

came concentrated in large establishments, the old method of rendering fat in open kettles has become happily obsolete. The chief nuisance of fat-rendering consists in the odors "which are all caused, partly by the storage of the decomposing fat on the premises, but mainly by the distillation of portions of the fat; which produces certain ill-smelling substances, such as acrolein and allylic alcohol, with sometimes capric, caprylic, and caproic acids."¹⁸

The prevention of fat-rendering from becoming a nuisance is accomplished by the following measures: (1) The use of undecomposed animal matter; (2) the employment of a low temperature in rendering; (3) the boiling of fat in tightly closed vessels; (4) the use of condensers for the removal and destruction of the gases and odors. The New York Sanitary Code has the following section: "That no fat, tallow, or lard shall be melted or rendered except when fresh from the slaughtered animal; and taken directly from the place of slaughter, and in a condition free from sourness and taint, and all other causes of offence at the time of rendering; and that all melting and rendering are to be in steam-tight vessels; the gases and odors therefrom to be destroyed by combustion or other means equally effective." Himes²¹ says: "The great secret in preventing nuisance is the avoidance of burning the materials, or even raising them to high temperature. The lower the temperature at which the work can be successfully carried on, the less is the risk of producing offensive smells. The temperature need not exceed 120° F." When steam methods of rendering are used, the need of condensers is imperative. "Condensers may be of several styles and shapes. The water may be introduced at the top, and broken by means of a plate, a short distance below, the shower may also be made by means of a rosette. The condenser itself may be made of iron, copper, or even wood. It should be made as high as possible, in proportion to the diameter. The gases should be introduced at the bottom, and passing up through the water shower, connect with the furnace fires by a pipe near the top." (Goldsmith.²²) Of the chemical methods of fat-rendering D'Arcey's method is by separation of the fat from its membranes by the action of sulphuric acid. Lard refining differs little from the general rendering of other fats, and, being done mostly by the low-temperature method, it is not offensive.

Bone and Blood Boiling.—In the processes of boiling these animal substances odors may arise which may be quite offensive. The following preventive measures are recommended by the Philadelphia Board of Health:²⁰ "The floors of all bone-boiling establishments and depositories of dead animals shall be paved with asphalt, or with brick or stone, well laid in cement, and shall be well drained. The boiling of bones, etc., shall be conducted in steam-tight kettles, boilers, or cauldrons, from which the foul vapors shall first be conducted through scrubbers or condensers, and then into the back part of the ashpit of the furnace fire, to be consumed. When bones are being dried after boiling, they shall be placed in closed chambers, through which shall be passed, by means of pipes, large volumes of fresh air, the outlet pipe terminating in the fire-pit."

Gut-Cleaning.—The utilization of the small intestines of animals for sausage skins and the manufacture of cat-gut is necessarily accompanied by a great deal of stench from the foul-smelling contents of the guts and the decomposition of animal matter. "The processes should be carried on away from habitations; the guts, etc., should not be allowed to come in a foul state, but must be utilized immediately, and proper precautions taken to let no foul matter cling to the floor or surfaces of the establishment. This may be accomplished by the use of plenty of water. The water in the tank where the intestines are macerated may be disinfected by a weak solution of chloralum or chlorinated soda."¹⁸ Parent-Duchatelet (Tardieu) denies that gut-cleaning is harmful to health.

The Manufacture of Soap.—Soap is manufactured from fat and alkalies. It may become a nuisance; (1) On account of the large quantity of fat, tallow, and fat animal

residue, which are collected from all animal waste matter, and which are, by the time they reach the soap factory, in a decomposing state. (2) By the processes inherent in fat rendering. (3) By the odors arising from the huge vats and tanks where the fat is being boiled with the alkaline lye. The prevention of the first nuisance is accomplished by insisting that only fat in a fresh state shall be allowed in the soap factories. The means of preventing fat-melting and rendering from becoming a nuisance have already been described. The nuisances caused by the odors arising from the boiling tanks can be prevented by fitting these with covers, and conducting the vapors either outside through a tall chimney, or, as in fat-rendering, through proper condensers.

Glycerin.—When the fatty acids of the fats in soap manufacture combine with the alkalies, the base left is a residue in the form of glycerin, which, before being fitted for the market, must be refined several times. During this process sweetish unpleasant odors are given off, which can be prevented by the same means as those which are used in treating odors from fat rendering.

Glue-Making.—All kinds of animal waste matter, hoofs, horns, skin scraps, leather scraps, etc., are used for the extraction of glue. As in the other processes employed for the utilization of all animal waste matter, the nuisance comes from the decomposing material, from the odors given out during boiling, etc., and from the offensive residue or "scrutch." The remedies are the same as in other kindred processes.

Treating and Tanning of Skins and Hides.—Animal skins, before they are converted into lasting leather, must go through a number of complicated processes. In the scraping, salting, hairing, brining, liming, puering, tanning, curing, and other processes very offensive and disgusting odors often arise; and in liming some sulphureted hydrogen may also be evolved. The process named "puering" consists in soaking the hides in a liquid composed of dog's dung. Tanning establishments should not be allowed in residential localities. The various manipulations may be done with little offence if the places are properly constructed and well kept.

Manufacture of Other Substances.—Among the other substances, the manufacture of which may become offensive, are the following: Illuminating gas, petroleum refining, distilling, brewing, vinegar-making, sugar-refining, boiling of oil, manufacture of varnish, cooking, etc.

Illuminating Gas.—The nuisance caused by the presence of gas works in populous localities is due to various gases and odors given off, during the many stages required, in the process of distilling gas from bituminous coal. The process especially objectionable is the "liming," or passing the gas through a closed chamber filled with quicklime, which is afterward deoxidized and gives off ammonium sulphide and sulphureted hydrogen. Oxide of iron has been substituted for quicklime, with a material lessening of offensiveness. Notwithstanding all the care employed and despite the modern inventions of condensers, scrubbers, and other means for destroying and absorbing offensive gases during the manufacture of illuminating gas, this business is still quite a nuisance to a neighborhood, and the best remedy is to remove it as far as possible from habitations.

In the processes of refining petroleum, offensive odors are given off. These are due to the escape of fumes during its distillation, as well as during the agitation of the refuse or "sludge" acid with alkaline solutions. Goldsmith recommends that the wash water from the agitators should be passed through a series of troughs furnished with cross slots, to retain all oily or tarry matter; and the treatment of the sludge should be carried on at a distance from crowded neighborhoods.

The nuisances caused in the processes of brewing, distilling, sugar refining, and other industries mentioned, consist in the odors given off at certain stages of manufacture and may be prevented by the same methods as those described in the section on Fat Rendering.

Tracy lays down the principles of controlling the nuisance caused by the odors and vapors which are given off

during the manufacture of various substances as follows: (1) Conveying and storing in tight vessels. (2) Substitution of less offensive processes for the more offensive. (3) Proper construction of the places where nuisances arise. (4) The use of plenty of water, proper cleanliness, and drainage. (5) The destruction of all offensive odors by passing them through condensers, etc., and from there into the fire pits where they will be consumed.

Gases and Vapors.—The number of the trades which may become a nuisance to the community on account of the vapors, acid fumes, and gases which are evolved in their processes, and are allowed to escape into the surrounding air, is very large. Among the more important of these are all the chemical trades; the manufacture of alkalies, ammonia, bleaching powder, soda, and glass; assaying, smelting, and the manufacture of jewelry, lead paint, certain drugs, etc.

The nuisance created by all of these trades can be summed up in the following: (1) Odors offensive to the neighborhood. (2) Deleterious gases. (3) Destruction of vegetation in the neighborhood.

The remedies advised for the prevention, or at least mitigation, of the nuisances are: (1) Removal, whenever possible, from crowded localities. (2) Dilution of the gases and vapors by air. (3) Condensation of gases by cooling them with water, by passing them once, or several times, either through condensers filled with water or through scrubbers filled with wet coke. (4) Absorption through discharging all gases into fire-pits, where they are destroyed by the action of fire, or by passing them through neutralizing substances, which are of course different for each of the different gases.

George M. Price.

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OCCUPATION DISEASES. See *Caisson Disease; Hands and Fingers, etc.; Lead Poisoning; Lungs, Diseases of; Pneumonokontosis; Siderosis; etc.*

OCEAN SPRINGS.—Jackson County, Mississippi. Post-Office.—Ocean Springs. Hotels.

This is a station on the railroad between New Orleans and Mobile, eighty-three miles east of the former, and fifty-seven miles west of the latter. It may also be reached by coast steamers from either city. The name of the springs is derived from their proximity to the gulf, the beach being but half a mile distant. According to Walton the springs are most resorted to by citizens of New Orleans and Mobile. The following analysis was made by Prof. J. Lawrence Smith:

ONE UNITED STATES GALLON CONTAINS:	
Solids.	Grains.
Sodium chloride	47.77
Potassium chloride	Trace.
Calcium chloride	3.88
Magnesium chloride	4.97
Ferrous oxide	4.71
Organic matter	Trace.
Ammonia	Trace.
Iodine	Trace.
Total	61.33
Gases.	
	Cu. in.
Sulphureted hydrogen	1.28
Carbonic acid	9.79

The water is a potent chalybeate, the iron being no doubt held in solution in the form of a carbonate. The unusual combination of carbonate of iron, chloride of sodium, and sulphureted hydrogen especially adapts this water to the treatment of diseases of the skin in persons of a scrofulous diathesis. James K. Crook.

OCHEE SPRINGS.—Providence County, Rhode Island. Post-Office.—Johnston.

The Ochee Springs are not properly a health resort, although there are many visitors in pleasant weather. There are a number of springs in the neighborhood, but only one is improved at the present time. The following analysis was made by Prof. John H. Appleton, of Brown University:

ONE UNITED STATES GALLON CONTAINS:	
Solids.	Grains.
Magnesium carbonate	1.13
Calcium carbonate	3.20
Calcium sulphate	.44
Potassium sulphate	.88
Sodium sulphate	.41
Sodium chloride	.57
Iron oxide and alumina	.75
Insoluble mineral matter	.58
Organic and volatile matter	.87
Undetermined	.15
Total	8.98

This water is pure and wholesome, and is said to act as a mild cathartic and diuretic when used continuously. It has been accorded a considerable reputation as an auxiliary in the treatment of kidney, liver, and stomach troubles. The water is used commercially. James K. Crook.

OCHRONOSIS. See *Pigment, etc.*

OCONEE CHALYBEATE SPRING.—Putnam County, Georgia. Post-Office.—Eatonton.

Lake Eaton branch of Central Railroad to Eatonton, and from thence by private conveyance to spring. This spring has had considerable local reputation for a number of years. The waters contain the following ingredients:

Iron carbonate.	Calcium sulphate.
Calcium carbonate.	Sodium chloride.
Potassium sulphate.	Silica.

The iron is insufficient in quantity to warrant us in placing the water in the chalybeate class. The flow is small but constant, the water issuing from a fissure in a granite rock. James K. Crook.

OCONEE WHITE SULPHUR SPRINGS.—Hall County, Georgia. Post-Office.—Bowdre. Hotel and cottages.

Location, six miles from Gainesville and two miles from Sulphur Springs Station, on the Southern (Richmond and Danville) Railroad. Hacks meet all trains.

This is one of the most attractive watering-places of the South. Long before the war Southerners of wealth and fashion gathered there annually. A few years ago the property was purchased by Mr. Ferdinand Phinizy, of Athens, and many improvements were made. The old buildings were torn down and a large, well-appointed hotel and handsome cottages were erected. The excellent and liberal management has kept the place popular, and

it now numbers among its guests visitors from far and near. No analysis is furnished, but the waters are said to be valuable in rheumatism, dyspepsia, and diseases of the blood. There are also bathing conveniences, including shower and plunge baths and a large swimming pool.

James K. Crook.

ODONTOMA.—This term has been applied in a general sense to a great variety of tumors arising in connection with the teeth—from the tooth follicle, the dentine, the cement, the enamel, the tissue about the tooth, or from the tooth structure as a whole. Different names have been applied to these growths by various authors, and at present the classification of these tumors is in a confused state. The majority of the observations are rather old, very little study having been made recently of this subject. By most writers the term *odontoma* is limited to those growths which arise at an early period of development of the tooth before the formation of the dentine. Those developing during later life from the dentine, cement, or enamel of the mature tooth are classed as *odontinoids*. These are further divided into *dentinoids*, arising from the dentine; *enameloids*, arising from the enamel; *dentalosteoma*, arising from the cement. The *true odontomata* are rare, and for the greater part form soft growths corresponding to the stage of development of the tooth, and presenting such varied appearances as to justify the diagnosis of myxoma, cystoma, sarcoma, or fibroma. Dentine may develop later in the tumor, the growth becoming hard, and after complete identification stationary in development. Occasionally they may reach such a size as to cause erosion of the jaw bone. They may be single or multiple. They are usually irregular or nodular; after identification they resemble dentine in structure. The *odontinoids* are usually very small and unimportant excrescences of the teeth, which are more of the nature of inflammatory hyperplasias than of true tumors, and are found in pathological conditions of the teeth, particularly in association with diseased roots. In caries of the teeth there may arise from the exposed pulp masses of granulation tissue of a polypoid character, the so-called *pulp-polyps* or *pulp-granulomata*.

The *cystic tumors* found in the jaw are sometimes included with the odontomata, but by other writers are placed in a class by themselves. Three forms of these cysts occur: *follicular* and *periosteal cysts* and the *multilocular cystoma*. The *follicular cysts* are found only during the period of dentition. They are usually monolocular, rarely multilocular cysts, having a wall lined by cylindrical epithelium. With the exception of those arising from the wisdom teeth they develop at an early age and grow slowly, taking several years to reach an important size. They arise from the cystic degeneration of a normal tooth follicle, or from supernumerary follicles or Anlage. In the cyst cavities there are occasionally found imperfectly developed teeth. The *periosteal cysts* arise chiefly as a result of chronic inflammatory processes affecting the roots; they are termed accordingly *peridental*, *periodontal*, *subperiosteal*, or *root cysts*. A portion of these formations arise from collections of pus beneath the periosteum; others take their origin from granulation tissue growing about the roots. The inner side of the granuloma is lined with epithelium derived from the remains of the epithelium of the cement. The granulation tissue may become converted into a firm fibrous capsule forming the cyst wall, the root of the tooth projecting into the cavity of the cyst. Proliferation of the epithelium lining the cyst may lead to appearances similar to those of dermoid cysts. More frequently the cysts contain a clear, mucoid, or thick brown fluid. They occur most frequently in the upper jaw. Carcinoma may take its rise from the epithelium of the cyst wall. The *multilocular cystomata* of the jaw are very rare tumors, taking their rise from the follicle; epithelial proliferations from the follicle forming alveolar or gland-like structures, which become cystic. The cyst walls are usually very thin. The growths may reach a large size, and cause great destruction of the jaw bone. Though seldom becoming

carcinomatous the cysts cause great enlargement and atrophy of the bone, the bony layer over the cysts being sometimes as thin as paper, or in other cases the bone may entirely disappear, leaving the cyst covered only by periosteum.

Sutton ("Tumors Innocent and Malignant") defines the odontoma as a tumor composed of dental tissues in varying proportions and different stages of development, arising from teeth germs, or from teeth still in the process of growth. He classes them, according to the part of the tooth germ concerned in their formation, as follows: (1) *Epithelial Odontoma*, from the enamel organ; (2) *Follicular Odontoma*; (3) *Fibrous Odontoma*; (4) *Cementoma*; (5) *Compound Follicular Odontoma*, all from the tooth follicle; (6) *Radicular Odontoma*, from the papilla; (7) *Composite Odontoma* from the whole germ. For a description of these varieties and for illustrations of cases the reader is referred to this work.

Alfred Scott Warthin.

CEDEMA.—(Hydrops, dropsy.) An increase in the amount of lymph within the tissue spaces or serous cavities is known as *edema* or *dropsy*. The fluid itself is often called a *transudate*; but at the present time the distinctions formerly held between edema and inflammatory exudate, and transudate and exudate, are no longer emphasized, inasmuch as the essential etiological factors are common to both. Various specific terms are employed to denote the portion of the body affected by the condition of edema, as, for example, *hydrops* is usually limited to the collection of fluid within the body cavities, *edema* to the collection of fluid within the lymph spaces of the connective tissue or parenchymatous organs, *anasarca* or *hydrosarca* to an edematous condition of the skin or subcutaneous tissues, *ascites* to the collection of fluid within the peritoneal cavity; while *hydrothorax*, *hydropericardium*, *hydrocele*, *hydrophthalmos*, *hydrocephalus internus*, *hydrarthros*, *hydrops bursarum*, etc., are used to designate the collection of fluid in the pleural cavity, pericardium, scrotum, eye, cerebral ventricles, joints, bursæ, etc., respectively. Localizations of edema of great importance clinically are designated as *edema of the lungs*, *edema of the glottis*, etc. The edematous swelling of the presenting portion of the fetal head is known as *caput succedaneum*. Edematous conditions of the conjunctiva are termed *chemosis serosa*. The term *dropsy* in strict use should be confined to the collection of fluid within the body cavities, but is applied in a loose way to any edema or collection of fluid of such extent as to be evident by the ordinary methods of physical examination.

Lymph.—Since edema is a pathological increase of the lymph, it follows that the production of the former must depend upon a disturbance of the normal mode of lymph production. The clear watery fluid which permeates the intercellular spaces of the tissues and bathes the serous surfaces is known as the lymph. Its chief source is the blood, and its constituents are passed through the walls of the blood-vessels by processes of diffusion, filtration, and specific secretory activity of the cells of the vessel walls. Under certain conditions the fluid of the cells and other constituents of the tissues may also pass into the free fluid of the tissue spaces. According to Heidenhain the lymph is composed of fluid derived from the blood, the lymph of the organ under consideration, and the water contained in the tissue cells and fibres. The ultimate source is, of course, the blood. Formerly regarded as a passive filtration from the blood-vessels, the formation of lymph is now considered by the majority of investigators to be of the nature of a secretion of the cells forming the capillary walls. In support of the view of the selective action of the blood-vessel walls are the facts that the composition of the lymph differs greatly from that of the blood plasma, and differs also in its composition in different parts of the body; further, under certain conditions it may contain more salts and extractives (urea and sugar) than the blood. The rapid passage of crystalloid substances from the capillaries into the lymph is also a strong point in favor of the view that the pro-

cess is not one of mere diffusion, but is the result of a force inherent in the cells of the vessel walls. According to Heidenhain the specific function of the capillary walls plays a controlling part in the formation of lymph. Certain substances injected into the blood-vessels increase the production of lymph (extracts of leeches, mussels, crabs, peptone, etc.); and it is also possible that the capillary secretion is directly under nerve influence. It is very probable that certain edematous conditions of the skin (urticaria, herpes zoster, etc.) are partly intoxications and in part due to nervous disturbances. The function of the lymph is the conveyance of nutrition to the cells and the removal of their waste products. From the lymph spaces the fluid is gathered into the lymph vessels passing to the lymph nodes, from which it is passed on to the veins by the larger lymph trunks. Not all the lymph is returned in this manner; a portion is undoubtedly taken up directly into the blood-vessels; or at least in some of the lymph nodes a portion is taken up by the capillaries of the lymphoid tissue.

ETIOLOGY OF CEDEMA.—It follows that as edema is the result of an increase in the amount of lymph, such an increase may be brought about either by an increase in the amount of fluid passed out of the capillaries, or by some obstruction to the outflow of lymph through the lymphatics. In general, the causes of edema are the various pathological conditions which may influence the process of lymph formation. The increased production of lymph may be due to an increase of the vascular secretion, or to an increased permeability of the vessel wall. These conditions may be brought about by increase of blood pressure, by pathological alterations in the vessel walls, or by the direct action of certain substances either upon the cells of the vessel walls or upon the nerves governing these, stimulating the capillaries to increased secretion. Within certain limits an increase in lymph production is equalized by an increase in lymph absorption through the lymphatics and also through the blood-vessels. Beyond this limit there arises a more or less permanent over-saturation of the tissues with lymph, and the condition of edema is established.

According to etiology four general classes of edema may be distinguished: *edema from stagnation of the blood*, that resulting from obstruction to the outflow of lymph, that caused by disturbance of capillary secretion, and *edema ex vacuo*. Clinically, a great number of varieties may be recognized: *toxic*, *thermal*, *traumatic*, *inflammatory*, *cachectic*, *infectious*, *hydræmic*, *anæmic*, *neuropathic*, etc., but all of these fall within the four etiological classes above named, the great majority belonging to the third class, namely, that produced by disturbance of the capillary secretion through alterations in the vessel walls.

ETIOLOGICAL VARIETIES OF CEDEMA.—*Edema of Stagnation.*—Following an obstruction to the onward flow of the blood, resulting from ligation or occlusion of the main venous trunks, or in general venous congestion, due to insufficiency of the heart, the capillary pressure rises and an abnormal secretion of lymph takes place. That the edema is due directly to the increased blood pressure within the capillary cannot be said to have been definitely proved. It is probable that as a result of the increased pressure the cells of the capillary walls are stimulated to increased secretory activity. It is also probable that degenerative changes in the endothelium result from the distention of the vessel, so that as a consequence of an increased permeability of the wall serous transudation occurs. The fact that in many cases no changes in the vessel walls of an edematous area can be found favors the theory of increased secretion. In chronic congestion the occurrence of edema is also favored by the resulting loss of elasticity of the tissues about the vessels. An increase of arterial pressure does not give rise to edema so long as the venous return is unimpeded, but in all cases of passive congestion there is an increased formation of lymph. This may be compensated for by an increased flow of lymph, but beyond a certain limit the fluid collects in the tissues. In cases

of general passive congestion the edema first shows itself in the most dependent parts of the body, the influence of gravity favoring the greatest increase of pressure in the vessels of these parts. As in general passive congestion there is some obstruction to the discharge of the large lymph trunks into the veins, the lymph of the tissues is not removed so rapidly as normally. Local passive congestion gives rise to local edema; thrombosis of the femoral vein causing edema of the lower extremity, occlusion of the portal circulation being followed by ascites, etc. The fluid in edema of stagnation always contains but a slight amount of albumin. With increase of pressure the amount rises, and a varying number of red cells may escape from the vessels into the lymph.

Edema Caused by Obstruction to the Lymph Circulation.

—It has been shown by a number of investigators that obstruction to the current in the lymph vessels is not as a rule followed by edema, on account of the numerous and universal collateral anastomoses, and also for the reason that the lymph may be reabsorbed by the blood-vessels. An actual obstruction to the lymphatic circulation can, therefore, hardly occur except in the case of the main lymphatic trunks. Even in these cases, if the production of the lymph remains normal, collateral channels may be developed, sufficient to carry off the lymph without causing edema. According to Baldaert the total occlusion of all the lymph vessels of a part may give rise to a pure lymphatic edema, which in the case of increased formation of lymph may develop into a tissue edema. Obstruction of the thoracic duct by tumors, aneurisms, etc., is usually followed by chylous ascites. Even in this event a collateral circulation may be set up; but in other cases the rupture of the receptaculum chyli gives rise to a chronic chylorrhœa into the peritoneal cavity. In the case of edema caused by stagnation lymphatic obstruction causes a great increase in the degree of the edema present.

Edema Caused by Disturbances of Capillary Secretion.

—As the result of chemical changes in the blood, imperfect oxygenation, anæmia, infections, intoxications, long-continued passive congestion, trauma, effects of low or high temperatures, etc., certain pathological alterations in the walls of the vessels may be produced, of such a nature as to cause an increase in the secretion of the vessel walls and give rise to edema. The exact nature of the changes we are at present unable to state; in some cases the endothelial cells appear granular, cloudy, and are exfoliated; in other cases no changes in the cells can be discovered. It is also possible that alteration of the cement substance between the cells favors an increased transudation of fluid. The forms of edema produced by the above-named factors are known clinically as toxic, infectious, neuropathic, inflammatory, etc.

Edema ex Vacuo.—After degeneration or necrosis of portions of the tissue of brain or spinal cord the necrosed material is absorbed and the defect becomes filled with fluid of a very low specific gravity and containing but a small amount of albumin. In atrophy of the brain and cord the subarachnoidal space and the ventricles may become enlarged and filled with a similar fluid. This process may be regarded as being of the nature of a compensatory attempt to restore the normal tension of the part.

NATURE OF THE TRANSUDATE.—The fluid of edema is usually colorless or pale yellow, clear, and of alkaline reaction. A few leucocytes and red cells are usually present. In cases with accompanying icterus the fluid may be yellow or even brownish. An excessive number of red cells may give it a reddish tinge. The collections of fluid in the serous cavities are more likely to vary in color in a noticeable degree, and usually contain flakes of fibrin. Occasionally they may contain large numbers of desquamated endothelial cells, leucocytes, or fat droplets. After rupture of chyle vessels the admixture of chyle with the fluid of an existing ascites may produce a milky turbidity of the ascitic fluid. In other cases the milky appearance of transudates may be caused by a precipitation of albumin. The chemical composition of transudates is closely related to that of the blood plasma.

The amount of proteids, salts, and extractives is a varying one, and is usually less than that of the blood. Under certain conditions the salts and extractives may occur in greater amounts than in the blood, but the amount of albumin is always much less. The fibrin-forming elements may be absent or present in small amount. Mucin is occasionally present. The proportion of albumin in pure transudates varies greatly in different parts of the body. According to Reuss, the proportion of albumin in pleural transudations is 22.5 *per mille*, in pericardial 18.3, in peritoneal 11.1, in the fluid of subcutaneous edema 5.8, in that of cerebral and spinal cavities 1.4.

The following table of the specific gravity and albumin content of certain transudates is given by Thoma:

	Specific gravity.	Per cent. of albumin.
Ascitic fluid in nephritis	1.006	0.56
Ascitic fluid in portal obstruction (cirrhosis)	1.008	.97
Ascitic fluid in general venous congestion	1.012	1.96
Pleural effusion in nephritis	1.007	
Pleural effusion in general venous congestion	1.012	1.30
Transudates of varying origin	1.007-1.011	0.05-1.1

As a rule the specific gravity of a pure transudate rarely reaches 1.010, usually falling below, 1.006-1.008. In inflammatory edema the specific gravity may reach 1.016-1.020. In inflammatory edema the amount of albumin is much greater than in pure transudates. The presence of abnormal substances in the blood plasma (sugar, uric acid, bile pigments, potassium iodide, phenol, etc.) leads to the presence of the same in the fluids of the tissues and body cavities.

GENERAL MORBID ANATOMY.—Edematous tissues are usually pale, swollen, and as the result of the deficient circulation colder than normal. The degree of change varies with the part involved and the structure of the tissue. The skin and subcutaneous tissue may take up an enormous amount of fluid; the skin may become greatly stretched, and an extremity may swell to many times its normal size. As a result of the extreme distention the skin at first becomes greatly thinned, smooth, and shining, later presents linear lines of rupture from which spontaneous oozing of fluid may occur; in chronic edema the skin usually becomes thickened, rough, scaly, and pigmented, and may show numerous lineæ albicantes. The most characteristic physical sign of edema is that of pitting on pressure, indentations made with the fingers in edematous tissues persisting for some time, because of the diminished elasticity of the tissues. The lymph spaces of the skin and subcutaneous tissues may become so dilated that incision into these allows the fluid to escape in a constant stream. The appearance of the incised tissue is that of a partial liquefaction, so great may be the saturation with fluid. Edema of the skin usually appears first over the ankles and beneath the eyes. The loose integument of the penis and scrotum may show the most extreme degree of saturation.

Collections of fluid in the body cavities, when extreme and long continued, cause dilatation of the cavity and compression of neighboring organs. The serous surfaces become grayish and more opaque and usually present more or less desquamation. In edema of mucous membranes the mucosa becomes swollen, pale, grayish, more or less translucent, and of boggy consistence. In the case of the lung the alveolar spaces become filled with fluid, the presence of the fluid causes a loss of elasticity and a partial atelectasis. On section a more or less abundant frothy fluid escapes from the cut surface. In marked pulmonary edema the volume and weight of the organ may both be greatly increased. Solid organs like the liver and kidney from the nature of their structure rarely show a marked condition of edema. When present, the cut surface of the organ is moist and glistening.

The microscopical examination of edematous tissues shows enlargement of the tissue spaces, separation of the connective-tissue fibrillæ, vacuolization of cells and nu-

clei, and the presence of fine albumin granules in the spaces occupied by the fluid. In the alveolar spaces of the lungs large numbers of desquamated epithelial cells are also found. In chronic edema hydropic degeneration of some of the constituents of the tissue may take place. As a result of the lowered resistance of edematous tissues, and the mechanical injury caused by stretching, distention, etc., secondary inflammatory changes are of frequent occurrence in and about edematous tissues.

CLINICAL VARIETIES OF EDEMA.—*Inflammatory Edema.*—The edema associated with inflammatory processes is not of the nature of a pure transudate, but is usually classed under the head of exudates. Its etiology is, however, to be sought in alterations of the vessel wall similar to those which give rise to transudates, though of a more marked character. It occurs as circumscribed or diffuse swelling of tissues, or as effusions into the body cavities. It differs from transudates in the character of its fluid, which contains much more albumin and greater numbers of red cells and leucocytes, and a much greater proportion of fibrin-forming elements. It may be caused by any of the factors—infectious, toxic, traumatic, thermal, etc.—that give rise to inflammation. The edema often seen in the neighborhood of inflammations is known as *collateral edema*. Inflammatory edema is regarded by some writers as representing the transition stage between the vascular changes that give rise to pure transudates or edema, and those which lead to inflammatory exudation.

Toxic.—Heidenhain found that intravascular injections of the enzymes of the salivary, pancreatic, and gastric secretions, peptone, egg albumen, decoctions of the muscles of crabs and crayfish, etc., produced a marked increase in the production of lymph. He explained this phenomenon as due to the stimulation by these substances of the secretory functions of the cells of the vessel walls. According to Hamburger bacterial products circulating in the blood may either increase the permeability of the capillary wall or stimulate the endothelial cells to an increased or abnormal secretory function. A changed chemical condition of the blood may have a similar action. It has been suggested that edema may be caused by a lack of oxygen, the resulting chemical changes in the blood or tissues causing an increase in osmotic pressure in favor of the tissues over the blood or lymph. The edemas formerly regarded as *cachectic* or *hydræmic* are most probably caused by the altered functional activity of the endothelium due to changes in the composition of the blood. The edema of chronic nephritis is probably to be explained in the same way. The acute edematous conditions of the skin, such as urticaria, are also due wholly or in part to intoxication. The injection of certain protective or curative serums (plague serum) may be followed by extensive urticaria, or even by a more generalized edema.

Hydræmic or Cachectic Edema.—It was formerly held that a hydræmic condition of the blood, due either to a diminution of the solids of the blood or to a retention of water, could be a direct cause of an increased transudation through the vessel walls. The latter were believed to behave as dead animal membranes, and the process of edema formation to be one of pure osmosis. It was shown by Cohnheim that hydræmia was not the direct cause of edema. Even when the blood is replaced to the extent of one-half its volume by decinormal salt solution, so that there is produced a marked hypoalbuminosis, no edema is caused. In extreme hydræmic plethora, edema may supervene when the amount of water in the blood becomes very great; but it does not develop in the same regions where edema ordinarily is found. Further, the occurrence of one-sided hydrothorax, or of bilateral hydrothorax with unequal amounts of fluid in the two pleural cavities, must be taken as strong evidence of differences in the structure and function of the capillary walls in the two sacs. In general it may be said that hydræmia does not produce edema, but only favors its occurrence. The edemas which occur in chronic anæmia, cachexias, chronic nephritis, etc., are, therefore, to be regarded as due to changes produced in the vessel walls

by the altered condition of the blood or by poisons circulating in the blood. By Thoma and other writers it is believed that cachectic and hydræmic edemas are due to sclerotic changes in the vessel walls (*angiosclerotic edema*). A loss of elasticity of the tissues may also favor the formation of edema in these conditions. The fluid of hydræmic or cachectic edema contains but a small amount of albumin as compared to inflammatory edema.

Neuropathic Edema. Angioneurotic Edema.—If the production of lymph is dependent upon a secretory function of the vessel walls it is very probable that such function is under nervous control, and that under certain nervous disturbances an edema may arise which may properly be designated as neuropathic. This is borne out by many clinical observations. In hysterical individuals and in persons who have been hypnotized localized edemas may occur that admit of no other explanation. In epilepsy pale or red areas of angioneurotic edema are not infrequently seen, in the shape of wheals, general urticaria, etc. In Basedow's disease urticaria not infrequently occurs, as well as circumscribed, unilateral edema localized in the hands or legs. Erythema nodosum and herpes zoster are also regarded as partly toxic and partly neuropathic. Edema also occurs after spinal paralysis; and in hemiplegia the affected side shows a more or less well-marked edema. According to Janowski the severing of the vaso-motor nerves in conditions of edema is followed by a great increase in the amount of the exudate. Vaso-motor disturbances in myelitis, tabes, sciatica, etc., are also associated with the production of edema. Toxic, thermal, or traumatic irritation of the nerves may also lead directly to edema. It must be borne in mind, however, that many writers hold that the existence of a purely neuropathic edema has not yet been proved.

Edema Fugax.—Transitory edema is designated by this term. The majority of the so-called neuropathic edemas are of this nature. Transitory edema is of not infrequent occurrence in Basedow's disease, chlorosis, severe anæmia, hysteria, etc. Such edemas usually appear during the day and disappear after a night's rest.

False Dropsy (Hydropsia Spuria).—The distention of cavities, chiefly those of glands, following stenosis or obliteration of the gland duct. The fluid usually results from the retention of secretions; it may be a thin serous or a thickened mucous fluid. In this class belong hydro-nephros, hydrosalpinx, hydroys cystidis fellæ, hydro-metra, hydroys processus vermiformis, hydroys sacci lacrymalis, etc.

Edema Intermittens.—Intermittent edema has been described in cases of malaria, and in febris intermittens larvata. The whole body surface may be involved, but often the edema is confined to the extremities, thorax, etc. Intermittent ascites and intermittent hydrarthros have also been observed.

Edema Neonatorum (Sclerema or Scleroma Neonatorum).—A condition of the skin of the new-born characterized by an infiltration of serum into the subcutaneous tissue, hardening of the skin, and lowering of the skin temperature. Many theories have been adduced in explanation of this condition, but it is probable that scleroma represents a symptom complex and not an independent disease. The majority of children affected are those born prematurely. The affection begins usually on the second to the fourth day. After the eighth day it is very rare. Congenital cases have been observed. In the majority of cases the condition is fatal. The edema has not been satisfactorily explained, but is probably due to changes in the blood following cardiac insufficiency, deficient oxygenation, and changed chemical nature of the blood in some cases due to intestinal intoxication. D'Agata is of the opinion that the condition is of the nature of a vaso-motor and trophic vagus neurosis.

OCCURRENCE OF EDEMA.—Edema is of most frequent occurrence in all forms of cardiac insufficiency, especially failure of compensation in valvular disease, chronic nephritis, cirrhosis of the liver, chronic anæmias, and cachexia, conditions in the lungs favoring venous stasis,

thrombosis of large veins, or obstruction of these by tumors. In cases of hæmophilia after repeated hemorrhages edema often occurs. Myelitis with decubitus is often associated with edema of the lower extremities. Mediastinal tumors, or growths arising in the lungs or bronchial glands, or aneurism may cause edema of one-half the body through pressure upon the large veins. In chronic chloral poisoning general edema of the skin occurs, and in chronic morphinism edema of the face has been observed. In both acute and chronic rheumatism circumscribed or diffuse edema often appears in various parts of the body; in chronic rheumatism it is not infrequently associated with arteriosclerosis, particularly of the arteries of the foot and of the tibialis posticus. Edema is also often associated with arteriosclerosis dependent upon other causes, vessel walls which show sclerotic changes being more permeable than normal vessels. In cases of cancer and ulcer of the stomach edema may occur after severe hemorrhages. In chronic tuberculosis it is of less common occurrence. In this disease it is more often confined to one of the lower extremities, usually the left, as the result of marantic thrombi in the crural vein or some of its branches. When double-sided the edema is due to cardiac insufficiency or to the changed condition of the blood. The development of amyloid disease or tuberculous peritonitis usually leads to extensive or general edema.

Edema of the larynx occurs in laryngitis, nephritis, malaria, cardiac insufficiency, enlargements of the thyroid, aortic aneurism, pressure of tumors upon the jugular veins and their branches, after the use of potassium iodide, inhalation of hot air, in acute infections, variola, typhoid, etc., in leukæmia, and in tuberculosis, syphilis, and carcinoma of the larynx, etc. Edema of the pharynx occurs in the same conditions, but most frequently in scarlet fever and in chronic nephritis. The edematous mucosa is swollen, translucent, and pale, these changes being most marked over the soft palate and uvula. The latter organ may be greatly increased in length and thickness and may cause serious disturbances of respiration. Edema of the lung occurs especially in cardiac insufficiency, chronic nephritis, in connection with inflammatory conditions of the lung, and also in association with cerebral disease. Marked edema of the penis and scrotum is very common in cases of extensive general edema. Local edema of these parts occurs in cases of stricture, traumatic injury of the urethra, bladder and seminal ducts, in infiltrations of urine, in syphilis, and after operations upon the bladder or rectum as one of the first signs of a phlebitis in the plexus prostaticus. There appears also to be an idiopathic form of edema of the penis. In chronic edema of this organ there often results a marked phimosis and a thickening of the mucous membrane of the external meatus. Edema of the external female genitalia occurs after difficult labor, in cases of ovarian or uterine tumors, in abnormal position of the uterus, prolapse, etc.

In cases of infection with the bacillus of *malignant edema* there develops very rapidly a general subcutaneous edema, in the fluid of which many bacilli are found. Only a few cases have been reported in man, some of these following the injection of musk in the course of typhoid fever, others occurring during the puerperium, and others arising apparently without external injury. It is very probable that some of the conditions reported under this head were not in reality cases of infection by this bacillus.

PROGNOSIS.—The consequences of edema vary with the etiology, location, and extent of the process. Collections of fluid in the body cavities may cause compression of important organs, lungs, brain, etc. As a result of edema of the nerves, degenerations and loss of function may take place. Edema of the glottis may cause sudden death from suffocation. Edema of the lungs is very frequently the immediate cause of death in cardiac insufficiency, chronic nephritis, etc. Fatal intracranial pressure may be caused by acute transudation into the cerebral ventricles and submeningeal spaces. Serious in-

terference with respiration and circulation may be produced by pressure upon the lungs or diaphragm or by pleural or peritoneal dropsies. In general it may be said that the prognosis in œdema is serious because of the important pathological conditions underlying its appearance.

TREATMENT.—In general this is directed to the condition which gives rise to the œdema. Extreme distention of œdematous skin may be relieved by puncture and continuous drainage. Collections of fluid within the body cavities may also be removed by aspiration (see also *Ascites*).
Alfred Scott Warthin.

ŒDEMA NEONATORUM, or œdema of the new-born, was long confounded with "scleroma neonatorum"—a distinct affection. Œdema may occur in infants prematurely born or in those born at term but of poor vitality; it differs in these subjects in no respect from œdema in older patients, and can hardly be considered more than a symptom, associated as it is with many different conditions of the body. As with œdema in general the parts are soft, waxy white, pit on pressure, and in the more dependent areas the swelling is greatest. Bad feeding, defective hygiene, exposure to severe cold soon after birth, feeble heart action, and atelectasis of the lungs are all causes tending toward the production of the symptom of œdema in new-born infants. The treatment is that of the general condition and should be directed toward the underlying causes. Artificial heat to maintain the body temperature is an important adjunct.

Charles Townsend Dade.

ENANTHE. See *Poisonous Plants.*

ŒSOPHAGUS, PATHOLOGY OF.—The wall of the œsophagus consists of a mucosa, submucosa, inner circular and outer longitudinal muscular coats, and an external fibrous tunic. The mucosa is covered with stratified squamous epithelium, and contains sparsely scattered mucous glands and few lymph follicles. In the upper portion striped muscle is also present in the wall, in the lower portion only unstriped. The poor blood supply, the lack of mucous glands and lymph follicles, and the thick covering of stratified squamous epithelium render the œsophagus less liable to disease than the closely associated structures, the pharynx and the stomach. The independent part played by the œsophagus in affections of these organs is often strikingly shown in the sharply limited borders of inflammatory processes in the pharynx, the inflammation ceasing abruptly at the beginning of the œsophagus. Though œsophageal disease is relatively rare, it is nevertheless of very great clinical importance, not only from the fact that disease of the œsophagus may interfere with the proper passage of food into the stomach, and thus give rise to general impairment of nutrition, but also because of the proximity of this organ to such important structures as the trachea, lungs, and aorta. Further, the examination of the œsophagus is relatively difficult, and possible only through the use of special instruments or apparatus. (For methods of examination see *Stomach, Surgery of the.*)

CONGENITAL MALFORMATIONS.—Though relatively rare, these conditions are of practical interest, inasmuch as children so affected may live for some time after birth, or even reach adult age. The malformations may exist alone or in connection with other defects. The following forms have been described:

1. *Œsophago-tracheal Fistula.*—Abnormal communications between œsophagus and trachea may occur. The most common form is that in which the œsophagus at the upper third ends in a blind tube, while the lower portion opens at its upper end into the trachea or bronchus. The upper and lower ends of the obliterated œsophagus may be connected by a muscular band or a firm fibrous cord. This malformation may be due to primary disturbances of development, or may be acquired during intra-uterine life as a result of suppurative processes in the glands lying between the œsophagus and the trachea.

The upper part of the œsophagus may be closed in this way by cicatricial contraction, while the lower part may be connected with the lumen of the trachea, or the reverse condition may occur. Children showing this malformation may be otherwise well developed; they die shortly after birth from inanition or aspiration pneumonia. In this connection should be mentioned also the rare occurrence of cysts lined with ciliated columnar epithelium, lying between the œsophagus and the bifurcation of the trachea. These cysts represent remains of the communicating canal between œsophagus and trachea. They may reach such a size as to cause compression of the œsophagus and secondary dilatations of the same, and are therefore of clinical importance. In other cases they may be discovered only accidentally, having given rise to no symptoms.

2. *Stenosis.*—Partial obliterations or narrowing of the lumen may occur as congenital malformations of either the upper or the lower portion of the œsophagus. The lower end of the upper portion may open into the trachea, or may form a blind sac. In other cases the œsophagus may be open as far as the level of the bifurcation of the trachea, at which point complete obliteration of the lumen may be found. In a few cases a membranous stenosis or obliteration has been observed, or the lumen has been closed by a ring-like fold of mucosa. Those cases of obliteration in which the continuity of the œsophagus has been completely broken have been explained by the development of the trachea and bronchi at the cost of the œsophagus; while those cases in which the continuity is not wholly lost, but in which the two portions of the œsophagus are connected by a muscular band, have been explained as the result of a fetal pressure-atrophy. The conditions are rare; only the partial stenoses have clinical significance.

3. *Total absence* of the œsophagus is without clinical significance and is found only in acardiac monsters.

4. *A reduplication* of the œsophagus (*diœsophagus*) has also been very rarely observed. The reduplication may be complete or partial, and occurs in different degrees of double monsters. It is likewise without practical significance.

5. *Congenital Dilatations.* In very rare cases there has been observed just above the cardiac orifice a peripheral dilatation of limited extent, the so-called "fore-stomach" or "antrum cardiacum." Children presenting this anomaly usually show the clinical symptom of rumination.

CIRCULATORY DISTURBANCES.—*Active hyperœmia* occurs in the early stages of inflammatory conditions. It may be due also to the irritation of certain foods or drinks. *Passive congestion* occurs in all cases of general passive congestion, particularly in chronic heart and lung diseases, cirrhosis of the liver, etc. In chronic passive hyperœmia the mucosa of the œsophagus is dark bluish-red; the epithelium often shows plaques of thickening (leukoplakia). Local dilatations of the veins occur, the so-called *œsophageal hemorrhoids* or *varices* (see Fig. 3615). In the upper part of the œsophagus they are relatively frequent, forming small blue nodules or sacular elevations; these possess no clinical significance. In the lower portion of the œsophagus they occur even more frequently, particularly in the region of the cardiac orifice, or a few centimetres above this. The enlarged veins project above the level of the mucosa, and may form saccular papillomatous masses resembling rectal hemorrhoids. The dilated tortuous veins may be as thick as a lead pencil or even larger. They represent vicarious enlargements of the collateral branches connecting the portal circulation (through the vena coronaria ventriculi) with the vena azygos. They occur particularly in portal obstruction (cirrhosis, syphilitic hepatitis, pressure atrophy of the liver, obstruction or thrombosis of the portal vein), as well as in chronic passive congestion due to cardiac insufficiency. They are found in the majority of cases in connection with rectal hemorrhoids. Their presence is revealed clinically by hemorrhage, which may be fatal. As an early diagnostic symptom in cirrhosis of the liver bleeding from œsophageal hemorrhoids is of great im-

portance. Preceding the hemorrhage there may be observed pain in the stomach, swelling of the spleen, and distention of the abdomen, severe pain radiating from the stomach region to the shoulders or extremities—these symptoms are followed by sudden hemorrhage from the œsophagus. Similar symptoms are often seen preceding hemorrhages from piles. The cause of the œsophageal hemorrhage may be due to increase of venous pressure or to ulcerative changes in the mucosa over the varices. Rupture of the varix has followed coughing, severe muscular exertion, dyspnoea, etc. In other cases no direct cause for the hemorrhage can be found. Repeated hemorrhages of small size may lead to severe anemia. The relative frequency of hemorrhage from œsophageal varices makes the condition a dangerous one.

Œsophageal hemorrhages may be caused also by injury, ulceration, new growths, etc. The hemorrhages very often arise from the large vessels in the neighborhood of the œsophagus, rather than from its own vessels. Bleeding from the latter occurs particularly in cancer of the mucosa. An aortic aneurism may erode the wall of the œsophagus and rupture into the lumen; or, on the other hand, the œsophagus as a result of ulcerative or carcinomatous changes may break into the aorta, carotid, left auricle, etc. Such an event is most likely to happen in cases of œsophageal carcinoma. In whatever way produced, the entrance of arterial blood into the œsophagus makes itself known by the appearance of the blood vomited up, providing the hemorrhage is of sufficient volume to cause immediate vomiting. There may, however, be a continuous slight oozing from an eroded artery or arterial aneurism, and the blood passing into the stomach may be so changed that its arterial character is lost before vomiting takes place. In some cases the blood may be digested and passed on into the intestines.

RETROGRADE CHANGES.—*Œsophagomalacia* is in the great majority of cases a post-mortem digestion of the mucosa of the œsophagus by stomach fluids which have passed, after or during death, through the cardia into the œsophagus. The epithelium is macerated, desquamated, or liquefied; the musculature may also be liquefied and perforated, the stomach juices passing into the pleural cavity. In the lightest grades, which are present in the majority of cadavers, the mucosa of the organ shows longitudinal stripes of desquamation corresponding to the longitudinal folds of the contracted mucosa. An intravital œsophagomalacia is of very rare occurrence, but has been described as the *round* or *peptic ulcer* of the œsophagus, which corresponds in all particulars to the round ulcer of the stomach. An *agonal* œsophagomalacia has been observed in severe cases of cerebral disease.

Atrophy of the œsophagus wall occurs in cachexia. *Degenerations* of the œsophagus wall are of very rare occurrence and have been studied but little. *Necrosis* is the most important retrograde process found in this organ. The most common cause is pressure, either from foreign bodies lodged within the lumen or from the pressure of an aneurism or tumor from without. As a result of the local anemia caused by the pressure there occur necrosis and ulceration. The *peptic ulcer* has been mentioned. *Decubital ulcers* may be found in advanced stages of severe cachexia. *Noma* of the cheek or pharynx, gangrenous tonsillitis, or gangrene of the lung may be associated with *gangrene* of the œsophagus. Corrosive poisons may cause more or less extensive necrosis of the œsophageal mucosa associated with inflammatory changes. Gangrenous œsophagitis occurs also in severe infections as a rare complication.

INFLAMMATION.—*Acute catarrhal œsophagitis* is the most common form. It is caused chiefly by irritating foods or drinks, through extension of inflammation from the pharynx or stomach, or as a secondary phenomenon in some of the acute infections (measles, scarlatina, typhoid fever, variola). As a result of the small number of glands in the mucosa there is often but little secretion. The epithelium may be desquamated, and the mucosa beneath hyperœmic, or cloudy white, or yellowish. Small ulcers

may be formed over the surface of the folds, and these may heal with the formation of small longitudinal scars. In the case of foreign bodies deeper ulcers may be produced. The symptoms of acute catarrhal œsophagitis are, pain in swallowing, regurgitation, thirst, raising of



FIG. 3615.—(Œsophageal Varices. (After Kraus.)

secretion, pain on moving the neck, tenderness on pressure in the deep cervical region. Spastic contractions of the œsophagus may also occur.

Chronic catarrhal œsophagitis occurs chiefly in smokers and drinkers, as well as in individuals suffering from chronic pharyngitis or, more rarely, gastritis. The condition is often secondary to the chronic passive congestion caused by cardiac or pulmonary disease. It is found also in the portion of the œsophagus above a stenosis. It may be associated with diverticula. In cases of chronic gastritis characterized by frequent eructations of irritating substances or by frequent vomiting of the same, there may be produced a chronic œsophagitis, which may be of a purulent or ulcerative character. This condition is not infrequently found in old men.

Chronic œsophagitis may not always give rise to symptoms. In severe cases there may be pain and discomfort in swallowing. The pain has usually the character of pressure, more rarely it is stinging or burning; when it is severe, spastic contractions and regurgitation may occur. Moderate quantities of mucus may be expectorated; this may occasionally contain streaks of blood. The differential diagnosis from the accompanying affections of pharynx or stomach is often very difficult. The symptom of dysphagia, less marked in the case of fluids than in the swallowing of solid substances, is the most constant and characteristic symptom. Examination with œsophagoscope or sound is usually difficult, but is necessary for the exact determination of the condition. This is of great importance, inasmuch as the symptoms of chronic œsophagitis and beginning carcinoma of the œsophagus are the same; and the differential diagnosis can be made only by means of the œsophagoscope.