treated with sulphuretted hydrogen to remove any soluble lead compounds, filtered, and evaporated until almost all the water was driven off, leaving the glycerin behind as a syrupy fluid. By evaporating down the spent leys of the soapmaker (after the soap is separated therefrom by "salting out," and any excess of alkali neutralized with sulphuric acid), and treating the residue with alcohol, glycerin can also be obtained, the alcoholic solution of it thus formed being simply evaporated to drive off the alcohol; but this process is far too costly for ordinary purposes. An improvement on this method was patented in 1858 by H. Reynolds, the concentrated leys being passed into a vessel where they are met by a stream of superheated steam at about 200° C.; the glycerin then passes over with the aqueous vapour, whilst the inorganic salts present are left behind. In the manufacture of stearic acid for candle-making (see CANDLE) one of the older processes was the saponification of tallow with lime, forming an insoluble lime soap and an aqueous solution of impure glycerin, from which the pure substance can be readily obtained by distillation with superheated steam. Less pure products were formerly obtained by treating the crude solution with sulphuric acid to separate lime, boiling to remove small quantities of volatile acids, evaporation, and filtration through animal charcoal to decolorize; or by evaporating, dissolving out by alcohol, and purifying by treating with lead oxide, filtering to separate an insoluble lead compound formed, removing lead from this filtrate by sulphuretted hydrogen, filtering again, and evaporating to a syrup. In practice all these older methods have, however, been superseded by the process patented in 1854 by Wilson & Payne. This consists in heating the fatty matter to be saponified in an appropriate still to a temperature of 290° to 315° C. (550° to 600° Fahr.), and passing in heated steam in such a way that it rises up through the fatty matter in numerous streams; saponification is thus rapidly effected, and the liberated glycerin and fatty acids are volatilized and carried along with the steam to the condensing arrangement. If the temperature do not exceed 310° C. there is no fear of the glycerin being decomposed, whilst under suitable conditions even higher temperatures than this can be employed without causing its decomposition; but there is always a great liability to destruction of glycerin when the temperature of 310° is exceeded. This arises from the tendency of the glycerin to char on heating, and to split up into water and *acrolein* (acrylic aldehyde), thus:—

$$C_3H_8O_3 = 2H_2O + C_3H_4O.$$

When a series of chambers is used as the refrigerator, the compartments nearest the still are found to condense little but fatty acids, the water and glycerin chiefly accumulating in the more distant chambers, the last of which is usually open to the air at the end; so that there is no excess of pressure in the still and condensers; the fatty acids readily separate from the aqueous solutions of glycerin, which only requires concentration by evaporation to be fit for the market. Since the date of Wilson's patent various special forms of apparatus for effecting the transformation have been patented by Wright & Pouché, Gilbee, and others.

This method of saponification is, strictly, only an improvement on former processes invented for the purpose of decomposing the glycerides and obtaining the fatty acids without the use of alkalies, lime, &c.; in these older methods the extraction of glycerin was not an important feature, and they were frequently worked in such a way as to decompose the whole or greater part of the glycerin *pari passu* with its liberation. Thus, as far back as 1825, Chevreul and Gay-Lussac sketched out the idea of the process of saponification by superheated steam, and the method was actually carried out with certain modifications by various chemists and manufacturers. For example, in 1842, E. Price & Co. patented, in the name of Jones & Wilson, a process of the kind, which was largely worked for some years; in this, the fatty matter freed from extraneous impurities is mixed with 6 to 8 per cent. of strong sulphuric acid, and then heated in copper boilers to about 180° C., by superheated steam blown through the mass for about two hours; after which hotter steam at about 300° to 350° is blown through, when fatty acids distil, but little or no glycerin passes over unaltered, almost the whole being charred or decomposed, forming acrolein, &c. Here the saponification and destruction of glycerin are largely effected by the sulphuric acid, as well as by the steam itself. Price's process was suggested to the inventors by Tilghman's method, brought out early in 1854, which consisted in making an emulsion of melted fatty matter and water (or solution of alkali) by agitation, and then pumping it through a long coil of iron tubing kept at a temperature near that of melted lead under a pressure of about 2000 lb to the square inch. In this way complete saponification is effected, fatty acids and an aqueous solution of glycerin being obtained when water is used, and soap with more or less water and glycerin when alkaline liquor is employed. It is noticeable that in this process it is not necessary that the alkali should be caustic, as it must be for the ordinary process of soap-boiling; sodium and potassium carbonates answer just as well as their respective hydrates (caustic soda, caustic potash).

Derivatives.—Among the numerous derivatives obtainable from glycerin by appropriate chemical reactions, may be more particularly mentioned *nitro-glycerin*, which is, strictly speaking, improperly named, inasmuch as it does not belong to the class of true nitro-substitution derivatives, but is simply constituted like tristearin, the radical of nitric acid displacing the hydrogen of the OH groups. By treating glycerin with nitric acid (preferably by dropping pure glycerin into a mixture of nitric and sulphuric acids) the following reaction ensues, the glycerin becoming what would be systematically termed *trinitrin* or *glycerotrinitrin*:—

$$\begin{matrix}CH_2.OH\\CH.OH\\CH_2.OH\end{matrix} + 3NO_2OH = 3H_2O + \begin{matrix}CH_2.ONO_2\\CH.ONO_2\\CH_2.ONO_2\end{matrix}$$

By treating the resulting "nitro-glycerin" with caustic potash, saponification ensues, potassium nitrate being formed and glycerin reproduced precisely as when tristearin is similarly saponified. Two other important products obtainable from glycerin are *isopropyl iodide* and *allyl iodide*, each of which serves as the starting-point of a large series of chemical products, many of them of utility in the arts. These substances are manufactured by heating glycerin with hydriodic acid, and are formed in virtue of the reactions:—

Glycerin.						Isopropyl Iodide.
$C_3H_5(OH)_3$	+	3HI	=	$2I_2$	+ $3H_2O$	+ C_3H_7I
						Allyl Iodide.
$C_3H_5(OH)_3$	+	3HI	=	I_2	+ $3H_2O$	+ C_3H_5I

Again, glycerin is employed in the manufacture of *formic acid*, which is prepared most conveniently by heating together glycerin and oxalic acid. The splitting up of oxalic acid into carbon dioxide and formic acid, which takes place only to a minute extent when oxalic acid is heated alone (owing to the further decomposition of the formic acid), then ensues with but little formation of bye-products, and especially with but little loss of formic acid through further decomposition. This arises from the occurrence of a cycle of changes highly interesting from a chemical point of view, and consisting essentially in the continual formation of a body analogous to monostearin, and its continual breaking up into formic acid, which distils over, and glycerin, which acts over again on a fresh portion of oxalic acid.

Technical Uses.—Besides its use as a starting-point in the production of "nitro-glycerin" and other chemical products, glycerin is largely employed for a number of purposes in the arts, its application thereto being due to its peculiar physical properties. Thus its non-liability to freeze (when not absolutely anhydrous, which it practically never is when freely exposed to the air) and its non volatility at ordinary temperatures, combined with its power of always keeping fluid and not drying up and hardening, render it valuable as a lubricating agent for clockwork, watches, &c., as a substitute for water in wet gas-meters, and as an ingredient in cataplasms, plasters, modelling clay, pasty colouring matters, dyeing materials, moist colours for artists, and numerous other analogous substances which are required to be kept in a permanently soft condition. From its softening property when applied to the skin, it constitutes a chief ingredient in many toilet preparations, creams, and the like. Many of these indeed, sold under fancy names, are nothing but glycerin diluted with water or weak alcohol, or mixed with some oleaginous emulsion or paste, and variously scented. Its solvent power for numerous substances renders it valuable in pharmacy as an ingredient in numerous preparations. In some of these the glycerin acts not merely as a solvent but also as a preservative against decomposition, owing to its antiseptic qualities, which also led to its being employed to preserve untanned leather (especially during transit when exported, the hides being, moreover, kept soft and supple); to make solutions of gelatin, albumen, gum, paste, cements, &c., which will keep without decomposition; to preserve meat and other edibles; to mount anatomical preparations; to preserve vaccine lymph unchanged; and for many similar purposes. Its solvent power is also utilized in the production of various colouring fluids, where the colouring matter would not dissolve in water alone; thus aniline violet, the tinctorial constituents of madder, and various allied colouring matters dissolve in glycerin, forming liquids which remain coloured even when diluted with water, the colouring matters being either retained in suspension or dissolved by the glycerin present in the diluted fluid. It has been proposed to use glycerin as a medium for the extraction of the odoriferous principle of flowers, &c., and as a substitute for sugar in the manufacture of some sorts of tobacco, the aroma of which is liable to be deteriorated should fermentation of the saccharine matter set in. Certain kinds of copying inks are greatly improved by the substitution of glycerin, in part or entirely, for the sugar or honey usually added. In fine, the number of useful adaptations of glycerin as an ingredient in order to confer certain special properties is almost unlimited, and its use in these directions is increasing yearly.

Impurities.—For some of these purposes it is essential that the glycerin should be of considerable purity. The chief impurities liable to be present vary with the mode of preparation. Substances made by saponification of oils, &c., with oxide of lead or lime, are apt to retain more or less of the metallic compounds, whilst glycerin extracted from soap-leys may also contain mineral matters. Such impure substances are readily purified by distillation with steam or under greatly diminished pressure. Glycerin prepared by saponifying clarified tallow, &c., by superheated steam, rarely contains fatty acids; if not deprived of practically all the water with which it is mixed in the distillate first obtained, it is less viscid and has a lower density, so that the specific gravity forms a good test as to whether it contains much water or not. Occasionally glycerin is met with intentionally adulterated with sugar-syrup, gum, mineral matters, &c., but such falsifications are comparatively rare. They may be detected by the substance being not wholly soluble in alcohol, by its leaving a residue on ignition in air, by its precipitating a solution of basic lead acetate (after being dissolved in water), or by other special tests, according to the nature of the impurity sought for. Thus, whilst pure glycerin does not reduce alkaline copper solutions so as to precipitate cuprous oxide when boiled therewith, the precipitation is readily produced by certain kinds of sugar, either without any previous treatment (*e.g.*, glucose), or after boiling for a short time with water acidulated with a mineral acid such as sulphuric acid (*e.g.*, cane sugar). (C. R. A. W.)

GMELIN, JOHANN GEORG (1709–1755), a distinguished naturalist, son of the chemist of the same name, was born at Tübingen, June 12, 1709. Having taken his degree in medicine, he in 1727 repaired to St Petersburg, where in 1731 he was appointed professor of chemistry and natural history. In 1733, by order of the empress Anna, he joined Deslisle, G. F. Müller, and Behring in an expedition for the exploration of Siberia, which was penetrated as far as the Lena. He returned to St Petersburg in 1743. In 1749 he was chosen professor of botany and chemistry at Tübingen, where he died, May 20, 1755. Linnæus named a genus of plants *Gmelina* in his honour.

His chief works are *Flora Sibirica* (4 vols., St Petersburg, 1749–50), and *Reisen Durch Sibirien* (4 vols., St Petersburg, 1752).

GMELIN, LEOPOLD (1788–1853), a celebrated chemist, was born August 2, 1788, at Göttingen, in the university of which city his father, Johann Friedrich Gmelin, was professor of medicine. He studied medicine and chemistry at Göttingen, Tübingen, and Vienna, and in 1813 commenced lecturing on chemistry at Heidelberg, where in 1814 he was appointed extraordinary and in 1817 ordinary professor of medicine and chemistry; the latter office he held till 1850. He died at Heidelberg, April 13, 1853.

Gmelin's fame rests chiefly on his chemical dictionary, the *Handbuch der Chemie*, the first edition of which, in 2 vols., was published at Frankfort in 1817–19. The fourth edition (Heidelberg, 1843, &c.) was written by Gmelin himself as far as the end of vol. v., was continued by Drs List and Kraut and others, and completed by an eighth volume on physiological chemistry, the work of Pro-

fessors Lehmann and Rochleder. A revision of the *Handbuch* by Kraut, in two parts, has since appeared. Of the fourth edition an English translation by H. Watts was published by the Cavendish Society in 1848–59. Gmelin was the author also of *Versuch eines neuen chem. Mineralsystems* (Heidelberg, 1825), and of numerous scientific papers. With Tiedemann he wrote *Versuche über die Wege auf welchem Substanzen aus dem Magen und Darmkanale in das Blut gelangen* (Heidelberg, 1820), and *Die Verdauung* (2 vols., Heidelberg, 1826–27).

GMELIN, Samuel Gottlieb (1743–1774), an eminent naturalist, nephew of J. G. Gmelin (see above), was born at Tübingen, June 23, 1743. He graduated there as M.D. in 1763, went to St Petersburg in 1767, and in 1768, with Pallas, Güldenstädt, and Lapuchin, commenced a journey for the scientific exploration of the south-east possessions of Russia. Having visited in succession the western districts of the Don, the Persian provinces to the south and south-west of the Caspian Sea, the regions of the Volga, and the eastern borders of the Caspian, he in 1774 was on his way back to St Petersburg when he was seized as a hostage by Usmey Khan, of the Kaitak tribe, through whose ill-treatment he died on July 27th of the same year.

His principal works are *Historia Fucorum iconibus illustrata* (St Petersburg, 1768), and *Voyages dans differentes parties des l'Empire de Russie* (4 vols. 4to, St Petersburg, 1770–84).

GMÜND, a town of Würtemberg, circle of Jaxt, formerly a free imperial town, is situated in a charming and fruitful valley on the Rems, here spanned by a beautiful bridge, 31 miles E.N.E. of Stuttgart. It is surrounded by old walls, flanked with towers, and has a considerable number of ancient buildings, among which are the church of the Holy Cross; St John's church, which dates from the time of the Hohenstaufens; St Leonard's church, situated on a height near the town, partly hewn out of the rock and much frequented by pilgrims; the chapels of St Joseph and God's Rest; and the Dominican convent, founded in 1204, now a house of correction. Among the modern buildings are the gymnasium, the drawing and trade schools, the Roman Catholic seminary, the town hall, the royal deaf-mute and blind institute, the blind asylum, the lunatic asylum, and two hospitals. The industries include the manufacture of gold, silver, copper, bronze, and brass wares, silk and part-silk cloths, tobacco, wax, glue, leather, furniture, bone-dust, and lucifer matches. There is also considerable trade in corn, hops, and fruit. Population in 1875, 12,838.

Gmünd was surrounded by walls in the beginning of the 12th century by Duke Frederick the elder of Swabia. It received town rights from Frederick Barbarossa, and after the dying out of the Hohenstaufens became a free imperial town. In 1546 it was besieged and taken by the Protestants, and in 1793 it was burned by the Swedes. It retained its independence till 1803, when it came into the possession of Würtemberg. Gmünd is the birth-place of the painter Hans Baldung and of the architect Heinrich Arler. In the Middle Ages the population was about 10,000.

GNAT, a name (Anglo-Saxon, *gnæt*) properly applied to the members of the *Culicidæ* (a family of the insect order *Diptera*, division *Orthorrhapha*, subdivision *Nemâtocera*, section *Eucephala*), but sometimes also used for the *Chironomidæ*. The *Culicidæ* consist of about 150 known species, of the genera *Culex*, *Anopheles*, *Aedes*, *Psorophora*, *Corethra*, &c.; they are distributed over the chief divisions of the world, and, in spite of their very feeble build, reach as far north as man has penetrated (having been found during Nares's recent Arctic expedition). As regards time, examples of a *Culex* and a *Corethra* have been discovered in the Tertiary beds of the Lower White River, Colorado. The *Culicidæ* are distinguished from their immediate allies, amongst other characters, by having the parts of the mouth produced into a slender porrected rostrum, nearly half the length of the insect, and composed of many distinct pieces (seven, according to Westwood, who remarks that the mouth in these delicate creatures is formed of the same number of pieces, and on the same plan, as that of the robust *Tabani*), and many-jointed palpi, very long and piloss in the male, in which sex the antennæ are plumose and 14-jointed. The fibrils of the antennæ are considered by Mayer as auditory organs. The usual special representative of the family is *Culex pipiens*, the common gnat, whose blood-sucking propensities have rendered it too well known. It pierces the skin with the needle-like lancets of its rostrum, which are barbed at the tips, and gradually inserts the whole of those organs, at the same time liquefying the blood by some fluid secretion, which apparently adds to the subsequent irritation. The female, recognizable by her more simple antennæ and palpi, alone attacks man, and, in default of her favourite food, will feed on the honey of flowers. This blood-sucking taste is shared by the allied *Simuliidæ*. The dreaded mosquito is nothing but a species of *Culex*, so closely allied to *C. pipiens* that it is difficult to say where "gnat" ends and "mosquito" begins, though the original mosquito is a native of Cuba. The curious humming noise (from which the name *pipiens* is fancifully derived) accompanying the flight of the gnat is caused by the extremely rapid motion of its wings, which have been calculated to vibrate 3000 times in a minute,—the great relative bulk of the thoracic muscles accounting materially for this. In connexion with the gnat's wing it may be observed that, though apparently clear, "battledore scales" have been discovered upon it by microscopists. The habit of gnats to associate in clouds has been frequently noticed, from the poet Spenser downwards; and instances are even on record of their gatherings round church-spires having caused alarms of fire, from being mistaken for smoke. This apparently arises from the extreme spontaneity and ease of the individuals in their evolutions, which are so rapidly conducted as to enable them to fly unwet in a shower of rain. It has been observed that many of these large gatherings are exclusively composed of females. The transformations of the gnat have often been chronicled, and by none in a more interesting way than Réaumur. The female deposits her eggs in a little raft or boat-like mass, upon the surface of water, using her hind-legs while packing them together; the larvæ hatched from them are very active, diving in a jerky manner quickly, and often coming to the surface to breathe, suspending themselves head downwards, and taking in atmospheric air through a spiracle in one of the large tubes into which the end of the body subdivides. The pupæ are also capable of active motion by means of paddles at the tail, and also suspend themselves under the surface for respiratory purposes, though not breathing as in the larva, but through two little tubes on the back of the thorax. When the perfect insect makes its appearance, the pupa-skin is used by it as a floating foothold until it is ready to take to flight. So short a time is occupied by the entire series of metamorphosis that many generations are perfected in one summer.

GNESEN (Polish, *Gniezno*), the chief town of a circle in the Prussian province of Posen, government of Bromberg, is situated on the Wrzesnia, 30 miles E.N.E. of Posen. Besides the cathedral, which contains the remains of St Adalbert, there are nine Roman Catholic churches, and there is also a Protestant church, a synagogue, a clerical seminary, and a convent of the Franciscan nuns. The industries are cloth and linen weaving and brandy making. A great horse and cattle market is held annually. The population in 1875 was 11,203, of whom about half are Poles.

Gnesen is said to be the oldest town in Poland, and was the capital of the kingdom till 1320. It was made the seat of an archbishop early in the 11th century. It is still the seat of the cathedral chapter, but the archbishop now resides at Posen.

GNOSTICISM, a general name applied to various forms of speculation in the early history of the church. The term γνῶσις is found in the Septuagint translation of the Old

Testament, and in the Apocryphal Book of Wisdom, denoting the knowledge of the true God, or knowledge communicated by Him. In the New Testament the word is frequently used by St Paul (1 Cor. i. 5, xii. 8; 2 Cor. iv. 6, x. 5), and in the second epistle of St Peter (i. 5, 6; iii. 18), to express the saving knowledge of God in Christ; and in the first epistle to Timothy occurs the significant phrase, "Oppositions of Science (γνώσεως) falsely so called." It may be inferred, therefore, that the use of the simple term, in a bad as well as a good sense, was not unknown to the apostolic age, although the expression γνωστικός (Gnostic) is said not to be found till the beginning of the 2d century, when it was first employed by the sect of the Ophites, or, according to some, by Carpocrates. Both expressions were used by the early Christian fathers with the double meaning already indicated. Clement of Alexandria, in his *Stromata* or *Miscellanies*, entitles the enlightened or perfect Christian a Gnostic (*Strom.* i. 20, ii. 6). He points out at length the distinction between the true Gnostic and the disciples of false systems who laid claim to the name of Gnostics. It is only to systems of the latter kind that the name of Gnosticism is now applied.

The sources of Gnosticism are to be found in diverse forms of religious and speculative culture antecedent to Christianity, especially in the theology of the Alexandrian Jews, as represented in the writings of Philo, and again in the influences flowing from the old Persian or Zarathustrian religion and the Buddhistic faiths of the East. To the theosophic system of Philo, with its mixture of Platonic and Old Testament ideas, some of the most characteristic conceptions of Gnosticism are certainly to be traced, such as the infinite separation between God and the world, and the necessity of a mediating power or powers in the creation of the world. This class of ideas prevailed largely at the time of the introduction of Christianity, especially in Alexandria, which was the great meeting-point of Jewish and Hellenic culture. The more the state of the pre-Christian Jewish mind and Jewish literature is investigated, the more do we recognize everywhere a strange commingling of old with new thoughts, of tradition with philosophy, of religion with speculation. The age was in all its aspects eclectic, and the Jewish no less than the Gentile schools of the time were centres for the fusion of old streams of culture from many quarters, and the rise of broader intellectual tendencies. Ever since the captivity, Judaism had borne more or less the impress of the old state religion which it encountered in its exile. How far post-Exilian Judaism was moulded by Zarathustrian conceptions is a very difficult question; but no historical student can doubt that its cosmogony, its angelology, and even its anthropology, were largely modified by contact with Persia. But not only was Zarathustrianism active in and through Judaism. In itself, it spread westward, and became directly and indirectly both a precursor and a parent of Gnostic speculation. Certain forms of Gnosticism seem little else than adaptations of the Persian dualism to the solution of the great problem of good and evil. In other forms of it, again, the Pantheism of India seems to have been a pervading influence. This, too, has its representative in the Jewish schools of the time, in the secret doctrines of the Kabbala, which many carry considerably beyond the time of Christ, although the two books through which we alone know these doctrines—the *Book of Creation* and the book called *Zohar* or *Light*—are plainly of much later production. These doctrines sprang up in Palestine, and not among the Hellenistic Jews. The philosophy on which they rest is plainly pantheistic. Whereas the principle lying at the foundation of the theosophy of Philo makes almost an absolute distinction between the Supreme indefinable Source of all things and the world, the philosophic postulate of the Kabbala is the identity of God and the world—the one being the Eternal Substance of which the other is the manifestation and form. "In place of the personal God, distinct from the world, acknowledged in the Old Testament, the Kabbala substitutes the idea of an universal and infinite substance, always active, always thinking, and in the process of thought, developing the universe. In the place of a material world distinct from God and created from nothing, the Kabbalist substitutes the idea of two worlds—the one intelligible, the other sensible,—both being, not substances distinct from God, but forms under which the Divine Substance manifests itself" (Mansel's *Gnostic Heresies*, p. 35).

Gnosticism is found reproducing one and all of these conceptions, with the additional idea of *redemption* directly borrowed from Christianity. In all its forms, it may be said to represent the efforts made by the speculative spirit of the time to appropriate Christianity, and to make use of some of its most fertile principles for the solution of the mysteries lying at the root of human speculation. The more advanced writers of the present day refuse to recognize Gnosticism as a *heresy*, or to speak of the Gnostics as deserters from the Christian Church. And they are right so far. The Gnostic schools were always so far outside the church. They were not *heretical*, therefore, in the ordinary sense. But it is no less true that Gnosticism, in all its developments, is only intelligible in connexion with Christianity. It was the impulse of Christian ideas which alone originated it, which constituted the vital force of thought that made it one of the most significant phenomena of early Christian history; and it is only its connexion with Christianity which can be said to make it any longer interesting.

The question as to the date of its origin has been much investigated of late by such writers as the late Dean Mansel among ourselves, and Lipsius, Harnack, and Hilgenfeld in Germany. Do we find traces of it in the New Testament writings? or are the supposed allusions to it there to be otherwise explained? It is well known that this question has an important bearing upon other questions as to the origin of some of the New Testament writings, and the special object for which these writings were composed. Without entering into details, or attempting to examine the several passages which may be supposed to contain allusions to Gnosticism in the New Testament, it may be said that such allusions, more or less definite, seem to occur in the later epistles of St Paul, especially the epistles to the Ephesians and Colossians, and in the Pastoral epistles. A supposed allusion has also been traced in the first epistle to the Corinthians, where the word γνῶσις, for the first time in the New Testament writings, is found in a depreciatory sense, in the phrase ἡ γνῶσις φυσιοῖ, ἡ δὲ ἀγάπη οἰκοδομεῖ (1 Cor. viii. 1). In so very general a use of the expression, however, even in its connexion with the question of eating meats which had been offered to idols, it must be held very doubtful whether anything more than a general meaning is intended. And the same remark applies to many even of the more defined modes of expression, such as *Pleroma* and *Æon*, which occur in the later epistles. The true explanation of all these phrases, as well as much else in St Paul's writings, is probably the fact that the spirit of Gnosticism, and the language which it afterwards developed and applied, were "in the air" of the apostolic age. Its modes of thought, as already seen, were prevalent in Philo and in other quarters, and the tendencies which were afterwards worked up into systems were no doubt in existence in the time of St Paul, and still more in the later apostolic time. It seems plainly against such tendencies, rather than against any special sects or schools, that the cautions of St Paul are directed. In the Apocalypse, and in the epistles and gospel attributed to St John, these tendencies are seen in a