while the weaker is strengthened, a point may be found where the two blend into a single mixed odor. In other cases, however, a point is found where there is no sensation, *i.e.*, the odors are perfectly compensated. An increase of either stimulus results in the sensation appropriate to it and there is no mixture whatever. The olfactory organ is easily fatigued, more so by some odors than by others, and it is found that when completely fatigued for one odor it may be insensible to some other odors, partially so to another group and wholly unaffected in its sensibility with reference to still another group.

Such experiments suggest points of departure for the study of olfactory qualities, and enough progress has already been made to suggest that the modalities of smell can be grouped into several graded series. The number of such groups will quite certainly be greater than those known for taste, where we have simply the four primary qualities, sweet, sour, salty, and bitter. Zwaardemaker's nine smell classes are as follows:

(1) Ethereal scents: Fruit odors.

(2) Aromatic scents: Camphor and spicy smells, anise, lavender, etc.

(3) Balsamic scents: Flower odors, vanilla, gum benzoin, etc.

(4) Ambrosiac scents: Amber, musk.

(5) Alliaceous scents: Garlic, ichthyol, vulcanized rubber, asafœtida, bromine, chlorine, etc.

(6) Empyreumatic scents: Toast, tobacco smoke, naphtha, etc.

(7) Valeric, or hircine scents: Cheese, sweat, etc.

(8) Narcotic, or virulent scents: Opium, cimicine, etc.

(9) Nauseous scents, or stenches: Decaying animal matter, fæces, etc.

The ability to discriminate different intensities of odors is not highly developed; in general, the least observable difference between two smell intensities of the same substance amounts to about one-third of the original stimulus. On the other hand, the olfactory organ is sensitive to exceedingly small amounts of the irritating substance, or as Ladd states it: "The sense has a great degree of 'sharpness,' or power to be excited by small quantities of stimulus, as distinguished from 'fineness,' or power to distinguish minute variations in the sensations." There are many familiar illustrations of this "sharpness." It is stated, for example, that in a litre of air 0.000005 gm. of musk can be perceived, 0.000001 gm. of sulphureted hydrogen and 0.000000005 gm. of oil of peppermint. The sense is more delicate if the air containing the odorous substance is warmed.

It is learned by suitable tests that the sensibility of the organ of smell is much more acute than the perception of odors. It was found in one series of tests, for example, that upon the average 9 parts of camphor dissolved in 100,000 parts of water could be sensed by the nose, but without the perception of a definite odor, it requiring a solution of more than four times this strength before the specific odor could be recognized. Experiments made to determine the relative sensitiveness of men and women in this respect have thus far yielded conflicting results. With children it has been found that the sensibility (in the sense used above) increases up to the age of six years and then progressively diminishes. The delicacy of perception, on the other hand, measured by graded solutions of camphor, increases progressively with advancing age.

One source of perplexity in the classification of odors is the fact that some substances which have powerful odors in a state of great dilution are less effective in a state of high concentration. For some perfumes there appears to be an optimum vapor density below or above which the excitation is less strong. It has also been suggested that for unknown phylogenetic reasons some odors may have greater affective values than others, or it may be that fatigue of the sense of smell is *cæteribus paribus* less for those odors which have an element of utility to the species.

It must not be forgotten that some odorous substances affect the terminals of the trigeminus nerve in the respiratory part of the nasal passages, giving rise to tactile or other general sensation which may be combined with the olfactory sensations. This can be proven by plugging the olfactory sinus, when the trigeminal stimulus alone is perceived. Classification is further impeded by the universal confusion of tastes and odors. We say a substance "smells sweet," when as a matter of fact experiment shows that the modality sweetness can be perceived only by the sense of taste; and conversely most of the tastes of common experience are greatly affected by odors simultaneously sensed.

In the majority of persons (Toulouse and Vaschide) the left side of the nose is more sensitive than the right. With most of the other senses, on the other hand, there is an asymmetry in one-fifth of the cases in favor of the right side (van Biervliet). The difference is explained by the fact that the left side of the brain is more highly developed (in right-handed persons) and that the central olfactory tract does not cross before reaching its cortical centres, while those for the other senses do cross.

The measurement of olfactory sensations cannot easily be done absolutely in terms of the strength of the stimulus, though examples of the results of some attempts at the measurement of the threshold for smell in absolute terms are given above. To arrive at a relative measurement of olfactory values there are two methods chiefly in use. According to the method of Passy a number of flasks of equal size are provided and into each is put a measured quantity of the odorous substance, the quantities being arranged in a graded series. The substance may be allowed merely to diffuse itself through the air within the flask (which must be kept stoppered when not in use), or it may be dissolved in water or some other inodorous medium. By the use of a sufficiently extensive series, threshold values of different odorous substances may be determined and various other researches carried out.

The method of Passy is very laborious and for most purposes, particularly in clinical work, the olfactometer of Zwaardemaker is more convenient. In its simplest form it consists of a glass tube, curved at one end for insertion in the nostril and bearing a scale (preferably in centimetres), which slides with easy friction into a slightly larger tube which is lined with the odorous substance to be tested. The inner tube passes through a screen near its curved end. Now, when the outer tube is slipped completely over the inner tube so that its odorous lining is wholly covered by the latter, air drawn into the nostril through the inner tube will carry no odorous particles. If, however, the outer tube is slowly slipped off from the inner tube, the air current will pass over more and more of the exposed surface of the odorous substance before entering the inner tube, until a point will be reached at which the substance is just perceivable to the sense of smell. In this way the normal threshold can be determined for various substances and numerous tests of physiological and pathological interest carried out.

This simple apparatus has been modified in various ways. A very simple instrument which has the advantage of relative permanence of adjustment can be constructed by using a section of ordinary red rubber tubing for the outer tube. This should be slipped inside of a larger glass tube to prevent the odor from escaping from the outer side of the rubber, and the odor given off from the inner surface of the rubber tubing will remain quite constant for many months. For other odors the outer cylinder may be made of porous earthenware, whose pores may be filled with a solution of the odorous substance. Commonly the olfactometer is made double with a separate cylinder and breathing tube for each nostril, and for the study of the compensation of odors Zwaardemaker has constructed a very elaborate apparatus with two separate cylinders (one for each of the odors to be employed) connected with a single breathing tube and so adjusted that the amount of odorous surface exposed in each tube may be easily varied during the

experiment. With the varying adjustments one odor or the other appears in consciousness alone until the proper compensation point is reached, when both odors vanish. The apparatus is provided with self-registering apparatus for recording on the kymograph the force of respiration in each cylinder and other data of the experiment.

The unit in all of these experiments is the "olfactie," or the stimulus necessary to produce the least perceivable sensation. The position on the scale of the olfactometer having been determined for this minimal value, this value is taken as the unit, or olfactie, and other stimuli are measured in multiples of this.

For the fuller consideration of the subject of this article, see the work by H. Zwaardemaker, "Die Physiologie des Geruchs" (Leipsic, 1895), and the article by the same author entitled, "Les sensations olfactives, leurs combinations et leurs compensations," in *L'Année Psychologique*, vol. v., 1899, pp. 202–225. A complete bibliography of the organ and sense of smell up to January, 1901, has been compiled by Bawden, in *The Journal of Comparative Neurology*, vol. xi., No. 1, April, 1901.

C. Judson Herrick.

OLIBANUM.—*Frankincense. Thus. Gummi, resina olibani.*—A gum resin obtained from *Boswellia Carterii* Birdw. and other species of *Boswellia* (fam. *Burseraceæ*).

Olibanum is collected in northeastern Africa, chiefly by the Somali natives, and is mostly exported viâ India. It is produced by small trees similar to those which yield myrrh, and is chiefly obtained from incisions made for the purpose. It exudes as a thick milky juice, hardening into the tears described below, which preserve their white color much longer than those of other similar substances.

Olibanum occurs in irregularly oval or subglobular tears, separate, or occasionally somewhat agglutinated in the poorer grades, usually 1.25 cm. (0.5 in.) or less in diameter, from almost pure white to yellowish-white, occasionally reddish-brown when long kept, the surface powdery; breaking readily with a nearly flat, waxy, lustrous surface, translucent in thin fragments; odor balsamic, slightly like turpentine; softening between the teeth, aromatic and somewhat bitter. Triturated with water, it forms a white emulsion and is almost wholly soluble in alcohol. When burned, it emits a very strong and pleasant odor, on account of which it is used as incense.

Olibanum consists principally of resin, usually from 60 to 70 per cent., or occasionally 75 per cent., with from 30 to 35 per cent. of gum and from 3 to 8 per cent. of volatile oil. Its bitter principle has not been examined. The volatile oil, which is an article of commerce for perfuming purposes, combines a slight lemon-like odor with that of the drug, and is of complex composition. The resin is divisible into two portions, namely, *Boswellic* or *Boswellinic acid* and *olibano-resin*. The gum is more like acacia than like tragacanth.

From a medicinal point of view, the uses of olibanum are quite unimportant. It is no longer official in any leading pharmacopœia and is but little used in professional medicine.

Owing to its fragrant properties, it is with some a favorite ingredient of plasters and ointments, and it is elsewhere used for odorizing purposes. It has mild counter-irritant and disinfectant properties, leading to its use as a vulnerary. Internally, it possesses the ordinary stimulating diuretic and expectorant properties of the oleoresins, and it also has a considerable use, especially among the laity, based chiefly on religious fancy, as an emmenagogue. The dose is from 1 to 3 gm. (gr. xv.–xlv.). It is used chiefly, perhaps, in the form of the emulsion, although the tincture is to be preferred.

Henry H. Rusby.

OLIGÆMIA.—A decrease in the total mass of the blood. The term is often used incorrectly as a synonym for anæmia. The latter term is used to indicate a deficient supply of blood to a part, or a deficiency in the total amount of blood within the body, or, most commonly, to designate a decrease in the number of the red cells or a diminution of the hæmoglobin. The expression *general anæmia* may, therefore, be regarded as expressing the same idea as that conveyed in oligæmia. The decrease in the total mass of blood may be due to a number of causes, and the following varieties may be distinguished:

Oligæmia Vera.—True oligæmia is due to a sudden loss of blood through hemorrhage. A loss of half of the total mass of the blood is invariably fatal, and hemorrhages of even less degree may cause death. The red cells may drop after a single large hemorrhage as low as two million. After such a loss of blood there is a rapid fall in blood pressure, the pulse becoming very small, frequent, and irregular. In cases of hemorrhage of slight degree, but continued through a long period of time, the deficiency is partly made up by an increase in the fluids of the blood, the true oligæmia becoming thus converted into a hydræmic oligæmia.

Oligæmia Hydræmica or Serosa.—An oligæmia with increase of water in the blood, the red cells and albumin being diminished, occurs after all hemorrhages, particularly in the case of oft-repeated or prolonged hemorrhages of slight degree, as in bleeding piles, excessive menstruation, etc., also in conditions characterized by loss of albumin, as in chronic nephritis, dysentery, chronic suppurations, prolonged lactation, tumor cachexias, scurvy, malaria, etc. The hydræmic condition of the blood leads to pathological changes in the blood-vessel walls, favoring the passage of fluids and the increased production of lymph (œdema). Hydræmia is, however, not the direct factor in the production of œdema, but only a favoring one.

Oligæmia Sicca (*Inspissatio Sanguinis, Anhydræmia*).—A thickening of the blood through loss of water may lead to a decrease of the total mass. Such a condition may occur in cholera, dysentery, severe diarrhœas, excessive sweating, insufficient supply of water, etc. The highest degree of oligæmia sicca occurs in Asiatic cholera. As a result of the circulatory disturbances thus produced, and an insufficient supply of blood to the nervous centres, the characteristic symptoms of severe anæmia may arise, although the total number of red cells and total amount of salts and albumin in the blood are not decreased. The thickened blood becomes tea-like, the blood serum is richer in albumin and in salts. The body tissues become very dry, and non-encapsulated serous exudates are resorbed.

Oligæmia Oligocythæmica.—A decrease in the total blood mass due to a diminution in the number of red cells (see *Oligocythæmia*).

Oligæmia Hypalbuminosa.—A decrease of the blood mass due to a decrease in the albumin of the blood. As a result of such loss of albumin the blood becomes more watery; the condition is therefore practically a form of oligæmia hydræmica. (See also *Blood, Anæmia*, etc.)

Aldred Scott Warthin.

OLIGOCHROMÆMIA.—A decrease in the amount of hæmoglobin in the blood. This is one of the commonest changes in the blood, and may occur either when the red cells are normal in number or in association with an oligocythæmia. A simple loss of hæmoglobin is the chief change in chlorosis and the secondary anæmias. In chlorosis the number of the red blood cells may be nearly normal, while the hæmoglobin may be greatly reduced, even to twenty or twenty-five per cent. or less. In the secondary anæmias the number of red cells is also diminished, but the hæmoglobin is reduced to a relatively greater extent; thus, for example, if the number of red cells be diminished to 2,500,000, the hæmoglobin is usually found to be lower than fifty per cent. The individual red cells are, therefore, deficient in hæmoglobin. This is shown microscopically by the presence of a central clear area in the red cell. This area may be of varying size and shape; in severe cases the hæmoglobin-containing portion of the cell may be reduced to a narrow ring, enclosing a clear and transparent central area. In very extreme cases some cells may contain no hæmoglobin at all

(the so-called blood shadows). In other cases the central clear area may not be enlarged, but small vacuoles occur throughout the cell protoplasm; the hæmoglobin may be preserved in the central part, and around this there may be a clear ring of varying width. Often the central portion stains very dark with eosin, and such cells are sometimes mistaken by inexperienced observers for nucleated red cells. Inasmuch as the darker central area takes the eosin and not the nuclear stain the mistake is inexcusable. In still other cases no definite vacuoles or clear spaces are seen within the cells, but their deficiency in hæmoglobin is shown by their lighter color and lighter staining. On the other hand, in pernicious anæmia the amount of hæmoglobin is relatively higher than the red cells; as, for example, if the red cells are 2,500,000 the hæmoglobin is fifty per cent. or higher. As a rule, however, both red cells and hæmoglobin are greatly decreased in this disease. The explanation of the relatively high hæmoglobin content is found in the presence of numerous large red cells (macrocytes) containing more hæmoglobin than the normal red cell. This may be regarded as of a compensatory nature. A pathological oligochromæmia occurs in all forms of anæmia, whether due to hæmolysis or deficient blood formation. In the latter case the individual red cells may contain a normal amount of hæmoglobin, or even a greater amount. In severe anæmias the hæmoglobin may be reduced to ten per cent. or less, but it must be borne in mind that the estimation of the low percentages is attended by a greater or less error. A physiological oligochromæmia occurs in the new-born during the nursing period, in the mature female after menstruation, and in the later months of pregnancy and the post-partum period. (See also *Anæmia*, etc.)

Aldred Scott Warthin.

OLIGOCYTHÆMIA.—A diminution in the number of the red blood cells, due either to lessened production or to an increased destruction of the same. The condition is of very frequent occurrence and may be due to a great variety of causes.

A physiological oligocythæmia occurs in hibernating animals during the winter sleep; observations made upon the marmot showed a diminution of the red cells from 7,000,000 to 2,000,000 during the period from November to February. There is also, according to some observers, a slight physiological variation in man, the number of red cells becoming slightly lower toward evening. According to Vierordt, Limbeck, and others, the red cells begin to diminish within one-half to one hour after the ingestion of a full meal, the number being reduced between 250,000 and 750,000 per cubic millimetre, remaining so for a short time, and after two to four hours gradually reaching normal again. The diminution is more marked after the ingestion of large quantities of fluids, and is therefore regarded as due to the dilution of the blood resulting from the absorption of fluid. According to some observers the red cells are increased in number during fasting or starvation, but Raum and Grawitz noted a definite diminution of red cells in healthy fasting men. Normal menstruation does not reduce the number of the red cells. After delivery there is usually found a diminution of red cells lasting for from ten to fourteen days. Under ordinary conditions the post-partum oligocythæmia is slight.

Pathological oligocythæmia occurs after hemorrhage, and in many infections and intoxications. It is found constantly in prolonged fevers, in leukæmia, cachectic conditions, malaria, syphilis, poisoning with mercury or lead, and in carcinoma, particularly of the stomach. A condition of oligocythæmia may also be produced by many poisons, the most important of which are: aniline, nitrobenzole, pyrogallic acid, toluylenediamine, potassium chlorate, amyl nitrite, phallin, helvellic acid, muscarin, arsenic, antimony, picric acid, carbon disulphide, sulphuric acid, glycerin, abrin, ricin, etc. In icterus the presence of the salts of the bile acids in the blood gives rise to oligocythæmia. The venom of poisonous snakes causes extensive destruction of the red cells. In yellow fever there is also a very marked destruction of red cells. Pernicious anæmia is characterized by marked oligocythæmia resulting from the destruction of the red cells by some poison as yet unknown. It is not improbable that the disintegration of red cells and the setting free of hæmoglobin may give rise to certain bodies or ferments having a hæmolytic action. In the oligocythæmia associated with infectious processes the specific poisons produced by the infecting organs have in the great majority of cases a decided hæmolytic action. In certain conditions of the bone marrow the formation of red cells may fall below the normal, hæmatopoiesis not keeping pace with hæmolysis. On the other hand, in cases of increased hæmolysis the bone marrow may present evidences of increased blood formation, and in very rare cases there is a probable similar compensation on the part of the spleen and lymph nodes. The diminution of red cells in the blood of man may be so great as a reduction to 500,000 or less per cubic millimetre. Such severe oligocythæmia is characteristic of the later stages of pernicious anæmia, but may be caused by poisons. (See also *Anæmia*, *Hæmolysis*, etc.)

Aldred Scott Warthin.

OLIVE OIL.—Oleum Olivæ. *Sweet Oil. Salad Oil.*—"A fixed oil expressed from the ripe fruit of *Olea Europæa* L. (fam. *Oleaceæ*)," U. S. P.

The olive is a small or medium-sized tree, with a much-branched trunk and numerous slender branches. The bark is gray, the wood compact, rather hard, agreeably scented, and susceptible of a high polish. Its fine yellow color, variegated with brown, in addition to the above qualities, make it a favorite material for small wooden ornaments and pieces of furniture.

The leaves of the olive tree are white underneath with a layer of stellate hairs. The fruit, the well-known olive, is an oval, pointed drupe, about 2 or 3 cm. (1 in.) long, consisting of a firm, very oily mesocarp, and a spindle-shaped, hard putamen, containing a single long and narrow, also oily, seed. Its color when ripe is dull blue or purple, its taste bitterish and oily.

This valuable tree is a native of Asia Minor, Palestine, and other parts of the Levant, where its cultivation is of the greatest antiquity, as the Old Testament and numerous ancient records show. It was introduced into the Mediterranean countries of Europe and Africa also at an early date, and has become thoroughly naturalized in some of them. In the course of time it appeared in the warmer parts of South America and elsewhere in the tropics, as well as in California in this country.

The fruit of the olive has been improved in form and size, as well as flavor, by cultivation, and there are several well-distinguished varieties. The olive is one of the most important products of Spain and Italy.

For the table, olives are gathered while still green, but fully grown, soaked in water or sometimes in lye to remove their natural bitterness, and finally pickled in a simple or sometimes flavored brine. For the oil they are allowed to ripen, and then are ground and subjected to pressure.

The quality of the product depends upon nicety in every stage of the operation; for the best table oil, fine fruits of good varieties must be taken, and the pressing done at once, without heat; this yields a moderate quantity of very clear, light-colored, generally slightly greenish, pleasant-flavored oil, generally called "Virgin Oil," which is sold for table use. The remaining cake is then broken up and heated or mixed with boiling water and more strongly pressed, when a further product of darker and stronger tasting oil is obtained. This grade of oil, which is called "foots," can be used for cooking or for fuel. An easy way, finally, for obtaining a large yield of oil is to lay the olives in heaps until decomposition begins, when a very strong-smelling oil (*huile fermentée*) results.

Composition.—No other fruit contains so large a proportion of fixed oil as this; it amounts generally to over one-half, and in good qualities to almost three-fourths. Besides, the fruit contains considerable *mannit*, diminishing as it ripens and the oil increases. Olive oil of the quality required for medicinal purposes is thus described: "A pale yellow, or light greenish-yellow, oily liquid, almost devoid of odor, having a nutty, oleaginous taste, with a faintly acrid after-taste, and a neutral reaction. Specific gravity, 0.915–0.918. Sparingly soluble in alcohol, but readily soluble in ether. When cooled to about 10° C. (50° F.), it begins to be somewhat cloudy from the separation of crystalline particles, and, at about 5° C. (41° F.), it begins to deposit a white, granular sediment; below 2° C. (35.6° F.), it forms a whitish, granular mass." The principal part, more than two-thirds, of olive oil is the liquid fat *olein*, or triolein; nearly all the rest is *palmitin*, with a little *stearin*, *butin*, and perhaps also *cholesterin*. Of the so-called "olive oils" in the American market the cheaper ones, even bottled and labelled in French as "Pure Olive Oil from Nice," etc., are at present almost entirely better grades of cotton-seed oil, and some of the more expensive sorts are said to be adulterated with it. This oil and other cheaper ones are also used abroad extensively as substitutes for or adulterants of this delicious and much-prized substance.

Action and Use.—This can be disposed of quite briefly, so far as its medical use is considered. Given internally, it is chiefly a fatty food, and is emulsified and absorbed as other fats are. It is slightly, only very slightly, laxative, and has no other physiological action. Locally applied it is a neutral protective from the atmosphere, as are other fats; but in this application it has given place somewhat to cheaper ones—suet, lard, cotton-seed oil, etc.,—and especially to the various *petrolatum* products.

It is rather frequently given as an injection, but *castor oil* is preferable for this purpose. Like most other fixed oils, it is destructive to insect life, and rectal injections and applications are often efficient in the treatment of ascarides. Many reports have been published of the efficacy of large quantities of olive oil, two to four gills at a dose, in favoring the removal of gall stones. A little cocaine may be added if there is a tendency to reject it. Its most extensive employment in medicine is perhaps in the composition of several liniments and of the pharmaceutical soaps; in this field it has also of late been replaced in this country by the cheaper oil from cotton seed.

Administration.—As a laxative, three or four tablespoonfuls are required,—a dose that is apt to disturb the stomach of one unaccustomed to oils. This, as stated above, may often be prevented by the use of gr. ¼ of cocaine, given just before the administration of the oil. As an injection, one or two teacupfuls, injected warm, and retained an hour or so and then followed by soapsuds, make a very efficient composition for relieving an overloaded rectum.

W. P. Bolles.

OLIVER SPRINGS.—Anderson County, Tennessee. Post-Office.—Oliver Springs. Hotel.

Access.—From Knoxville viâ Southern Railroad (formerly East Tennessee, Virginia, and Georgia Railroad), thirty-five miles northwest to springs.

The Oliver Springs and the small village of the same name are situated on the southern slope of the Cumberland range of mountains, where the counties of Anderson, Roam, and Morgan join their boundary lines. The surroundings of the resort are very pleasing, and the climate is of a genial, attractive character. The average summer temperature at the springs is 72° F., and of the winter 38° F., showing an unusually low variation. It is said that malaria has never been known to exist in the vicinity. There are nine mineral springs within the ten acres occupied by the hotel grounds. They have not been fully analyzed, but are said to contain iron, manganese, lithia, magnesia, and sulphur. They are used considerably for medicinal purposes, and, joined with the beautiful scenery, the pleasant climate, and a comfortable, new hotel, they serve to render this location a very attractive one for the health or recreation seeker.

James K. Crook.

OLYMPIAN SPRINGS.—Bath County, Kentucky. Post-Office.—Olympian Springs.

Access.—Viâ Lexington and Big Sandy Railroad to Mount Sterling, thence by stage.

These springs are ten in number, and are of the saline-sulphureted variety. The waters are promptly diuretic in their action. Analysis was made by Dr. Robert Peter in 1858, and again in 1887. Following is the result of the former analysis of the salt sulphur spring:

One United States Gallon Contains:

Solids.	Grains.
Magnesium carbonate	7.20
Iron carbonate	Trace.
Lime carbonate	13.93
Potassium chloride	10.67
Sodium chloride	166.01
Magnesium chloride	55.39
Lime sulphate	Trace.
Iron and bromide	Trace.
Alumina	Trace.
Silica	1.04
Water and loss	78.60
Total	332.84

Gases: Carbonic acid, sulphureted hydrogen, not estimated.

A re-examination of the waters in 1877 showed essentially the same results. The following additional ingredients were found in minute quantities:

Baryta carbonate.	Sodium iodide.
Strontium carbonate.	Sodium sulphide.
Sodium carbonate.	Boric acid.
Calcium chloride.	Phosphoric acid.
Lithium chloride.	Manganese carbonate.
Sodium bromide.	

Examination of the two other springs showed the presence of sodium carbonate in the proportion of twenty grains per gallon. One of them contains a little less than two grains of iron carbonate to the gallon.

James K. Crook.

OMENTUM, PATHOLOGY OF.—The term omentum (epiploön) is applied to the folds of peritoneum which connect the stomach with its neighboring organs, the liver, colon, and spleen. In structure similar to the mesentery, each omentum may be regarded as a special mesentery connecting the stomach with the organs named. They are usually designated respectively as: *gastro-hepatic* or *lesser omentum* (*omentum minus*); *gastro-colic* or *great omentum* (*omentum majus or epiploön*); and the *gastro-splenic* omentum.

The *gastro-hepatic* (stomach-liver) *omentum*, or small omentum, extends from the lesser curvature of the stomach and the adjacent first part of the duodenum to the portal fissure of the liver, enclosing between its two layers the hepatic artery, portal vein, bile duct, and associated structures, bound together by loose connective tissue.

The *gastro-colic* (stomach-colon) *omentum*, or great omentum, connects the greater curvature of the stomach and the adjacent first part of the duodenum with the transverse colon. It is the largest of all the peritoneal duplications, and is composed of four layers of peritoneum; it is much more voluminous than is necessary for the mere connection of the stomach and colon, and hangs down in front of the small intestines like an apron.

The *gastro-splenic* (stomach-spleen) *omentum* is a double fold of peritoneum passing from the dorsal surface of the stomach, near its left border, backward to the hilum of the spleen. It runs below into the gastro-colic omentum. It is often called the gastro-splenic ligament. It contains the splenic vessels.

In structure the omental folds are composed of either two or four layers of the peritoneal membrane, a basement structure of very loose connective tissue, containing a remarkable number of blood-vessels and lymphatics, and more or less adipose tissue, the whole being covered with endothelium. Small lymph nodes are not infrequently found in the great omentum, less frequently in

the gastro-splenic, but are almost constantly present in the lesser omentum. These usually show the structure of ordinary lymphatic glands, but hæmolymph glands also occur. Accessory spleens are of common occurrence in the gastro-splenic omentum.

The great omentum is by far the most important, both physiologically and pathologically considered. That its function is of great importance, in so far as the protection of the peritoneal cavity is concerned, cannot be doubted. It usually contains a large amount of fat tissue, and this fact, taken in connection with its "coverlet" investiture of the small intestines, has led to the view, advanced by both Aristotle and Galen, and commonly accepted even to-day, that the organ is of service in preserving the heat of the body and protecting the intestines against chilling. Such function, doubtful as it appears, is of slight importance compared with the protective function of the omentum against intraperitoneal infection. The remarkable richness of the organ in blood-vessels and lymphatics—far in excess of the needs of the structure itself, if intended only for a protective covering—is structural evidence of the chief omental function. The vessels form a rich plexus throughout the connective tissue beneath the endothelial covering, the vessels themselves in many cases being separated from the peritoneal cavity by the endothelium alone. Numerous clinical observations tend to show that the transudation of lymph into the abdominal cavity or the absorption of lymph from the cavity is an important function of the omentum. Many writers hold that the omentum is a modified lymphatic ganglion. It has been shown experimentally that, after the removal of the omentum, animals are much more susceptible to intraperitoneal injections of micro-organisms than control animals whose omentums have not been removed. The inference may be drawn that micro-organisms obtaining entrance to the peritoneal cavity are taken up by the omentum and there rendered harmless or are killed.

In local traumatism, or after operations involving the peritoneum, in beginning peritoneal infection, local peritonitis from whatever cause, etc., the omentum is quite commonly found attached to the affected area, entirely surrounding it and shutting it off from the remainder of the peritoneal cavity. This occurs particularly in appendiceal and tubal disease, following the beginning of a local peritonitis, but it is also of very frequent occurrence over the surface of liver, spleen, intestines, etc. It would appear that the omentum is attracted to the diseased area; the location of such adhesions deep in the pelvis or in parts of the peritoneal cavity not usually occupied by the omentum would indicate such a movement of the omentum to the affected part. The slightest irritation in any part of the peritoneum is apparently sufficient to cause the omentum to attach itself to the affected area, and to shut off the focus of infection from the remainder of the peritoneal cavity. Even when microscopic changes are not visible, alterations of the intestinal wall permitting the passage of germs or of their products, are sufficient to cause such adhesions. The plastic exudate thrown out by the omentum at the point of lesion no doubt offers some purely mechanical protection against the spread of infection; it is also probable that the secretion poured out from the omental vessels has some bactericidal or antitoxic action. Furthermore, the bacteria received into the lymphatics of the omentum are either rendered less virulent or are destroyed.

Malformations.—The great omentum may be entirely absent, or only incompletely developed. Variations in size and shape are common; partial defects of large size are not infrequent. Misplacements of portions of the organ are found in connection with congenital hernias. Congenital cysts of the omentum are of very rare occurrence.

Circulatory Disturbances.—The vascular relations of the omentum are such as to make the circulatory conditions of this organ dependent upon that of the neighboring structures. Inflammations of the gastro-intestinal tract, hernias, obstructions, tumors, disturbances of the portal circulation affect the vessels of the omentum to a more or less marked degree.

Active hyperæmia of the omentum occurs in the early stages of epiploitis, also after the sudden diminution of abdominal pressure after the removal of ascitic fluid or of a tumor of large size.

General passive congestion of the omental vessels follows portal obstruction, either as the result of hepatic disease or of pulmonary or cardiac affections. The vessels of the great omentum may be markedly congested in advanced stages of cirrhosis, or in failure of compensation in valvular disease of the heart. In such cases the congested omentum plays a large part in the production of the associated ascites.

Advantage has been taken of the dilated condition of the omental vessels in cirrhosis of the liver, and of the fact that the omentum readily forms adhesions with other structures, by an attempt to set up a collateral circulation between the portal and the systemic veins by means of "*Morrison's operation.*" This consists in the establishment of an anastomosis between the vessels of the omentum and those of the anterior abdominal wall through artificially induced adhesions. The peritoneum is first rubbed, and the omentum sutured to the area so treated. It is at present too early to speak of the value of this procedure; but very favorable results have been reported. In a case operated upon by Lens, venous channels were demonstrable in the adhesions that had formed between omentum and peritoneum. Animal experimentation shows the possibility of the establishment of such a collateral anastomosis. Similar results may be obtained by adhesions formed between the diaphragm and the liver or spleen.

Hemorrhage.—Small ecchymoses occur into the omental tissues in extreme active or passive congestion, in severe cases of the acute infections, in sepsis, in epiploitis, fat necrosis, secondary carcinoma, hæmophilia, etc. Large hæmatomata are rare; they may occur in association with fat necrosis in cases of acute pancreatitis, or in severe epiploitis associated with appendicitis or salpingitis, or very rarely in hæmophilia.

Infarction.—Incarceration or torsion of the omentum may, by shutting off the blood supply, give rise to an anæmic necrosis. Ligation or thrombosis of the epiploic artery will produce the same result. In cases of resection of the omentum in herniotomy a thrombosis may be induced in the omental vessels which may extend to the gastric arteries. In cases in which the ligations are near the epiploic artery, anæmic ulceration of the stomach or hepatic infarction may occur, as the result of the extension of thrombosis into the gastric and hepatic vessels.

Œdema of the omentum is of frequent occurrence. It may be due to general or local passive congestion, obstruction of the portal circulation, epiploitis, etc. In acute epiploitis associated with general peritonitis and ascites the omentum may be very much swollen. As a rule, œdema of the omentum is manifest in the resulting ascites; the free interchange of fluid between the lymph spaces of the omentum and the peritoneal cavity relieves the omentum, so that it does not become swollen through the accumulation of fluid in its tissue spaces, until the collection of ascitic fluid in the peritoneal cavity reaches a certain degree of tension.

Ascites.—The omental function of lymph production and lymph absorption is directly connected with the development of ascites. All conditions favoring an increased formation of lymph by the omentum, as well as those preventing the absorption of peritoneal fluids, lead directly to ascites. Malpighi was perhaps the first to suggest that ascites may be caused by a pouring out of fluid from the omental vessels. In a case reported by Landgraf, an ascites intractable after fourteen tappings disappeared after the sloughing of a part of the great omentum which presented itself in an omental hernia. Similar cases have been observed. Eitel reports an interesting case of marked ascites which had been repeatedly tapped. A large tumor was found to be present in the upper part of the abdomen. On operation this was discovered to be the great omentum tightly rolled upon itself, its veins constricted and its circulation impeded. It was unrolled and the ascites was cured. The cause was attributed to the fact that the patient, a worker in a quartz mill, was in the habit of carrying a heavy box of mill product pressed against his abdomen. Other cases of a similar nature point to the omentum as a direct factor in the production of ascites.

Hydrops Omenti.—The collection of fluid between the layers of the great omentum is so designated. This condition occurs more frequently in cases of ascites in children than in old individuals.

Chylous Ascites.—In cases of secondary carcinoma of the omentum or in chronic fibroid omentitis, the ascitic fluid may be white or milky, due to fat or albumin in suspension. The presence of these substances may be due to the fatty degeneration of desquamated endothelium or tumor cells, or may result from the obstruction of chyle vessels. In the former case, when little fat is present in the fluid, the condition may be designated as *pseudochylous ascites.*

Retrograde Changes.—Atrophy of the omentum, as shown by total or marked disappearance of its adipose tissue, occurs in cachexias and wasting diseases as a part of the general marasmus. Atrophy of the fibrous trabeculæ may also occur. Cases have been observed in which the atrophy of portions of the organ gives rise to large open spaces between its coarser trabeculæ.

Necrosis of the omentum may be caused by incarceration or torsion, by ligation or thrombosis of omental vessels, or it may be associated with gangrenous conditions of the intestines.

Fat necrosis of the omentum occurs in acute pancreatitis, in pancreatic carcinoma, and in association with fat necrosis of the abdominal fat elsewhere. The necrosed areas are yellowish-white, slightly elevated and opaque, and usually circular in outline. The omentum may look as if it had been touched with a hot iron. The necrotic areas may be hemorrhagic. In cases of longer standing lime salts may be deposited in the necrosed cells.

Amyloid has been reported as occurring in the walls of the omental blood-vessels.

Hyaline change of the walls of the omental arteries is found in chronic fibroid omentitis, in association with omental tuberculosis, in the neighborhood of inflammatory adhesions, etc.

Calcification may follow fat necrosis, or occur in old tubercles. In two cases of splenic anæmia associated with hepatic cirrhosis (Banti's disease) numerous small nodules of calcification were found by the writer throughout the abdominal fat.

Inflammation (*Omentitis* or *Epiploitis*).—Inflammation of the omentum is essentially a part of a more or less general peritonitis in the great majority of cases; but in certain instances the omental inflammation preponderates, or appears to be primary; and further, as mentioned above, localized peritonitis is almost always associated with a localized epiploitis, the omentum adhering to and shutting off the inflammatory process (see *Peritonitis*). The character of the epiploitis is the same as that of the general or local peritonitis with which it is associated, viz., *fibrinous, purulent, gangrenous,* etc. The omental process is, however, in all cases characterized by a greater tendency to proliferation and formation of granulation tissue than is the case with the other portions of the peritoneum. This is especially true of the localized forms of epiploitis with adhesion; the inflammatory process is essentially plastic in character (omentitis adhæsiva). As a result of very active inflammations there may be formed such large masses of granulation tissue in the omentum as to produce tumors which may be mistaken clinically for neoplasms.

Inflammatory Tumors of the Omentum.—As the result of such excessive production of granulation tissue in the inflamed omentum, there is not infrequently found a tumor-like thickening of the omental tissues. This may occur in any part of the abdomen, but is most frequent in the appendix region. The thickening of the omentum may be diffuse or nodular, often limited to the portion adherent to the peritoneum about the primary focus. In other cases the omentum may be rolled up tightly above the level of the umbilicus, forming a firm cylindrical mass extending across the abdomen. The tumor mass may develop very rapidly in acute processes, but more gradually in chronic inflammations. After the inflammation has subsided the tumor may disappear through the resorption of exudates and the contraction of the granulation tissue, and the omentum may become detached. In other cases, after the inflammation has disappeared, the tumor remains and the omental adhesions become hard and organized. In purulent cases the inflammation may persist, and a chronic tumor then remains, composed of an inflammatory focus (abscess) surrounded by thick omental adhesions of granulation tissue. In other cases, after the termination of the inflammation, the omentum becomes detached, the granulation tissue is converted into fibrous tissue, and the omentum is greatly changed in form by the production of diffuse or nodular fibroid thickenings (omentitis fibrosa). If there is much retraction of portions of the new fibrous tissue the omental tumor may be very small and irregular (omentitis fibrosa retrahens).

Inflammatory tumors of the omentum also follow laparotomy, in which either the normal or the inflamed omentum has been ligated and in part removed. Torsion of the omentum may also give rise to an omental tumor. In some cases, after an operation for strangulated hernia, the omentum has become inflamed, though not involved in the strangulation. In all these cases the inflammatory tumor develops slowly; in one-half of the recorded cases the period of development varied from one to four months, and in some cases the interval was much longer. The tumor is usually on the same side of the body as that upon which the operation was performed, its location depending upon the amount of omentum removed. It may or may not be adherent to the abdominal wall. The tumor is usually about the size of an orange, but may be much larger. When adherent to the wall the tumor is immovable; if non-adherent it may be moved upward or laterally, but not downward. The surface of the mass is usually smooth, the consistence firm. It is tender on pressure. It usually does not move with respiration, or only slightly. Percussion gives a dull tympanitic note, often completely dull. In the centre of the tumor may be found the ligatures used to tie off the omentum, and it is believed by some that the use of silk ligatures in such operations plays an important part in the development of the tumor.

Clinically, the inflammatory tumors of the omentum may be mistaken for ovarian tumors, misplaced liver or spleen, malignant growth of the intestines, etc. In certain cases they have been regarded as malignant neoplasms (sarcoma) even after microscopical examination. Coley mentions a case in which a portion of the omentum had been excised on account of its presence in a left inguinal hernia. The stump became inflamed, withdrew, and gave rise to a mass in the region of the splenic flexure. Malignant disease was suspected, the abdomen was opened, and a portion of tissue removed for examination. The diagnosis was "probable spindle-celled sarcoma." The patient died after a radical operation. The autopsy showed that the inflamed omental stump had become attached to the splenic flexure, and the section for microscopical examination had been cut from the very abundant inflammatory tissue.

In two cases in the writer's experience there were found, in the region of the appendix, large tumor masses that clinically presented characteristics of malignancy. Microscopical examination of tissue removed for diagnosis showed a very cellular granulation tissue, rich in blood-vessels, having relatively thick walls. In one case the diagnosis of "omental granulation tissue" was given. The patient recovered, and the tumor completely disappeared. In the other cases the first sections examined were prepared by a quick method for immediate diagnosis. The

section showed a sarcomatous-like structure of round and spindle cells grouped around blood-vessels, suggesting an endothelioma. Study of the sections showed large numbers of plasma cells present, and the fact that all of the blood-vessels had relatively thick walls. A diagnosis of omental granulation tissue was then given. A year afterward the tumor was reported as having entirely disappeared. There can be but little doubt that some of the so-called disappearing malignant tumors of the abdomen belong to this class. The microscopical appearances of small bits of tissue removed for diagnosis may on first glance strongly suggest a sarcomatous growth. In the relatively thick sections obtained by means of the freezing microtome or by quick embedding methods the finer points necessary to a differential diagnosis are usually not sufficiently clear for a safe diagnosis, and it is from such sections that the diagnosis of sarcoma is usually made. The writer holds that in carefully prepared sections the differential diagnosis between such forms of richly cellular granulation tissue and sarcoma may be made without great difficulty. The presence of numerous plasma cells, the prominence of the small vessels, both in number and in size, their relatively thick walls, the hypertrophic character of their endothelium, the marked endothelial proliferation, the typical character of the mitosis, the presence of fibrin and small pus collections, are all points establishing the diagnosis of subacute or chronic development of granulation tissue. The presence of adipose tissue and coarse trabeculæ of fibrous tissue are also of service in fixing the origin as omental.

Omental Abscess.—An acute omental abscess may develop without the association of a general peritonitis or of any discoverable local change. In the majority of cases, however, the appendix is the seat of primary infection. Omental abscess may be associated with salpingitis, and very frequently follows laparotomies or herniotomy. In those cases in which the omental abscess is apparently of cryptogenic origin, or overshadows the primary lesion, it may be inferred that the resistance of the omental tissues had been lowered, or that the organ, through circulatory disturbances or for other reasons, has been unable to overcome the virulence of the bacteria taken up. The abscess may be found in any part of the abdominal cavity, but as the omentum is commonly rolled up, it lies usually above the level of the umbilicus. It may develop around ligatures which are used in tying off the omentum. The organ is reddened, thickened, and is usually adherent to the abdominal wall by a fibrinous exudate, which is most marked over the abscess. The latter not infrequently forms an encapsulated pocket of pus between the omentum and the anterior abdominal wall, and may extend into the tissues of the latter. The clinical symptoms are those of sepsis, with local pain and tumor. In many cases the abscess becomes chronic, a large amount of fibrous tissue is formed about the encapsulated area, the adhesions become hard and firm, and a gradual healing of the abscess may take place. A more or less generalized peritonitis may accompany the abscess. Occasionally the pus may break through into the intestine and recovery follow. Rupture into the peritoneal cavity may cause a severe general peritonitis which may be fatal.

Sequelæ of Omental Inflammation.—As a result of inflammatory conditions of the omentum there may arise adhesions between the organ and the various abdominal viscera; these may cause stenosis, or snaring off of portions of the bowel, obstruction of the ureter, pressure upon the common duct or pylorus, abnormal position of the pelvic organs, etc.

Progressive Changes.—Either fibrous or fatty *hyperplasia* of the omentum may occur in the portion of the organ included in hernial sacs. The hyperplasia may take on the character of a lipomatous growth. Cases have been reported of such hyperplasias in hernial sacs which reached half-way to the knees.

The remarkable capacity for *proliferation* possessed by the omentum has been taken advantage of in plastic operations in the abdomen. (For further details in regard to this part of the subject, the reader should consult the article next beyond this.)

Tumors.—Primary neoplasms of the omentum are rare. *Fibroma* and *lipoma* have been described. In the former class of cases the actual disease may in reality have been a localized fibroid thickening resulting from an inflammatory omental tumor. The so-called lipomatous growths have been, in the majority of cases, localized or diffuse fatty hyperplasias.

Of the primary malignant tumors reported as occurring in the omentum *endothelioma* and *myxosarcoma* are the forms whose origin in this organ is supported by observation; but it must be observed that the rarity of such cases, and the imperfect descriptions given, leave us very much in ignorance as to the occurrence and nature of primary omental tumors. In the older literature there are occasional reports of "*primary cancer*" of the omentum, "scirrhus of the omentum," and "primary colloid disease," "vesicular degeneration," "hydatid disease," etc. The exact nature of this peculiar growth of the omentum, apparently primary in some cases, cannot at present be stated. Primary epithelial growths (carcinoma) of the omentum of course do not occur. In some cases the growth may have been secondary to colloid carcinoma of the stomach or intestine, or to cystocarcinoma of the testis or ovary. In typical cases the omentum is greatly thickened; its surface is uneven, flocculent, and shreddy, this appearance being due to the projection of rounded villus-like masses of gelatinous material attached by shreds of tissue. The appearance strongly suggests hydatid disease of the placenta. On microscopical examination the mass of the omentum has a finely spongy texture of connective tissue enclosing masses of gelatinous material. Swollen cells are occasionally found in the spaces. If we exclude the cases of true *colloid cancer* or *cystocarcinoma, secondary* to primary tumors in other organs, there still appears to be a peculiar myxomatous growth of the omentum, which according to the most careful reports (Eve and others) must be classed as a *myxoma* or *myxosarcoma*. No proof of its endothelial origin exists. Matas has reported a case of primary myxosarcoma of the omentum with secondaries in peritoneum and accompanied by a mucoid ascites.

The flat or warty growths, originating from endothelium, may be primary in the omentum as well as in the peritoneum. Microscopically, the primary endotheliomata of the peritoneum consist of cords or strands of cells in the connective tissue beneath the endothelial covering. The cords of cells appear to follow the lymph vessels. The growth may originate from the superficial layer, or from the endothelium of the lymph vessels.

Omental *cysts* have also been reported, and have been interpreted as "*simple serous cysts*," "*distended lymph vessels*," "*congenital multilocular cystoma*," etc. It is not improbable that the latter variety was a primary tumor of the ovary, which after becoming adherent to the omentum, had been freed from its original attachments. Such a process has undoubtedly occurred in the case of the so reported *dermoid cysts of the omentum*. Though primary dermoids of the omentum may occur, it is highly probable that those observed have originated from primary ovarian dermoids in the manner described.

Secondary malignant growths of the omentum are of very common occurrence; they represent most frequently carcinoma metastases from primary growths in stomach, intestine, gall-bladder, pancreas, ovaries, testis, uterus, and prostate. A number of cases of melanotic sarcoma of the omentum have been reported. While the growth, in several of these instances, was regarded as primary, it undoubtedly was metastatic from primaries in the skin or choroid.

Pseudomyxoma.—The omentum as well as the general peritoneal surface may be involved in the process known by this name. It is due to rupture of an ovarian cystoma, the discharge of mucoid or colloid material into the peritoneal cavity, and the organization of the latter by proliferation of the peritoneal tissues.

Parasites.—*Echinococcus* of the omentum has been reported. After rupture of a primary hydatid cyst into the peritoneal cavity the omentum may be secondarily involved in connection with the remainder of the peritoneum.

Tuberculosis of the omentum is of relatively common occurrence. In many cases the infection of the peritoneum appears to be primary in the omentum. The thickened omentum may be tightly rolled up, forming a tumor-like mass which may be mistaken for a neoplasm. In primary tuberculosis of the female genital tract, large tubercles may be found in the omentum. (See also *Peritonitis, Septic and Tuberculous.*)

Syphilis.—A fibroid omentitis has been observed in congenital syphilis, and in connection with syphilitic cirrhosis and fibroid splenitis.

Foreign Body.—A case is reported of an encysted needle being found in the omentum. Gauze, sponges, ligatures, or foreign bodies left in the peritoneal cavity during laparotomy may become included in omental adhesions.

Aldred Scott Warthin.

OMENTUM, SURGERY OF.—The omentum is composed of two layers of peritoneum which are derived from the anterior and posterior walls of the stomach. They pass downward in front of the abdominal organs into the hypogastric region, and are reflected backward upon themselves and pass upward until they reach the transverse colon. There they separate, and after covering this portion of the intestine they come into contact behind it, forming the transverse mesocolon. Thus the omentum is really made up of four layers, but in adult life the layers cannot be wholly separated, although this construction gives to the omentum a very loose and lobular character. In almost all persons the omentum contains a good deal of fat, and in individuals who are very stout the quantity of fat is proportionally large.

The function of the omentum under normal conditions seems to be to afford protection to the underlying coils of small intestine, and also to facilitate their movements. Under pathological conditions it has the further function of applying itself to any wounded surface of the peritoneum within reach, so that it may even be able to occlude a perforation and prevent fatal escape of intestinal contents. By reason of its large serous surface it doubtless aids materially in the resorption of extravasated fluids from the peritoneal cavity.

The lesions of the omentum which are of surgical importance are traumatic, inflammatory, parasitic, and neoplastic.

Traumatisms.—If the abdominal cavity is opened, for example, by a stab, the omentum will often be found presenting itself in the wound. It frequently serves a useful purpose by protecting other more important organs from exposure to infection and traumatism in an open wound. It may even protrude through a stab wound which opens both the lower part of the pleural cavity and the peritoneal cavity through the diaphragm. It is the most common content of a hernial sac. The omentum which is thus prolapsed into a wound may be uninjured, or some of its vessels may have been opened by the traumatism, or it may become inflamed, or it may become gangrenous either on account of the traumatism or secondarily through its becoming strangulated in the wound.

Intraperitoneal hemorrhage from a larger omental vessel may prove fatal because the thin walls of its vessels favor long-continued bleeding. In excising prolapsed or injured or adherent portions of omentum the surgeon should be careful to see that every bleeding vessel is secured by a ligature. If the omentum which presents itself in a wound is uninjured and the wound itself is clean, the omentum may be cleansed and replaced; otherwise it should be cut away.

Inflammation.—The simplest form of inflammation which can affect the omentum is of a traumatic character. This is most frequently seen in connection with an omental hernia, where repeated slight traumatisms give rise to local fibrinous peritonitis with the formation of adhesions. The hernia will then become partly or wholly irreducible and the omentum will be still more exposed to slight injuries. This condition is often seen in inguinal and umbilical herniæ. In operating upon such herniæ, it is customary to excise portions of omentum which are badly matted together by adhesions, or whose surfaces are deprived of their peritoneum when the omentum is torn loose from the hernial ring. The removal of more or less of the omentum does the patient no harm, but the stump of the omentum may give rise to serious trouble. It sometimes retracts, and becomes adherent to the abdominal wall or some portion of the intestine, while adhesions take place about it to such an extent that a mass is formed that has more than once been mistaken for a tumor. In one case within the knowledge of the writer a section of this new-formed fibrous tissue was removed and was pronounced by a well-known pathologist to be a spindle-celled sarcoma. In consequence an extensive resection of the descending colon, to which the omentum was adherent, was performed, and from the indirect effects of this operation the patient died. Such an inflammatory tumor in the omental stump will, like all cicatricial tissue, decrease in size in the course of time, but it may give the patient a great deal of trouble during the process, and the adhesions produced by it may continue to give trouble long after the inflammation has subsided.

Suppurative inflammation may develop in the omental stump, usually as the result of an infected ligature. If general peritonitis is avoided, an abscess may be produced within the omentum. The omentum under such circumstances will attach itself to the surrounding parts, including the anterior abdominal wall, so that it may be possible to open the abscess without entering the general peritoneal cavity.

The more chronic inflammations, such as syphilis, tuberculosis, and actinomycosis, may involve the omentum, usually in common with other portions of the abdominal cavity. Omental echinococcus is also known, and in very rare instances an echinococcus cyst of the omentum reaches a great size, although the lesions in other portions of the peritoneum are insignificant.

Tumors.—A few primary tumors of the omentum have been reported. They are for the most part lipomata, sarcomata, or cystic tumors of congenital origin. Dermoid cysts and teratomata are thus explained. There are also acquired cysts of the omentum of a serous or hemorrhagic character, the latter being secondary to hæmatoma. Thus the tumors of the omentum are similar to those of the mesentery.

In addition to these primary tumors of the omentum secondary nodules may develop on its surface and within it in case of malignant disease of other abdominal organs, while tumors of the transverse colon may grow downward into the omentum so that they simulate omental tumors. A careful examination after the abdomen is opened will usually show the starting-point of such a tumor.

An omental tumor is characterized by a great range of mobility as long as adhesions do not exist. For this reason a small cyst may easily be mistaken for a solid tumor. As tumors of the mesentery often have a great mobility, it will scarcely be possible to differentiate them from omental tumors before the abdomen is opened.

The removal of an omental tumor requires no special technique. On account of the thin walls of the vessels all bleeding should be stopped by ligature before the abdomen is closed. Mass ligatures cannot well be avoided, but the amount of tissue included in each ligature should be small. It is also worth while to approximate the peritoneal surfaces of the omentum by a continuous catgut suture so as to prevent the formation of extensive adhesions. If an echinococcus or epithelial cyst cannot be removed *in toto*, it should be sutured into the abdominal wound and drained.

Omental Grafts.—The omentum has occasionally been used to cover a defect in the peritoneum which could not be closed by direct suture or as an additional safeguard