ether or chloroform to prevent tetanus of the respiratory muscles, which is the most frequent and dangerous cause of death. After the first grave and imminent danger has passed, chloral can be given. If respiration stops, artificial respiration must be resorted to."

DOSE.—Internally 0.02 to 0.05 gm. several times a day may be considered a safe dose, and even 0.1 gm. may be given. For hypodermic use in operations it is advisable to keep under the 0.05 gm. limit. Weak solutions of one per cent. and two per cent. should be used, well distributed over the field of operation. For spraying (nose, throat) weak solutions (two per cent.) should be used in known quantity. For operations in nose, pharynx, and larynx, brushing with strong solutions cannot be avoided, but in these cases the danger is obviously less because the quantities used are small. Careful watching of the patient and gradual administration in all cases will increase the safety of continued administration.

COCAINE HABIT.—Most subjects of the cocaine habit are victims of the opium habit who have taken cocaine for the purpose of curing themselves, have not succeeded in their efforts, and have consequently become addicted to both drugs. It is therefore not easy to state the symptoms of the cocaine habit pure and simple. Luff (London *Lancet*, September, 1889) tells of a man who used 0.25 gm. daily during three years for nasal catarrh, and who in consequence was very much reduced physically, mentally, and morally. He became unsociable, incapable of attending to his business, because unable to come to any decision. Palpitations of the heart and obstinate constipation were also among the symptoms from which he suffered. Bauer (New York *Medical Record*, November, 1885) tells of a man who replaced the use of alcohol by daily injection of 0.67 gm. cocaine. He became very weak, lost all appetite, had attacks of delirium, and ultimately fell into complete physical and mental decay.

From all observation it appears that rapid falling off in flesh is one of the most prominent somatic symptoms of the cocaine habit. Erlenmeyer (*Deutsche med. Zeitung*, 1886, p. 483) reports a falling off of twenty to thirty per cent. within a few weeks, without diminution of food and with no existing catarrh of the stomach. He lays great stress on the respiratory and vaso-motor disturbances caused by the blood-vessel-paralyzing properties of cocaine: frequent pulse, relaxation of arterial system, profuse perspiration, syncope. The psychical symptoms are very marked and characteristic, and in well-developed cases offer the clinical picture of hallucinatory paranoia. They consist, according to Obersteiner, chiefly of feelings of fright caused by hallucinations, especially in the visual and sensory spheres. Either terrible apparitions are seen or great hordes of small animals. These latter hallucinations are most likely based on itching paræsthesias of the skin, giving to the patient the impression of the presence of insects or worms under the skin and causing him to scratch. There exists an interesting observation of Ehrlich's, in his experiments with mice above mentioned, which closely recalls these paræsthesias and hallucinations based upon them. One of his mice, after three weeks' use of cocaine, began to gnaw its limb, so that in the course of the next few days the whole right thigh down to the knee was entirely denuded. Ehrlich's explanation of this remarkable fact is that paræsthesias due to degeneration of the peripheral nerves provoke the gnawing, while the simultaneous anæsthesia of the skin leaves the latter without the protection of sensation.

While some writers deny the existence of symptoms due to withdrawal of cocaine in cases of well-formed habit, others, like Obersteiner and Erlenmeyer, affirm the contrary. According to Obersteiner they frequently appear only after the lapse of a fortnight and consist of sudden collapse and a feeling of impending death. Erlenmeyer emphasizes the vaso-motor disturbances as palpitation, weakness of the heart, dyspnœa, syncope, depression of humor, enormous weakening of the will power. According to all writers the prognosis of the cocaine habit is not a good one, as patients very readily relapse. It is reported that the habitual use of cocaine among the negroes in our Southern States is deplorably common, and that, no adequate restrictive measures upon its sale being in force, it is on the rapid increase.*

Carl Koller.

COCCIDIA. See *Protozoa*.

COCCULUS INDICUS. (TOXICOLOGICAL.)—Cocculus indicus is the dried fruit of *Anamirta paniculata* or *Menispermum cocculus*, order *Menispermaceæ*. It is a climbing plant indigenous to Asia, India, and the neighboring islands. This fruit or berry is also known as Coccus indicus, cocculus, Indian berry, Indian cockle, fish berry, fisher's berry, and Levant nut. The berry is shaped somewhat like a kidney, and is about the size of a small marble. It consists of a light yellow seed of excessive bitterness, covered with a woody shell. The external coat is of a dark-brownish color. This fruit has been used to adulterate beer and ale in order to make them more bitter and inebriating. It is extremely poisonous to fish, and on this account has often been put into the water of fish ponds. It enters into the composition of various decoctions for killing vermin. Of late years the chief importance of this berry consists in its being the source of picrotoxin. The shell contains two inert principles: menispermin and paramenispermin. Picrotoxin ($C_{30}H_{34}O_{13}$), the active principle, was discovered in 1820 by Boullay. This drug may be prepared by extracting the berries with boiling alcohol. The crystals are odorless but very bitter, neutral, and soluble in caustic ammonia; also in a large proportion of cold water, far more easily in hot water, and in thirteen parts of alcohol. There are no official preparations of Cocculus indicus except picrotoxin itself. The *antagonist* is chloral, which opposes its cerebral and spinal effects, although it has the same depressing power over the heart and respiration. Anæsthetics control the convulsions incident to the overdose of picrotoxin; and acetic acid also affords relief.

The *physiological action* of pictrotoxin is that of a cerebro-spinal stimulant, affecting particularly the centres in the medulla. It slows the action of the heart as well as respiration after having accelerated them transitorily.

*As Dr. Koller's connection with the employment of cocaine as a local anæsthetic has often been stated erroneously, I requested him to furnish me with a brief account of the actual facts, in order that I might publish it as an addendum to the main article on this drug. From the letter which I received from him in response to my request I quote the following:

"The events which led to the therapeutic use of the anæsthetic properties of cocaine were by no means accidental, as represented. On the contrary I had, one year before the summer of 1884 (the year in which my cocaine experiments were made), experimented with various substances (morphine, bromide, chloral, etc.), in order to find a local anæsthetic which I thought would be valuable in eye operations, as the general anæsthesia, with its sequels of vomiting, etc., is not desirable for these operations. I gave these experiments up as unsuccessful, but my mind was prepared to grasp an anæsthetic as soon as it presented itself. It happened that my friend, Sigmund Freud (Privatdocent of Neurology in the University of Vienna), was making experiments on the physiological action of cocaine, and he gave me some to take internally. I took it and felt the numbness of the tongue, and said to myself: Here is an anæsthetic. I went at once into Stricker's Laboratory, where I took a guinea-pig and made the experiments which established in my mind the usefulness of cocaine as a local anæsthetic. In less than two weeks the experiments were finished. I gave to Dr. Brettauer, of Trieste, a vial of the solution. He was travelling through Vienna to Heidelberg, to attend the meeting of the German Ophthalmological Society, and there he exhibited for the first time my experiments. That cocaine makes the tongue numb was nothing new, but could be found in every text-book on toxicology. That the anæsthesia of the eye cannot be discovered *accidentally* by a drop squirting into one's eye—which fanciful accident has been alleged as the cause of my so-called discovery—is best shown by the fact that another friend, who, upon the suggestion of Dr. Freud, tried the 'astringent' effect of cocaine in conjunctivitis and trachoma, and who did put it into his own and other people's eyes, failed to notice the anæsthesia. Physiologists had before me put it into the eyes and noted dilatation of the pupil, but had not grasped the idea of a local anæsthetic.

"After I had established, to my own satisfaction, the usefulness of cocaine in eye surgery, I induced Dr. Jellinek, a laryngologist of Vienna, to use it in the larynx. To what extent it was used, shortly or immediately after this, in other branches of medicine, is known.

"What I may justly claim for myself is, not that I introduced cocaine into eye surgery, but that I originated the idea of a local anæsthetic."—Editor of REFERENCE HANDBOOK.

The brain is not affected to any extent. Picrotoxin has a marked local action, stimulating all the secretions, especially those of the intestines. Röhrig noted uterine contractions. In over-doses its action is much like that of strychnine. It can be differentiated by the character of the spasm produced: that caused by picrotoxin is choreic, affecting chiefly the flexor muscles; that due to strychnine being tetanic, and affecting chiefly the extensors.

The *symptoms* are twitchings and inco-ordination of the muscles, increased reflexes, spasms, convulsions, delirium, stupor, coma, death from cardiac paralysis; glottic spasm, burning taste, pain in the throat and stomach, vomiting, and diarrhœa. The breath is very characteristic.

As to the *fatal dose*, according to Blyth, probably from two to three grains would be dangerous for an adult. The frog, which seems the most suitable animal for experimentation with this drug, shows an extreme abdominal swelling as a result of its ingestion. There are very few fatal cases of poisoning by picrotoxin in man on record. The absorption of this drug by the stomach and by the body surface is rapid. The method of its distribution in the tissues has not yet been clearly demonstrated. Neither is its excretion by the urine well understood, although the poison has been detected unchanged in this excretion.

The *post-mortem* changes offer very little which is characteristic. According to Kobert the brain and lungs are congested. The heart is flabby and the salivary glands are swollen. There may be signs of gastro-intestinal irritation and peritonitis.

Kobert gives the following method of separating picrotoxin from the organism: "The extracts from the organism, purified by means of neutral plumbic acetate and freed from lead, yield picrotoxin to amylic alcohol or chloroform. It will reduce alkaline cupric sulphate solution. Evaporated with concentrated HNO_3, then touched with concentrated H_2SO_4, and, finally, upon addition of NaOH solution, it turns brick-red. With H_2SO_4 alone, a saffron-yellow appears." When in aqueous acid solutions, picrotoxin can be extracted by chloroform, amyl alcohol, or ether. After evaporating the solvent the crude picrotoxin can be crystallized out of water and examined.

A *test* which may be applied is as follows: The suspected picrotoxin is dried and mixed with three times its amount of saltpetre. A little H_2SO_4 is added, after which the mixture is decomposed by an excess of soda lye, when there will appear a transitory brick-red color.

The *treatment* consists in the use of the stomach-pump or in the administration of emetics, *e.g.*, mustard, zinc sulphate, or apomorphine subcutaneously. Chloroform is valuable when convulsions take place. Amyl hydrate and paraldehyde are useful as antidotes. In order to allay tetanus, chloral, gr. x. to xx. every half hour, may be administered: the effects must be watched. Or, ʒi. of potassium bromide, or, in severe cases, ʒi. of the bromide with gr. xx. of chloral may be given.

Emma E. Walker.

CŒLIO-HYSTERECTOMY. See *Cæsarean Section*.

COCCYGODYNIA.—For this term, sometimes written coccydynia, medical nomenclature is indebted to Sir James Y. Simpson, who gave the name to a painful affection of the coccyx, or of the parts in intimate relation with that bone—claiming for the name the negative merit that it conveyed no erroneous impression concerning the pathology of the disorder.

It is probable that the term embraces several distinct diseases, some of which may be simply neuralgic; some, possibly, rheumatic; some only sympathetic; while others are certainly due to organic degeneration of the bony structure itself, or to fracture or dislocation of the bone.

As the name implies, it matters not what may be the morbid condition which gives rise to it, pain in the region of the coccyx is the symptom that calls into exercise the resources of the medical art.

The affection is more common in women than in men, and is most frequently encountered in women who have borne children, though it is by no means confined to them. It may continue indefinitely, if left to itself, and the pain is sometimes very severe.

The pain is provoked by pressure, by any movement of the bone, or by contractions of the muscles attached to the coccyx. Sitting, and especially rising from the sitting posture, ascending stairs, walking, defecation, and even micturition in some cases, occasion paroxysms of intense suffering.

The principal causes of coccygodynia are direct violence to the coccyx, injuries inflicted during parturition, the influence of cold, and uterine, ovarian, or rectal disease.

The *diagnosis* is not attended with difficulty. A thorough physical examination will always remove any obscurity and enable the surgeon to detect, by means of bimanual manipulation with one finger in the rectum, any displacement of the bone and to distinguish between this affection and painful hemorrhoids, anal fissure, foreign bodies within the rectum, or any other pelvic disorder with which the symptoms may be associated.

A favorable *prognosis* may always be given, unless the pain should be dependent upon some incurable disease elsewhere; otherwise, with proper treatment, complete relief can be promised.

The *treatment* should, of course, vary to meet the conditions that may be present. If, upon investigation, the affection is found to result from uterine, ovarian, or rectal disease, curative measures should be addressed to the primary disorder. In the absence of any such exciting cause, or of any displacement or appreciable disease of the bone, the remedies appropriate in the several forms of neuralgia may be resorted to with a fair prospect of success. Among the most potent of these are opium, quinine, arsenic, salicylate of sodium, blisters, and electricity, and such general medication and such management as the condition of the patient may require.

In the event of failure after a faithful trial of this plan, surgical interference should be confidently advised. Two procedures are available.

One consists in the isolation of the coccygeal bones from the surrounding tissues, by means of a tenotomy knife; the other, first practised by Dr. J. C. Nott, of Mobile, in the removal of the coccyx entire, or of the lower part of the bone.

A modification of the operation proposed by Dr. Nott was suggested a few years ago by Dr. Garretson. He exposes the bone by an incision through the skin, and by means of a "burr" attached to a dental engine, the bone is ground away to any desired extent, leaving the periosteum upon the anterior surface, with all of its attachments, intact.

In the great majority of cases, the thorough division of the muscular and tendinous structures surrounding the coccyx will suffice, though occasionally the extirpation or the enucleation of the bone, or a portion of it, will be found to be necessary to effect a permanent cure.

The complete excision of the bone is followed by no lasting inconvenience, and most surgeons would prefer to do the radical operation at once, rather than incur the risk of failure by doing only a little less, and thereby subject the patient to the ordeal of a second operation.

The operation is made by an incision over the coccyx. All attachments to the borders and to the apex are severed close to the bone by blunt scissors. The apex being thus freed, the bone is drawn strongly backward and attachments to the anterior surface are divided. Disarticulation from the sacrum is then accomplished and, after arrest of all hemorrhage, the wound is closed. On account of the depth and size of the cavity, accurate coaptation by tiers of catgut sutures is recommended.

In one case which has come to the attention of the writer—the case reported by Dr. Floyd W. McRae—relief was not obtained by the ablation of the coccyx entire, but was secured only by the subsequent removal of the sacral bursa and of Luschka's gland, both of which were enlarged.

James B. Baird.

COCHINEAL. COCCUS.—"The dried female of Coccus cacti L." (U. S. P.).

The cochineal insect is a native of Mexico and Central America, where it abounds as a parasite upon several genera of *Cacti*, especially the Opuntias. It is also found, probably native, in the West Indies. For commercial purposes, however, it has long been bred and raised upon *Nopalea Cochinillifer* (L.) Lyons, *Opuntia Tuña* (L.) Mill, and other species of Opuntia which are cultivated in plantations for the purpose. The pregnant females, about two hundred times as numerous as the males, placed upon them, deposit their numerous progeny, which feed and live upon the plants. These when fully grown (and pregnant) are collected, killed by heat, and dried. This insect, together with its foster plants, have been introduced into the West Indies, East Indies, Java, Southern Europe, and Africa.

Description.—The dried cochineal is described as follows: "About one-fifth of an inch (5 mm.) long; of a purplish-gray or purplish-black color; nearly hemispherical; somewhat oblong and angular in outline; flat or concave beneath; convex above; transversely wrinkled; easily pulverizable, yielding a dark-red powder. Odor, faint; taste, slightly bitterish. It contains a red coloring matter, soluble in water, alcohol, or water of ammonia; slightly soluble in ether, insoluble in fixed and volatile oils. On macerating cochineal in water the insect swells up, but no insoluble powder should be separated."

Cochineal, being an expensive article, is subject to much adulteration; crude foreign substance, like stones, starch, tapioca, etc., and insoluble and heavy earths caused to adhere, are easily detected. The most difficult to recognize is the substitution of partially exhausted, for fresh insects; this can be detected only by a sort of assay for the coloring powder left in them.

The wild *Cocci* are collected in Mexico and elsewhere to supply an inferior grade of cochineal. Besides, *Coccus Ilecis* Fabricius, Kermes is a larger species, living upon a species of oak (*Quercus coccifera* Linn.). It is collected and dried in Southeastern Europe, and has constituents similar to those of *C. Cacti*, but the color is inferior and less in quantity.

Composition.—Good Honduras cochineal contains, according to Hager, six per cent. of *moisture*, from fifteen to eighteen of *fat*, from forty to forty-five of *carminic acid*, from three and a half to five of *ash*, and from seven to eleven of insoluble residue. Of these the only one of use is the carminic acid or coloring matter, a brilliant red powder, soluble in water and alcohol, but insoluble in dilute acids. It is the basis of carmine, and the different pink, purple, and other beautiful *lakes* used in painting and dyeing.

Uses.—Like nearly everything else that can be in any way swallowed, this too has been used in medicine as "anodyne, tonic, astringent." It has no medicinal value whatever, and is wholly consumed at present in the manufacture of dyes and paints. In pharmacy and confectionery it is frequently used for its color.

W. P. Bolles.

COCILLANA.—The bark of *Guarea Rusbyi* (Britton) Rusby (fam. *Meliaceæ*), a good-sized tree. The writer, in 1886, found this bark in use among the Indians of Bolivia as an emetic and purgative, and recognized by them as a fatal poison in overdoses, the symptoms being those of poisoning by ipecac, though with rather more irritation of the intestine. Its medicinal action is also in general like that of ipecac. It contains a little tannin, two resins, and the alkaloid *Rusbyine* (*Eccles*). The two latter are active and overcome the effect of the tannin, producing a laxative effect. As an expectorant, cocillana acts within half an hour, stimulating the secretion of the bronchial mucous membrane and producing a free flow of mucus; this continues for some hours, and is followed by diminished activity of the glands. It has very little action on the skin. It has proved of greatest service in chronic and subacute bronchitis when the secretion is scanty and tenacious. In such cases, it liquefies the secretion and stimulates expectoration. The fluid extract, in doses of ηl x. to xx. every three or four hours, seems to have been the most serviceable means of securing its effects. In the early stages of acute inflammation it should not be given. In bronchorrhœa and in the aged, with profuse secretion, it is not advised, as it does not stimulate the respiratory organs, and might produce too free secretion within the tubes. In phthisis it has to be used with caution on account of its irritant action upon the digestive tract, and the danger of producing inflammatory foci in the lungs.

Henry H. Rusby.

COCOA BUTTER. See *Cacao, Butter of.*

COCONUT, OIL OF.—*Oleum Cocos.* The fat obtained from the albumen of the seed of *Cocos nucifera* (L.) (fam. *Palmaceæ*). This magnificent palm, a native, perhaps, of tropical Asia and many islands of the Pacific and Indian Oceans, is cultivated in all warm countries for its edible seeds and numerous useful products. Its well-known fruit and seed are among the largest in the world. Several methods are employed in separating the oil, and give rise to some diversity of appearance in the product. That obtained by cold expression is softer, and melts easier than the oils obtained by heat. These also vary according to the degree of heat and method used. Sometimes the pulp is simply warmed and then expressed as above, at other times the oil is boiled out as lard is in the country. The yield is about fifty per cent. The oil varies in consistence from that of hard lard or butter, to that of petroleum, in the summer, and melts between 60° and 80° F. It is greenish-white or creamy-white in color, and has a lard-like odor, with, in most specimens, a certain degree of rancidity. Taste, when fresh, not disagreeable. It is a rather complicated substance, and contains free and combined fatty acids, both fixed and volatile. Among the principal glycerides are those of *palmitic, caprylic, myristic,* and *lauric acids*, also those of *stearic* and *caprinic acids*, and others.

In the countries where it is produced, coconut oil is used for all the every-day uses of such fats—food, fuel, light, soap, etc. In temperate climates it is not likely to displace the olive, cotton-seed, almond, and many other oils like them, with which those countries abound. It is, however, abundant and cheap, and when good, not disagreeable—and well adapted to fill the place of lard and other animal fats in the preparation of ointments and cerates. It has been given as a substitute for cod-liver oil, but with no particular advantage. It is very largely used in soaps. A butter, to be distinguished from Cacao butter, is made from this oil which possesses the merit of enduring hot climates without becoming rancid, and this has been recommended for military and naval uses. Distinct tænicidal properties are recognized in the domestic uses of coconut oil, and large doses (ʒ ij. to iv.) have proven efficient in intractable cases of tapeworm.

Henry H. Rusby.

CODEINE, CODEINA.—($C_{17}H_{17}$ [OCH_3] [OH]NO + H_2O). This alkaloid, which is chemically *methyl morphine*, is obtained from opium to the average extent of about one-half of one per cent. Its solubility in water, about gr. vi. to the ounce, as well as in alcohol, is noteworthy. It is thus described in the Pharmacopœia:

"White, or nearly translucent, orthorhombic prisms, or octahedral crystals, odorless, having a faintly bitter taste, and slightly efflorescent in warm air.

"Soluble, at 15° C. (59° F.), in 80 parts of water and in 3 parts of alcohol. In boiling water codeine melts into oily drops which dissolve in 17 parts of the water. It is very soluble in boiling alcohol; also soluble in 30 parts of ether and in 2 parts of chloroform.

"At 100° C. (212° F.) codeine loses its water of crystallization (5.67 per cent.); at 155° C. (311° F.) it melts, forming a colorless liquid; and, when ignited, it is consumed without leaving a residue.

"Codeine is neutral to litmus paper.

"Codeine is dissolved by cold, concentrated sulphuric acid (free from nitrose) without producing a color.

"If about 2 c.c. of this solution be poured into a small porcelain capsule, and 1 drop of highly diluted nitric acid (made by adding 1 drop of nitric acid to 100 c.c. of water) added, a bluish or blue tint will be developed.

"Another portion of this solution, of about 2 c.c., gently warmed, and mixed with 1 drop of a mixture of 1 volume of ferric chloride T.S. and 19 volumes of water, likewise assumes a bluish or blue tint (difference from *morphine*).

"On adding to 5 c.c. of an aqueous solution of codeine (1 to 100) 10 drops of bromine water, and shaking so as to redissolve the precipitate formed, the liquid will gradually develop a light claret-red tint. This tint may be developed at once by the addition of ammonia water.

"On sprinkling 0.05 gm. of codeine upon 2 c.c. of nitric acid (specific gravity 1.200), the crystals will turn red, but the acid, even when warmed, will acquire only a yellow color (difference from and absence of *morphine*)."

Although no salt is official, salts with most of the acids ordinarily used for such purposes are in the market. All are soluble in very small amounts of water except the sulphate, which requires 40 parts and the hydrochlorate which requires 20 parts.

The properties are in general similar to those of morphine, but it cannot subdue pain. Light irritations, however, yield to it. It depresses the cerebral functions, and if there be not much pain or other preventive cause, induces sleep. This is followed by increased excitability. It therefore appears that, just opposite to morphine, its primary action is depressant, its secondary stimulant, a fact which is commonly true of methyl compounds as compared with the substances so combined. It thus follows that the secondary effects are secured more promptly and strongly with increase of dosage, and for an anodyne the dose must be kept down. The most common use of codeine is as a respiratory sedative. It does nothing to cure the condition but relieves the disturbance, reduces the cough and thus permits sleep. It will also reduce the amount of sugar in the urine. It has been used to favor recovery from the morphine habit. The dose is 0.03 to 0.1 gm. (gr. ss. to iss.). For hypodermic injection the dose is about half as great.

Henry H. Rusby.

COD-LIVER OIL.—Oleum Morrhuæ. *Oleum Jecoris Asellæ.* "A fixed oil expressed from the fresh livers of Gadus Morrhua L., and of other species of *Gadus*" (U. S. P.). The similar oils from the pollock, hake, and haddock have also been much used, but are not now officially recognized. The English and German Pharmacopœias unite in requiring the oil to be expressed without much heat. The United States does not limit the heat, but the requirements of the market here effectually exclude oils in any way injured in extraction. The British Pharmacopœia requires that the solid fat be filtered out at about 28° F.

The codfish is too well known to require description. It is very widely distributed and abundant, inhabiting the temperate and colder parts of both the Atlantic and the Pacific Ocean.

Cod-liver oil is prepared in several ways, according to the character of the fisheries and the use to which it is put. If the fishermen are far from shore, as on the Banks, where the boats remain out perhaps for several weeks, the livers are thrown, as the fish are cleaned, into barrels, where they lie until putrefaction begins, and the oil escaping from the decomposing cells rises to the top. This is then drawn off. Upon returning to the shore, the remaining pulp is boiled and the rest of the oil strained out. Such products are dark in color, offensive-smelling and unfit for medicine. The pale, sweet oils are made by fishermen who catch near shore, and every day or two land with their fish; they separate the oil at once from the fresh and clean livers. The common way is simply to scald the livers in water until the tissues become disintegrated, when the mass is strained through cloths, the water and oil finally separating from each other upon standing. The best method is to heat the livers in a vat or barrel by means of injected steam until they become softened, and then strain them and allow the oil to separate as above. Most of the fine oil used in this country is prepared in this way during the winter months, and then has also a portion of its stearin, etc., removed by freezing and expression. Some of our fine oil is manufactured on the New England coast; that of Europe, in Norway, Scotland, and England. The better grades of Norwegian oil are now very extensively imported for medicinal use here. The best is the Loffoten.

Cod-liver oil has had some reputation as a medicine for a century or more, but its extensive and most important use in phthisis is less than half as old.

The quality of oil suitable for dispensing is a pale yellow liquid of faint fishy odor, and a peculiar, at first not very marked, but finally disagreeable, slightly acrid taste. It does not dissolve in alcohol, but, like all fats, is readily soluble in ether. Its specific gravity is about .922. "If one drop of the oil be dissolved in twenty drops of chloroform, and the solution shaken with one drop of sulphuric acid, it will acquire a violet-red tint, rapidly changing to rose-red and brownish-yellow (U. S. P.). In addition to the above test, and others, a cultivated taste and smell are necessary to judge of the quality, or even genuineness, of the drug.

Composition.—Although a complex mixture, it is not known how far its value depends upon its complexity; certain it is that the modern clear and comparatively agreeable oils contain less of the unusual ingredients than the older ones, and that some of these ingredients, at least, were cadaveric products of decomposition of the livers, or empyreumatic decompositions brought about by the method of manufacture. These clear and light oils are more efficient as medicines, as they certainly are less disgusting, and can be taken by numerous persons who could not endure the others.

The very different action of cod-liver oil from that of other animal fats consisting of olein, palmitin, and stearin has recently been explained, by the announcement that its constituents are chiefly therapin and jecolein, fatty substances very different from those above named. On the other hand, assuming it to have the usual composition, the most extensive efforts have been made to discover in it something in the nature of an active constituent. Iodine, bromine, phosphorus, cholesterin, and bile acids have all in turn been credited with the peculiar properties of the oil, but these theories have been successively abandoned. Free acids are less in amount in the better oils, and the same is true of the several alkaloids which have been discovered, especially trimethylamine, aselline, and morrhuine. This question is of great importance, as it determines our ability or inability to secure the effects of the oil from extractive preparations. It may, however, be truthfully affirmed that this has not been found possible. The body of the oil must be assimilated in order to get its benefits, and the above theory as to its fatty substances being *sui generis* is the only one which presents elements of probability.

Action and Use.—This is the most readily absorbed and assimilated of oils. A loop of intestine containing it, compared with another containing another oil, is said to show an appreciable gain over the other in absorption. It is natural, therefore, that, added to other food, it should increase nutrition and the accumulation of fat. This quality is sufficient to explain its usefulness in the treatment of cases of simple emaciation, from bad nutrition, in chronic and wasting diseases, at the end of fevers, etc. So far, it can hardly be considered a medicine, but only a particularly useful form of non-nitrogenous food. It is emulsified and absorbed exactly as other oils are, and undoubtedly becomes in the same way a part of the bodily tissues. In this view, other oils should have the same effect according to their assimilability, and suitable doses of olive, linseed, and lard oils should be equally as good, and cream, from its state of emulsion, even better. Experience has not, however, con-

firmed their equality. The most important uses of cod-liver oil, moreover, are observed in a series of cases whose pathology is as obscure as the action of the remedy—such as the "scrofulous" diseases, whether glandular or ulcerative, chronic rheumatism, etc. It must in these cases act in some gentle and peculiar way upon the pathological processes, tending to return them to normal physiological ones, and in this respect is to be classed in the heterogeneous number of medicines called alteratives. Its uses have been mostly noticed in the preceding sentence but may be recapitulated a little more in detail. It is given, more than in any other disease, in phthisis pulmonalis. The long, wasting course of this complaint calls very distinctly for remedies that will prevent waste on the one hand, and promote nutrition on the other. Alcohol and cod-liver oil may be regarded as types of these two therapeutic agents, and experience has long ago shown them to be two of the most generally useful things that can be given. Neither is a specific, neither appears in the slightest degree to change the character of the poison lying at the root of the complaint, but both retard the loss of flesh and strength, each in its peculiar way. The oil is often given alone in the early stages of the disease, and generally with advantage, as alcohol in small doses more readily loses its effect. It is also frequently combined with malt extracts, the hypophosphites, iron, iodine, and other alteratives or aids to nutrition. Besides the general action, the oil has an undoubted favorable effect upon the chronic bronchitis and catarrhal pneumonia present, and it is therefore of value in the cough of consumption. It is also of great service in subacute and chronic idiopathic bronchitis ("colds in the chest"). In the persisting colds of infants and the aged, with a good deal of weakness, it has no equal. In chronic catarrh of various mucous membranes, ear, nose, vagina, urethra, etc., especially if attended with, or depending upon, debility, it is sometimes useful. In hip disease, and similar degenerations of other joints; in glandular abscesses, in chronic ulcers; in short, wherever there are waste, emaciation, and thinness of blood, it is to be tried. A peculiar method of its employment in the fisheries is in half-tumblerful doses, to break up an acute cold.

The great obstacles to the fullest use of cod-liver oil are its taste, which is so repugnant to many that they can scarcely take it, and its liability to disagree with the stomach, and either to produce nausea and vomiting, or, what is equally disastrous, to impair the appetite and so to more than undo all its possible benefit. The different methods of administration mentioned below sometimes overcome this, but most important is the exclusive use of the carefully prepared and nearly tasteless oils referred to above.

Administration.—The dose of the oil is from 12 to 30 c.c. (ʒ iij. ad ʒ i.) two or three times a day. If it can be taken clear it may be so given; the taste, even of the best, is somewhat repulsive, and becomes more so toward the last of the bottle in summer, as it rather easily becomes rancid. It is best, therefore, to purchase only a small quantity at a time, and to keep it as cool as possible. The taste may be disguised by means similar to those used with other oils (*e.g.*, *Castor Oil, q.v.*): rinsing the mouth thoroughly with whiskey, spirit of lemon, peppermint, or some such pungent vehicle; swallowing the oil at once, and again rinsing the mouth, is as good as any of the extemporaneous means used for this purpose. The liquor, if one prefers to do so, may be spit out. Large elastic capsules containing 6 or 8 gm. (ʒ i. to ij.) are made, but not much used, on account of their expensiveness. The following combination, when liquor is to be given with it, is a well-known favorite:

Cod-liver oil	50 parts.
Whiskey	35 "
Comp. tincture of lavender	15 "

It must be thoroughly shaken for every dose, as the oil immediately begins to separate. The lavender is added only as a flavor, and may be omitted. All oils appear to be less offensive to children than to adults.

Another method is to mix the oil with about an equal part of one of the syrupy malt extracts; the mixture does not separate so readily as the above. Its taste is well borne by children. Then there are the numerous emulsions made and advertised everywhere. They come under one of the following classes: First, mucilage emulsions, of which the following is an example:

Cod-liver oil	50 parts.
Oil of wintergreen	2 "
Mucilage of tragacanth	15 "
Water of orange flowers, sufficient to make	100 "

A little "knack" is required to make it well. The mucilage is the emulsifying agent, and the oil should be added to it very slowly, and *most thoroughly stirred until it is divided into invisible particles*, before the water is added. The oil of wintergreen is only a flavor, which may be varied to suit. This makes a good, permanent mixture of about the consistence and appearance of thick cream. Instead of tragacanth, mucilage of acacia, about twice the amount, or a decoction of Irish moss, may be used.

Second, egg emulsions: These are made like salad dressings, by using the yolk of egg as the suspending ingredient. The following is a good one:

Cod-liver oil	50 parts.
Oil of sassafras	3 "
Chloroform	2 "
Glycerite of yolk of egg	10 "
Rose water, enough to make	100 "

Here the oil and the egg must first be "emulsified," when the other ingredients may be added—the water last. This is a thinner liquid than the preceding.

The pancreatic emulsions are nominally made by emulsifying with pancreatin, and are theoretically the most perfect of all, but are practically attended with some difficulty; the ordinary "pancreatin" of the shops will not make a good result, and of those claimed to be so produced some are made by means of added alkalies, others by the fresh pancreas itself, and some do not even contain any cod-liver oil at all. Considerable care has to be exercised with all proprietary preparations, to see that the percentage of oil is not deficient, as the drawing out of the oil is a favorite method of rendering the preparation palatable. An ounce or two of perfectly sweet pancreas, chopped fine and mixed thoroughly with a gallon of oil, will, it is said, suffice, when the oil is filtered off and mixed with water, to emulsify it perfectly. Like the other emulsions, it can be flavored to taste. Iodine, iron, the hypophosphites, and other suitable additions can be made to all of them, but alcohol and tinctures are incompatible with the mucilaginous ones. If the patient would chew a bit of raw smoked herring before taking the oil, its taste would not be noticed.

The "wines," and similar preparations, of cod-liver oil, under whatever fanciful names, are utterly unreliable and are to be classed as unscientific.

Morrhuol is an alcoholic extract of the oil. Very little is yielded by fresh sweet oils, and the yield increases with the degree of putridity of the article. It is therefore to be regarded as essentially a putrefactive product, and whatever useful properties it may claim to possess, it need not be used for the effects of the oil.

Cod-liver oil is often given by inunction, with benefit, especially to marasmic babies. *W. P. Bolles.*

CŒLOM, COMPARATIVE DEVELOPMENT OF THE.—In all vertebrates the primitive intestine forms two sets of diverticula which are destined to become permanent tissues, (1) one toward the medullary groove which forms the chorda dorsalis, and (2) two lateral diverticula which form the body cavities. These latter are later on

subdivided into pleural, pericardial, peritoneal, and other cavities. A detailed description of the theory of the formation may be found in Balfour's work, in Hertwig's "Embryologie," and in Minot's "Human Embryology."

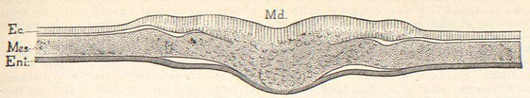

Fig. 1390.—Transverse Section through the Posterior Region of a Chick, with Six Pairs of Myotomes. (After Waldeyer, from Minot.) *Ec.*, ectoderm; *Mes.*, mesoderm; *Ent.*, entoderm; *Md.*, medullary groove.

When sections are made through very young embryos of higher vertebrates, just after the blastodermic membranes are well formed, a solid mesoderm is found, as shown in Fig. 1390. Although in lower vertebrates the mesoderm is produced by lateral diverticula from the entoderm, which are hollow from the beginning, in higher vertebrates the mesoderm is first laid down as a solid mass of cells. Soon the cells of the mesoderm on either side of the chorda divide into two layers, the somatopleure and the splanchnopleure (Fig. 1391, *Som.* and *Spl.*). From the two lateral cavities between these two layers the peritoneal cavity is formed.

The more accurate early formation of the pleuro-peritoneal cavity, in its relation to the other organs, we find carefully studied by Budge, who by means of injection followed it in the chick. With a fine hypodermic syringe he filled the various spaces of the cœlom as they appeared, thus showing very clearly the extent of this cavity in various embryos. The splanchnopleure, according to Budge, may be split into two layers, a dorsal or lymphatic and a ventral or vascular. As the first blood-vessels are formed, lymph vessels appear on their dorsal side, which flow together to form networks and accompany the primitive veins to the axial part of the germinal area. Here the lymphatics form two spaces, one on either side of the body, which are soon united by a bridge, or rather duct, on the ventral side of the heart. Therefore, in birds at least, the primitive pleuro-peritoneal cavity appears somewhat as an **H**, the uprights of which are on either side of the body, and the cross-piece on the oral side of the sinus venosus. In its further development the sinus venosus grows to the dorsal side of the cross piece, thus reversing the relation of the vascular system to the lymphatic, or rather cœlomic system. The uprights of the **H** fall to the outside of the body and are swallowed up in the formation of the amnion. Fig. 1392 is a cross-section from a chick at this stage, and shows that the greater portion of the cavity is now on the outside of the body. The cross-piece of the **H** is immediately on the ventral side of the heart, and forms the cavity of the pericardium by the heart growing into it. Its communication with the remaining cœlomic cavity is later on cut off in higher vertebrates, while in lower veretebrates it may remain open.

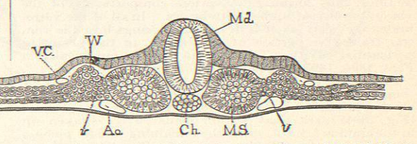

Fig. 1391.—Transverse Section of a Chick of the Second Day. (After Waldeyer, from Minot.) *Som.*, Somatic mesoderm; *Spl.*, splanchnic mesoderm; *Ec.*, ectoderm; *Ent.*, entoderm; *V.C.*, vein; *W.*, Wolffian duct; *Md.*, medullary canal; *Ao.*, aorta; *Ch.*, chorda; *M.S.*, myotome.

According to Budge two diverticula grow from the cross-piece, one on either side of the chorda, toward the tail of the body, and form the primitive pleuro-peritoneal cavities. Budge's paper was published from fragmentary notes after his death, and I am certain that the above statement is not correct. Professor His has placed before me Budge's specimens, which I think show conclusively that the interpretation of his injections is not correct. Most of his injections were made into the amniotic fold as the amnion was forming. Cross-sections of embryos show that on either side there is a large cavity (Fig. 1392, *Som.*) which communicates freely with the pleuro-peritoneal (*Coe*). Before the amnion is complete we have lateral cavities on either side of the body, communicating with each other only by means of the cross-piece on the ventral side of the heart. This is the freest portion of the communication, which also communicates most freely with the pleuro-peritoneal cavities.

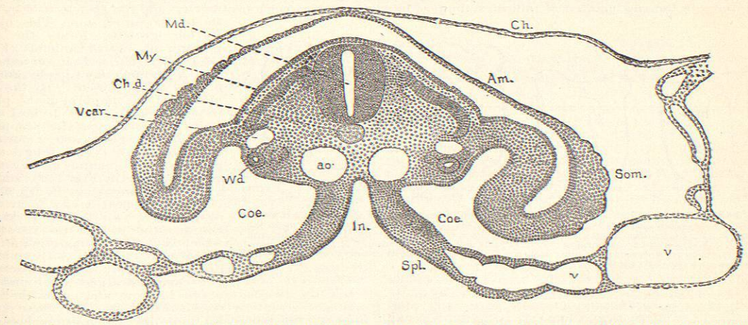

Fig. 1392.—Section through the Body of a Chick of the Third Day. (After Minot.) *Ch.*, Chorion; *Am.*, amnion; *Som.*, somatopleure; *v.*, blood-vessels; *Coe.*, cœlom; *Spl.*, splanchnopleure; *In.*, intestine; *ao.*, aorta; *Wd.*, Wolffian duct; *Vcar.*, vena cardinalis; *Ch.d.*, chorda dorsalis; *My.*, myotome; *Md.*, medullary canal.