was sharply defined. The most important sign, however, is the presence of distended veins in the abdominal and lower thoracic walls. The veins are sometimes tortuous and varicose, and may reach the size of the little finger. The anastomosis is performed by the superior and inferior superficial epigastric, the long thoracic, the superficial circumflex iliac, the external pudic, the lumbo-vertebral anastomotic trunk of Braune, and various other veins. There is also communication through the visceral veins and the azygos. When the anastomosis is chiefly through the deep vessels to the exclusion of the superficial ones, the diagnosis becomes much more difficult, if not indeed impossible. Should occlusion of the renal veins occur as well, hæmaturia and albuminuria may be present, yet these are more often absent than present. The diagnosis is rendered still more probable when one is able to determine the presence of retroperitoneal new growths in the upper part of the abdomen or of tumors at the hilus of the liver. Schlesinger (*Deutsche med. Woch.*, S. 460, 1896) has pointed out that in a few cases the obstruction is in one leg only. This may be due to the existence of a collateral circulation on one side due to a former iliac thrombosis; to complete occlusion of the iliac on one side with a parietal thrombosis of the inferior cava; or to congenital duplication of the cava.

Thrombosis of the portal vein is perhaps more commonly of the septic variety (portal pylephlebitis). This is one of the common accompaniments of abscesses of the liver. The affection as a rule extends from the mesenteric vessels and is not uncommon in appendicitis. Simple portal thrombosis when it develops gradually is hardly to be diagnosed. When present the symptoms are those of portal obstruction, viz., ascites, hæmatemesis, enlargement of the spleen, dilatation of the superficial abdominal veins, and progressive emaciation. The symptoms may, however, be far from characteristic, or indeed may be absent. In general, however, the acute onset, the intensity of the portal obstruction, and particularly the quick return of the ascites after tapping are very suggestive. These points are of all the more importance when the signs develop in a hitherto healthy person or in the course of some affection not ordinarily associated with portal obstruction.

Thrombosis of the mesenteric veins is usually due to ulceration or other inflammatory lesion of the intestines. It is rather common in appendicitis. As a rule the superior mesenteric vein is first and chiefly affected. The condition is frequently a thrombophlebitis. There may be no symptoms, but generally there are intense abdominal pain, tympanites, vomiting, sometimes bloody, melæna, and collapse.

Thrombosis of the renal veins is comparatively common, especially in children with marasmus. It may extend from the vena cava, but may be primary. Contrary to what one would expect, hæmaturia and albuminuria are rather more often absent than not.

Thrombosis of the splenic vein is rare. It is usually associated with abscess or infarction of the spleen, or disease of the pancreas. In some cases the process spreads in a retrograde manner from the mesenteric and portal veins, as in one of my cases. Welch has met it also in calcification of the splenic vein, and Köster in typhoid. Infarction and necrosis of the organ may result, as in a case arising from torsion of the pedicle, described by Osler.

Obliteration of the superior vena cava is excessively rare as an autochthonous condition. Generally it is due to the pressure of a mediastinal growth, enlarged glands, or an aneurism. The symptoms, when characteristic, are cyanosis and œdema of the face, arms, neck, and thorax, and dilatation of the veins over the anterior aspect of the thorax and upper part of the abdomen.

Thrombosis of the pulmonary veins is usually secondary to lesions of the lungs, such as gangrene, tumors, abscess, emphysema, pneumonia, and tuberculosis. It may rarely give rise to emboli in the general arterial system.

Thrombosis of the innominate, subclavian, and jugular veins is met with in connection with cardiac disease and compression. Occasionally it is seen in acute rheumatism, tuberculosis, empyema, traumatism, marasmus, and infection. Thrombosis of the jugular frequently originates in thrombosis of the lateral sinus in cases of mastoid suppuration, and may give rise to general infection. The symptoms in the various forms are analogous to those already described.

Treatment.—Cases must be treated on their merits. Marasmus, enfeebled circulation, and infection being the important etiological factors, one should endeavor to promote nutrition, to strengthen the heart, and to prevent complicating infection. In the last event, should the focus of infection be accessible, it should be treated on surgical principles. We are, however, unable to control the process of thrombosis directly, so that our further efforts should be directed to assisting the establishment of collateral circulation, in order to minimize the effects of congestion and to prevent gangrene. These measures are, however, only applicable to the affection when it involves the extremities. In the case of venous thrombosis of the lower extremities the *utmost care must be taken to avoid detaching the clot*, on account of the imminent risk to life from pulmonary embolism. Here "masterly inactivity" is the watchword. Absolute rest must be enjoined, suitable diet prescribed, and the limb fixed in a proper position. In the case of the lower extremity the patient should lie on the back, with the limb on an inclined plane. The limb should be wrapped in cotton-wool. If pain be severe, applications of lead and opium should be employed or morphine be given internally. All manipulation and even palpation of the limb should be strictly avoided. Massage is absolutely contraindicated. I have known death to result from this irrational procedure. To insure fixation of the limb plaster of Paris may be applied to the hip. The patient should be confined to bed in an average case for at least six weeks. The danger can hardly be said to be past, however, for two weeks longer. During convalescence gentle bandaging should be adopted or a long stocking worn.

Should gangrene result, the case must be treated on ordinary surgical principles. *Albert George Nicholls.*

THRUSH. See *Mouth, Diseases of*, in The Appendix.

THYMACETIN.—An analgesic, prepared and named by Hoffman, of Leipsic, and brought to the notice of the profession in 1892 at a meeting of the Berlin Association for Psychiatria and Nervous Diseases, by Prof. F. Jolly (*Cent. f. die gesam. Ther.*, February, 1892). It is closely allied to phenacetin, bearing the same relation to thymol that the older drug does to phenol. It occurs as a white crystalline powder, only slightly soluble in water. Professor Jolly described the results of a series of experiments upon animals, with this drug, and its use in a number of cases of nervous and mental diseases. He did not find that it had any antipyretic action, but its analgesic and hypnotic properties were undoubted. He found it of most service in headaches and pain of a purely nervous character, but when there was any organic disease it failed to produce any beneficial effects. He considered its action equal to that of phenacetin. As an hypnotic it was administered with success. The dose ranged from three and three-quarters to fifteen grains. No toxic action was noticed, but it produced an acceleration of the pulse and a complaint, in some cases, of a fulness, beating, and noises in the head. *Beaumont Small.*

THYME or **GARDEN THYME.**—(*Herba Thymi*, P. G.; *Thym*, Cod. Med.). The dried herb of *Thymus vulgaris* L. (fam. *Labiatæ*).

The common garden thyme is a low, slender, more or less hairy, much-branched shrub, a foot or less high, with brown, nearly cylindrical branches, minute, opposite, narrowly oval or lanceolate leaves, and blunt, interrupted, spike-like clusters of violet-colored flowers terminating the branches. Flowers small. Calyx and corolla both labiate. Stamens four, sometimes short and equal, at other times long, exserted, and in pairs. It

is a native of Southern Europe, but cultivated there and elsewhere for centuries.

Thyme has but little history as a medicine, being mostly used as a condiment and flavor for soups, etc. It has, however, far more important medicinal properties than others of its class. Since these are almost wholly due to the volatile oil and its contained thymol, they are considered below in connection with those substances. It contains about two and a half per cent. of volatile oil, with a small amount of tannin and other unimportant constituents. The dose of thyme is 2–4 gm. (gr. xxx.–lx.).

Fig. 4710.—Thymus Vulgaris. Flowering branch, about half natural size. (Baillon.)

Oil of Thyme (*Oleum Thymi*, U. S. P.) is thus described by the Pharmacopœia.

"A yellowish or yellowish-red liquid, having a strong odor of thyme, and an aromatic, pungent, afterward cooling taste. It becomes darker and thicker by age and exposure to the air.

"Specific gravity: 0.900 to 0.930 at 15° C. (59° F.).

"It does not fulminate with iodine.

"The oil is soluble in half its volume of alcohol, forming a clear solution which is neutral or only very slightly acid to litmus paper. The oil is also soluble, in all proportions, in carbon disulphide, and in glacial acetic acid.

"With a drop of ferric chloride T.S. the oil yields a greenish-brownish color, which changes to reddish.

"If 1 c.c. of the oil be shaken with 10 c.c. of hot water, and, after cooling, the liquid be passed through a wet filter, the filtrate should not assume, with a drop of ferric chloride T.S., a bluish or violet color (absence of *carbolic acid*)."

The oil thus described is what is known commercially as the *brown* or *red oil*, besides which there is a *white oil*. The latter was formerly described by the Pharmacopœia, but is, as a matter of fact, medicinally inferior to the former, though it is preferred for those purposes in which absence of color is an object. The commercial oil varies most widely in its characteristics, even when genuine, and the official description should be carefully observed. Although oil of thyme is of complex composition, its properties are essentially those of its thymol, of which the amount should be from twenty to twenty-five per cent. Occasionally a larger or smaller part of this is naturally substituted by carvacrol. *Cymene* and *thymene* are also present. The dose of the oil is one to five, or even ten minims.

Thymol ($C_{10}H_{14}O$) is also official, and is defined as "a phenol occurring in the volatile oils of *Thymus vulgaris* L., *Monarda punctata* L., and *Carum Ajowan* (Roxb.) B. et H., and is thus described:

"Large, colorless, translucent crystals of the hexagonal system, having an aromatic, thyme-like odor, and a pungent, aromatic taste, with a very slight caustic effect upon the lips.

"Its specific gravity, as a solid, is 1.069 at 15° C. (59° F.), but when liquefied by fusion it is lighter than water. It melts at 50° to 51° C. (122° to 123.8° F.), remaining liquid at considerably lower temperatures. When triturated with about equal quantities of camphor, menthol, or chloral, it liquefies.

"Soluble in about 1,200 parts of water at 15° C. (59° F.), and in less than its own weight of alcohol, ether, or chloroform; also readily soluble in carbon disulphide, glacial acetic acid, and in fixed or volatile oils.

"Its alcoholic solution is optically inactive.

"If a very small crystal of thymol be dissolved in 1 c.c. of glacial acetic acid, and then six drops of sulphuric acid and one drop of nitric acid be added, the liquid will assume a deep bluish-green color.

"If 1 gm. of thymol be heated in a test tube, in a water-bath, with 5 c.c. of a ten-per-cent. solution of sodium hydrate, a clear, colorless, or very slightly reddish solution should be formed, which becomes darker on standing, but without the separation of oily drops (absence of *thymene*, or lævogyrate *pinene*, $C_{10}H_{16}$). If to this solution a few drops of chloroform be added, and the mixture agitated, a violet color will be produced.

"When a crystal of thymol is heated in an open capsule, or in a watch-glass, on a water-bath, it should gradually volatilize, leaving no residue (absence of *paraffin, spermaceti*, etc.)."

Thymol, besides its important properties as a carminative and intestinal and general stimulant, shared by the volatile oils of the *Labiatæ* in general, is one of the most useful antiseptics which we possess. It is of the greatest service both for its application to the outer surface of the body and to all mucous surfaces, and especially in purulent and other septic catarrhal disorders, and as an intestinal disinfectant. Its value for the latter use depends upon the energy and permanence of its effects, it being superior in these respects to carbolic acid, yet possessed of but very slight poisonous properties, large doses being required for the production of poisonous effects. It is the principal active constituent of "listerine," with which the *Liquor Thymoli Compositus*, or *Antiseptic Solution*, is practically identical. The dose of thymol is one to five grains. An ointment of thymol, strength five per cent., is frequently of great value in relieving itching. *Henry H. Rusby.*

THYME, WILD, or *Serpyllum*, is the herb *Thymus Serpyllum* L., native of the Old World and sparingly naturalized in the United States. The stems are much more slender even than those of garden thyme, partly prostrate, and usually reddish and pubescent. The leaves are shortly petioled, opposite, scarcely one-fourth of an inch in length, and about half as broad, ovate, the flowers small, pale, and darker-spotted. Its odor and taste are similar to those of garden thyme, and it contains a volatile oil practically identical with that of oil of thyme, with which its properties agree.
Henry H. Rusby.

THYMOFORM is a yellowish, tasteless powder composed of formaldehyde and thymol and smelling feebly of the latter. It is insoluble in water, mineral oils, or glycerin, but dissolves in alcohol, ether, chloroform, and olive oil. It is an antiseptic dusting powder.
W. A. Bastedo.

THYMOL CARBONATE AND THYMOL-URETHANE. See *Thymotal.*

THYMOL CHLOR-METHYL-SALICYLATE is a white crystalline powder which is insoluble in water, but is soluble in alcohol, ether, acetic ether, and in dilute solutions of the alkalies. It is used as an antiseptic.
W. A. Bastedo.

THYMOTAL.—Tyratol, thymol carbonate—is prepared by passing phosgene gas (COCl) through a twenty-per-cent. solution of sodium hydroxide in which thymol is dissolved. It is a white, nearly tasteless crystalline body with a faint thymol odor. It passes through the stomach unchanged, but probably splits up in the intestine. It is employed as an anthelmintic in dose of 0.5–1 gm. (gr. viij.–xv.) for children, and 2 gm. (gr. xxx.) for adults.

Pool, of Dutch Guiana, says it is better than thymol for the anchylostomum duodenale.

Thymol urethane has a similar use and dosage.

W. A. Bastedo.

THYMUS.—Introduction.—The thymus gland (also known in English as the thymus, or popularly as the neck or throat "sweetbread"; in German as the Thymus, Thymusdrüse, Brustdrüse, Bries or Briesel; in French as thymus) enjoys the unique distinction not only of being a transitory organ of extra-uterine life in man, but also of existing in three or possibly four distinct and different morphological conditions during its life history.

Comparative Anatomy.—This organ is not, however, peculiar to man, being present in all vertebrata, including the lampreys (cyclostomata) in which its existence was considered doubtful until recently. Its development does not proceed so far in some of the lower vertebrate animals as in mammals, being often arrested at the epithelial stage as seen in certain fishes where, during life, the thymus is an epithelioid organ, or rather an epithelial, mucus-secreting gland. In other fishes, in reptiles, and in birds it usually attains the condition of a lymphadenoid structure and persists through life, though it may undergo retrograde metamorphoses. In mammals the thymus passes through certain changes leading to its complete transformation into indifferent tissue before adult life is attained, but to this rule there are many exceptions, as one may discover by careful dissection of such animals as the rabbit, guinea-pig, dog, cat, cow, and horse. It is by no means uncommon to find large, well-developed thymus glands apparently quite like the "sweetbread" of the calf or lamb among adult animals of the varieties mentioned. This is the case in man, as we shall see later.

Embryology.—Until comparatively recent years the embryology of the thymus was obscure; but the observations of Renaut, Kölliker, Stieda, Born, Rabl, and Mall have pretty thoroughly established the developmental history of the organ. The generally accepted idea now is that in the higher orders, and probably in all vertebrata, the thymus develops as a paired organ from the third pair of gill clefts, and according to most authorities from the endodermal lining of these clefts, though His first held that the ectoderm furnished the component cells of the thymus anlage, and Kastschenko maintained that both ecto- and endodermal cells participated in forming the primary organ. The anlage of the thymus is a pouch of endoderm forming in the third gill cleft, and in a human embryo of the fifth week His found this pouch open. Originally the thymic pouch communicates with the fore gut or pharynx, but this connection is soon lost and the elongated sac with thickening epithelial walls, first lying transversely across the future neck, becomes free from its moorings to the gill clefts and shifts toward the tail, the larger dorsal end becoming the future head of the organ. The lumen of this cylindrical sac remains open, how long is still unsettled, though the twelfth week in man is the period usually assigned, after which the anlage becomes a solid cord of cells with numerous buds. Thus in its first appearance this organ is similar to a secreting tubular or acinous gland. A shifting of the endodermic anlage continues in the direction of the future thoracic cavity along the vagi and carotid arteries, reaching almost to the heart, finally making the lobes into which the fully formed organ is divided.

But the anlage does not long enjoy a strictly endodermal structure, for blood-vessels push in from the mesoderm and soon after round cells, presumably also of mesodermic origin, insinuate themselves into the epithelial cords, while others gather about to form investing masses which soon predominate. As we shall see later, these mesodermic cells form the larger bulk of the fully developed thymus, which, even in the fœtus, attains great size.

The preceding account represents the most widely accepted views relative to the origin of the thymus in man, though such points as the possible participation of other (the fourth) gill clefts and of the ectoderm should be mentioned. In vertebrates below mammals variations are seen, the second gill cleft in the frog, the first four in fishes, and the second, third, and fourth being at times called upon. The questions as to the time of closure of the lumens of the tubules in the anlage and the relation of these tubules to the corpuscles of Hassall (*vide infra*) are still under discussion.

It is at least worthy of passing notice that some similarity exists in the development of the thymus and several organs in its immediate neighborhood, like the tonsils, thyroid, and parathyroids, though the full details regarding their embryology have not been established.

Anatomy.—The fully formed human thymus makes an organ of considerable size lying in the anterior mediastinum at or near the median line. It generally consists of two broad and flat lobes more or less closely united with vascular connective tissue, and enveloped by a continuous sheath of fascia partly from the deep fascia of the neck and in part a reflection of the cephalic portion of the pericardial sac. As this smooth capsule is stripped from the organ several layers of loose areolar tissue come into evidence, the deeper ones of which send offshoots into the substance of the gland. The cephalic extensions of the thymus bring it almost in touch with the lateral lobes of the thyroid, to which it is united by a cord-like mass of dense connective tissue containing branches of the inferior thyroid artery and some veins. Downward, the thymic lobes reach well upon the pericardium, a distance of two or three finger-breadths, and to the interval between the second and fourth ribs. Its ventral surface is separated from the manubrium sterni by loose areolar tissue. Dorsally, its thoracic portion lies in relation to the arch of the aorta, the aortic branches, and the left innominate vein. The body and edge of the right lobe adjoin the innominate artery, superior vena cava, and right phrenic nerve; while the left lobe comes close to the common carotid artery and left phrenic nerve. Both vagi and the recurrent laryngeal nerves lie well behind the lobes of the thymus, and this is the case with the carotids in the cervical region. Here, also, the continuation of the organ brings it to lie beneath the origin of the sterno-hyoid and sterno-thyroid muscles, and in front of the trachea, everywhere more or less separated by loose connective tissue and fat. Thus it is seen that the thymus lies partly in the neck and partly in the chest, its thoracic portion being the expanded leaflets or lobes, its cervical portion consisting of the narrow finger-like extensions of these lobes. The organ might aptly be compared to two small, rather thin hands in the index attitude, the two fingers lying closely together and pointing upward. As a whole the organ is loosely held in position; it can be easily moved sidewise and lifted somewhat, and, after severing its thyroid connections, it shortens and sinks into the chest.

The blood supply of the organ is derived principally from the mediastinal branches of the internal mammary artery, and from the inferior thyroid. Its dorsal surface, applied to the pericardium, is penetrated by minute branches of the pericardial arteries. All its arteries are comparatively small, thus differing from those feeding the thyroid. On the contrary, the thymic veins are large, making a stem 3 mm. in diameter lying between the lobes and terminating in the left vena innominata (Dwornitschenko).

The lymphatics are numerous and large. They enter the glands of the anterior mediastinum and, according to Astley Cooper, two large vessels proceed, one from each lateral lobe, to open by one or more orifices into the internal jugular vein (Quain's "Elements of Anatomy," tenth edition, vol. ii., pt. ii., p. 556).

When fully exposed by dissection the thymus, in the height of its development, is a soft, smooth, pinkish, or pinkish-gray, bilobed, flattened organ, slightly concave dorsally where it lies against the heart's sac, widest below and tapering above. Because of the penetration of connective-tissue bands into its substance it is mapped out into distinct lobules and sublobules, giving it the

"sweetbread"-like appearance, not unlike that shown by the pancreas or the salivary glands. Within the lobules it is often possible to make out distinct rounded or polygonal follicles. A milky juice has been described by the older anatomists as coming from the cut organ especially in young children, or in adults in whom the organ was persistent and enlarged, and this circumstance has recently been alluded to as possibly of pathological significance. Probably, however, this condition is the result of a post-mortem softening; one of the artifacts to which the organ is prone. Of the same nature is the central canal with its lateral branches, or the "central cavity" so persistently mentioned in descriptions of the human thymus even in some present-day treatises on anatomy.

At the height of its normal growth the thymus attains a length of 9.5 cm., a width of 5 cm., a thickness of 1 cm., and weighs 20 gm. It sinks in water with a displacement of 21 c.c. But the organ may depart widely from the average standard; it may be larger or smaller. Its relations will vary according to its size, and it may lie to the left or right of the median line. A bridge of true thymic tissue may come in direct contact with the thyroid gland, or 3 or 4 cm. may intervene between the thyroid lobes and the cephalic extensions of the thymus. Sometimes the distinct divisions into lobes may be lost, or one lobe may greatly exceed its fellow in size. Multiple lobes, from three to seven or eight, may at times be found. Small lobes or islets of thymus tissue are sometimes found at a considerable distance from the organ proper, making *accessory thymuses*, as also seen in the case of the spleen and thyroid.

Histology.—The connective-tissue envelope of the active thymus sends offshoots or septa into the gland, dividing the lobes into lobules, and these again into secondary lobules from 4 to 11 mm. in size, finally separating the lobules into smaller, roughly spherical foci of solid thymic tissue termed follicles or acini, from 0.4 to 0.7 mm. in size. Ordinary white fibrous tissue mixed with elastic fibres makes the principal part of the enveloping sheath or capsule surrounding the thymus; in this more or less fat is mixed, depending upon the proportion of adipose tissue in the body at large. In the finer septa isolating the follicles or acini only loose white fibres with delicate elastic fibrils are present (Mall).

The follicles consist throughout of adenoid tissue, giving the impression made by the follicles of the lymph glands, even to the extent of showing a lighter central portion and darker periphery. This resemblance is heightened by the fact that the vast proportion of the elements composing the thymic acini are lymphoid cells. But more careful examination with higher magnifying powers brings out an evident difference between the central portion or medulla, as it is called, and the germinal centre seen in the follicle of lymph nodes. The darker, more solid peripheral portion of the acinus (cortex) is quite similar to the bulk of tissue composing the follicle of a lymph gland.

The cortical and medullary portions of the thymic acini are not sharply circumscribed. In general the reticulum of the medullary substance forms a network or framework of branching cells whose processes communicate with each other and with the walls of the blood-vessels. The nuclei of these radiating cells are 6–8 μ in size and rather poor in chromatin. In the meshes of the network lie small mononuclear leucocytes with nuclei 3–5 μ in diameter (lymphocytes); larger leucocytes with polymorphous nuclei are more seldom present, along with the eosinophilous cells described by Schaffer, which are also found along the blood-vessels of the interlobular connective tissue. Multinuclear (giant) cells are also to be found in the medulla, which, according to Watney, are derived in part from the cells of the framework. But, as Schaffer finds, there are also multinuclear cells which are united with the capillaries at the ends of which they are located and with whose retrogression they are related. At certain points the constituent cells of the framework press closely together, making flattened polyhedral objects whose arrangement resembles that of stratified epithelium. Here the extraneous (multinuclear) cells are entirely absent or only sparingly found. These nests or cords of epithelium, deprived of blood-vessels, show, at certain places where they adjoin the connective tissue, a layer of higher cells which resemble those in the basement layer of a stratified epithelium. That the medullary substance of the thymic follicle arose from an epithelial anlage cannot well be doubted from the outspoken epithelial nature of the cells just described, which must be regarded as direct descendants from the anlage. It is more difficult to decide whether the radiating cells of the medullary framework are epithelial in origin. In preparations stained after Van Gieson's method a portion of the medullary framework shows connective-tissue fibres, indicating that a part at least of this network is mesodermic in origin.

Besides the epithelial islets just described one finds in the thymus of advanced embryos, in greater numbers in the fully developed organ, and in the early stages of its retrogression, numerous characteristic objects varying in size and condition. These bodies are known as the concentric or lamellated corpuscles of Ecker, Hassall's corpuscles, or thymic corpuscles. They abound in the medulla exclusively. In the simplest form they are spherical bodies 13–22 μ in diameter, with a central portion feebly refractive, homogeneous, or granular, surrounded by shell-like flattened epithelial cells. The nuclei of the epithelial cells are plainly discernible, or they may be swollen, with their chromatin dispersed or even entirely missing. Here and there between the constituent cells leucocytes appear which may even penetrate to the central mass of the corpuscle. These bodies closely resemble the epithelial cell-nests or pearls seen in epitheliomas. Their nature and origin was long obscure, but the embryological studies of His and Stieda have thrown light on the question, which is not, however, even now definitely settled. According to the authorities just quoted the formation of these bodies is due to the separation of the primary thymic epithelium into isolated portions by the ingress of mesodermic elements, the pressure apparently producing their spherical contour, after which a degeneration of the central cells ensues, though this degeneration does not follow a uniform course. Usually a homogeneous refractive mass appears; at other times refractive granules, droplets, or flakes form. Whether the homogeneous substance is colloid, or not, is undetermined, though the microchemical test of Amman shows the same color-reaction as that given by the colloid of the thyroid gland. The substance is compared to that of prostatic stones by Kölliker. It certainly is a proteid and not a fatty substance, though both fatty and calcareous changes occur in Hassall's corpuscles. Frequently concentric corpuscles are seen in which the nuclei have entirely disappeared and the cell substance has become reticulated; or it undergoes transformation into soft masses which give a mucin reaction.

Along with the simple concentric corpuscles, bodies appear with multiple centres from which the cell layers radiate. Irregular forms, spindle- or club-shaped, or variously bent and knotted, also abound. But in all these corpuscles the concentric disposition of the component parts is retained. These bodies may reach a size of 0.1 mm. It is important not to confuse with these true thymic corpuscles epithelial cell-masses devoid of the concentric arrangement, found especially in individuals of advanced age, in which the thymus is well along in its retrogression; they attain a diameter of 0.2–0.3 mm., and may be designated epithelial spherules.

In poorly fixed or macerated specimens the Hassall corpuscles and epithelial spherules readily fall out during preparation; and where several of them have been in contact, a space is left which may easily be mistaken for a central canal. The loss of large epithelial spherules from the medulla may give the impression of considerable cavities here, but these artifacts are not to be confounded with cavities clad with ciliated epithelium, first noticed by Remak, which are of embryonic origin due to im-