normal and the cut surface is pale as compared to the gray color of a normal node. There is no tendency to necrosis.

There may be hyperplasia of the lymph nodules in the organs, such as the liver, spleen, and kidney, and in the walls of the intestine; but diffuse infiltration of the viscera with lymphocytes is not seen. The changes in the blood are those of a severe anæmia of a chlorotic type, without increase in the number of leucocytes. Pinkus has recently claimed that all cases of Hodgkin's disease show a relative lymphocytosis, but this has not been proven and the cases which the writer has been able to observe have shown no such change. Death is usually due to some intercurrent condition or to the mechanical action of the tumors—as, for example, compression of the trachea.

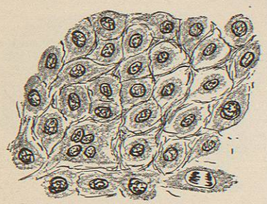

FIG. 3314.—Lympho-Sarcoma. The intercellular connective tissue is well developed in distinction from that in small round-cell sarcoma. (Dr. F. C. Wood.)

2. Tuberculous hyperplasia of a smaller or larger number of nodes. A number of cases have been described which ran a clinical course exactly similar to that of Hodgkin's disease, but showed on autopsy either nodes with a large amount of necrosis and tubercle tissue, or a simple hyperplasia of the nodes without any morphological tubercles in these nodes. Tubercle bacilli can be demonstrated by staining or by animal inoculations. The blood of such cases shows the anæmia characteristic of Hodgkin's disease. Pinkus claims, however, that a relative lymphocytosis is not present in the tuberculous cases.

3. Hyperplasia of the lymph nodes in connection with either lymphatic or myelogenous leukæmia. Such hyperplasia is of more or less constant occurrence, especially in the lymphatic types, but the enlargement rarely reaches the extent seen in Hodgkin's disease. The examination of the blood reveals the nature of the disease. The nodes may be simply hyperplastic, with a great increase in the number of lymphocytes and a loss of the characteristic morphology, as is seen in lymphatic leukæmia, or the nodes may show alterations known as myeloid degeneration in cases of myelogenous leukæmia. This change consists in the appearance, in the lymph node, of structures found under normal conditions in the bone marrow only. These are the myelocytes or characteristic cells of the marrow, with the granulations proper to the three types which are found in that situation. These myelocytes are deposited in the node and there proliferate, forming small masses of a structure strikingly different from that of normal lymphoid tissue with its small non-granular cells. The nodes in the acute forms of lymphatic leukæmia often show hemorrhagic areas; these are less common in the chronic leukæmias.

4. Lymphosarcoma. This form of primary new growth arising in lymph nodes is distinguished from the tumors formed in Hodgkin's disease by the fact that it does not retain the normal morphology of the node but rapidly proliferates and breaks through the capsule to infiltrate the surrounding tissues and to form metastases in other portions of the body. The tumors show a marked tendency to degenerate and soften at their centres. Another point of differentiation between lymphosarcoma and the hyperplasias of the lymph nodes is in the large amount of connective-tissue reticulum between the cells of the former. This also aids in differentiating these tumors from the small round-celled sarcomata in which the connective-tissue reticulum is small in amount, or entirely absent in portions of the growth.

The lymphosarcomata may involve only a group of nodes, or a number of nodes in different portions of the body may enlarge simultaneously and by their metastases give rise to a general sarcomatosis with a diffuse infiltration of the tissues of the body, especially those of the liver and kidney.

5. Sarcoma. Primary sarcomata of the lymph nodes are rare. They must not be confused with the lymphosarcomata which usually involve a number of nodes simultaneously and diffusely infiltrate the organs of the body. The true sarcomata are confined as a rule to a single node, soon break through the capsule, and form nodular metastases by the transfer of tumor particles through the medium of the blood current, but they do not as a rule involve other lymph nodes.

The types of sarcomata which have been described as arising from lymph nodes are: spindle-celled sarcoma, with more or less fibrous tissue; melanosarcoma; angiosarcoma; and round-celled sarcoma; the last being often indistinguishable from the true lymphosarcoma. Ziegler figures an alveolar sarcoma of a lymph node.

Endothelial tumors have been described as arising in lymph nodes, but, inasmuch as the morphology is always suggestive of carcinoma, it is probable that the cases reported have been due to the invasion of a node from some internal carcinoma whose existence was not observed.

The writer has in his possession two tumors from the region of the neck, one of which is morphologically an endothelioma of the cylindromatous type, the other an alveolar sarcoma derived apparently from the large endothelial cells of the trabeculæ. It is possible, however, that both of these growths are congenital remains from some of the glandular structures in the neck, and that the lymphoid tissue which they contain is merely the lymphoid tissue so often seen about the congenital cysts and ducts of the cervical region.

Secondary invasion of the lymph nodes by sarcomata is rare. The tumor particles reach the nodes through the blood-vessels as a rule, and spread diffusely throughout the lymphoid tissue. Such metastases occur most frequently in certain types of sarcoma, notably the small round-celled and the melanotic forms. In central sarcomata of the bone the regional lymph nodes are frequently invaded.

6. Carcinoma. Carcinoma of the lymph nodes is always secondary to a tumor of such portions of the body as contain epithelium. Such secondary invasion of lymph nodes by the cells of epithelial new growths takes place through the afferent lymphatics; and the cells, therefore, are first deposited in the lymph vessels and the sinuses at the periphery of the node. In very early cases the cells

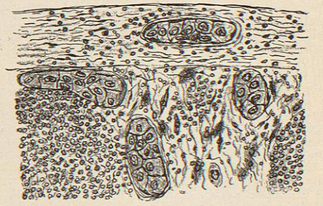

FIG. 3315.—Invasion of a Lymph Node with the Cells of a Carcinoma. The peripheral lymphatics and a portion only of the sinus are involved. (Dr. F. C. Wood.)

of the tumor may be confined to these points and not invade the follicles or cords. The tumor cells may attach themselves to the walls of the lymphatics and grow over the surface of the endothelial cells lining these vessels, giving rise to an appearance which has been erroneously interpreted as a new formation of carcinoma cells from





the endothelial cells of the vessel walls. The sinuses may be partially or wholly filled with the large cells of the new growth, which can be distinguished from the sinus endothelium by the more regular outline of the cell and the abundant chromatin of the nucleus. As the growth of the tumor cells continues the entire node may be replaced by them, but usually, before this takes place, there is a considerable increase in the amount of connective tissue present. Degenerative changes may take place in the tumor cells with necrosis of the tissue and softening of the centre of the node. Occasionally these softened nodes become infected and give rise to a suppurative periadenitis.

The presence of a malignant epithelial growth usually causes a slight hyperplasia of the neighboring lymph nodes, even though the tumor is not infected with microorganisms or ulcerated. These changes are confined chiefly to the peripheral sinuses and produce an hyperplasia of the sinus endothelium which may be mistaken by a careless observer for an invasion of the tumor cells. The germ centres of the follicles are also more prominent in these nodes than in those under normal conditions. Apparently the metabolic products of the tumor have the power of slightly irritating the lymph nodes through which they are filtered.

Lymph nodes invaded by the cells of a carcinoma can usually be diagnosed by gross inspection. The node is hard, and on section the areas involved are much paler than the normal node and more opaque; but occasionally nodes will be seen which, though invaded by the new growth, do not differ sufficiently from the normal to allow of a diagnosis by inspection, and recourse must then be had to microscopic examination. Nodes invaded by a sarcomatous new growth cannot usually be distinguished from the normal except by their size. An exception is seen when the sarcoma is of a melanotic type; such nodes may be almost black from the pigment of the tumor.

*Francis Carter Wood.*

**LYMPHOMA.**—This term has been used indiscriminately to indicate any enlargement of the lymphadenoid structures of the body, without regard for the true nature of the enlargement or its etiology. Most commonly it is applied in general medical literature to the generalized lymphadenoid hyperplasia associated with leukæmia and pseudoleukæmia (often distinguished as "malignant lymphoma"), or to the more localized glandular enlargements of lymphosarcoma, benign lymphatic hyperplasia, and primitive splenomegaly; yet it is by no means infrequently that "syphilitic lymphoma," "scrofulous lymphoma," or "acute lymphoma," is referred to under this title. In the proper use of the word, it should be limited to apply only to true neoplasms that reproduce the structure of lymphadenoid tissue. These tumors would be benign, since malignant tumors of similar nature would come, in the usual classification, under sarcoma, specified as "lymphosarcoma." A new growth of lymphadenoid tissue of infectious origin, whether the etiology is known or not, should not be called lymphoma. The confused condition of the classification of the various lymphatic enlargements is attributable to the ambiguous structure of the growth and the difficulty of distinguishing even those of known etiology from one another. That the term lymphoma continues to be used in this irregular way is probably because benign tumors reproducing lymph-gland structures, that are distinctly neoplasms, are so rare. Such a case has been described by Le Count,[1] but there seem to be few other instances in the literature, probably because they have not been recognized, rather than that they do not occur. Le Count's case is described as follows:

In section the fresh specimen is light reddish, its surface studded with areas resembling closely the Malpighian bodies of the spleen. The growth is encapsulated, has no coarse trabeculæ, is not very vascular. Histologically it is characterized by reproducing quite closely, but with some differences, the structure of a normal gland. There are many nodes with an area of large pale cells, of endothelial type, which are usually central and located at or near the point where an arteriole breaks into capillaries. Surrounding this are quite regular rows of small lymphoid cells. The tissue between the nodes is loose, consisting of a fine, non-nucleated reticulum, supporting small lymphoid cells.

Because of its rarity, and its eminently benign course, such a true lymphoma is merely of scientific interest. Of much more importance are the lymph-gland enlargements associated with leukæmia and pseudoleukæmia, which are what is commonly designated by the term lymphoma. While leukæmia is a fairly distinct condition, as well pathologically as clinically, the reverse is true of pseudoleukæmia, and to obtain any clear picture of its anatomical basis is almost hopeless. If we admit, however, that by pseudoleukæmia or Hodgkin's disease is understood a fairly definite symptom complex, characterized by general lymphadenoid hyperplasia, anæmia without leucocytic increase, and a course always downward, and accept the view that these conditions may be produced by a variety of etiological factors, the situation is somewhat simplified. Then we can place on one hand those cases which are manifestly infectious, generally tuberculous, as has been shown by Sternberg,[2] Crowder,[3] and others. This leaves a group in which the glandular enlargement is much more like a tumor growth, both in structure and in absence of apparent cause. Two types of enlargement may be distinguished. In one the process resembles that of a malignant tumor, both macroscopically and microscopically. In the other, the change retains the essential features of benign growth, although multiple, and this benign enlargement corresponds anatomically to the localized enlargement of one or a small group of glands that is observed occasionally remaining for long periods without the accompanying manifestations of Hodgkin's disease, which local glandular enlargement is quite generally known among surgeons as lymphadenoma. This process then simulates a true benign tumor growth, and it is to this that the term lymphadenoma* is best applied, to distinguish it from the malignant type of lymphadenoid growth, to which the term *lymphosarcoma* should be restricted.

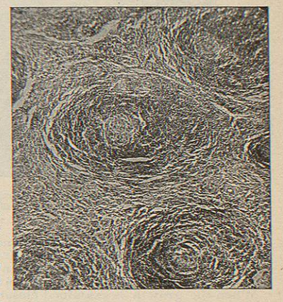

FIG. 3316.—True Lymphoma. Photograph of section showing lymph nodes and internodal tissue. Slightly magnified. (Le Count.)

The use of the termination *oma*, placing this condition among the tumors, is tentative, for there is much reason to believe that eventually such enlargements will all be found to be infectious; but as this is equally true in the case of many other tumors, such terminology is justifiable. It must be admitted, however, that the most substantial reason for using such a term as lymphadenoma at all lies in the fact that such usage is general, even by acknowledged authorities, and the function of such an article as this is rather to record what is than to suggest what should be.

*Other names found in use to indicate the general glandular enlargement of Hodgkin's disease are: lymphadenosis, lymphosarcoma, lymphoma, malignant lymphoma, pseudoleukæmia, anæmia lymphatica, adénie, lymphadénie. Since these terms are in many instances contradictory, it is evident how loose the ideas and nomenclature on this subject really are.

Lymphadenoma, as above defined, is a process of enlargement of lymph glands which is remarkable in affecting several glands simultaneously, or in rapid succession. Usually the growth is limited to one group at first, to involve the others later, or it may appear in widely separated places at the same time. Sometimes the usually recognized groups of glands alone are involved, but often every portion of lymphadenoid tissue in the body is

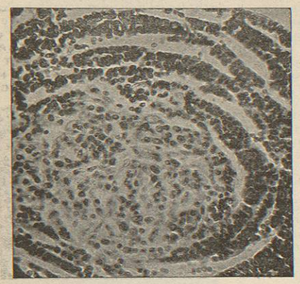

FIG. 3317.—Photograph of Centre of a Lymphoma Node, Showing the Pale Germinal Centre and the Rows of Lymphoblasts. (Le Count.)

affected, and microscopic structures may enlarge to considerable swellings. It is this peculiar diffuseness of the process that distinguishes it from any ordinary tumor growth and makes the infectious origin seem so probable.

When the growth is examined closely it is found that even in the largest masses the individuality of the component glands has not been lost by fusion; each preserves its own capsule, although they may adhere closely to each other. The separate glands may reach the size of a hen's egg, although usually few are larger than a hickory nut. The groups of glands in the cervical, axillary, mediastinal, and retroperitoneal regions often form huge tumors, of irregular outline and nodular surface. In consistence the glands are about as soft as normal kidney tissue. The external surface is pale, and the cut surface a pale pink. In some glands the cut surface shows almost no apparent structure, it is alike from centre to margin; in other cases, a considerable growth of connective tissue is seen, dividing the gland into irregular lobules. The gland is not pultaceous, and areas of necrosis and hemorrhage are rarely seen. Suppuration is uncommon, and almost always due, when present, to erosion of some surface. If the spleen is enlarged, as it usually is, it seems that the follicles are affected chiefly, and in a way quite like the glands. The tonsils and intestinal lymph follicles project, and may form tumors similar in structure to the glands.

Microscopically it is seen that a great increase in all the cellular elements of the gland has taken place, disorderly and not constant in proportion or arrangement. The arrangement of follicles and sinuses is quite lost. Both the large endothelial and small lymphoid cells are increased, sometimes one out of proportion, sometimes the other. Often there is also a distinct increase in fibrous tissue, generally in strands extending from the capsule toward the centre. Frequently large cells are seen, sometimes with a single enormous, irregularly shaped, deeply staining nucleus; large cells with from three to a dozen nuclei are also abundant in some cases. Phagocytic endothelial cells containing blood pigment and mononuclear cells may also be found. As a rule the more extensive the process the more the structure diverges from that of the normal gland; in the circumscribed, simple lymphadenomata, without constitutional symptoms, the growth may be quite similar to the true lymphoma.

Lymphadenoma differs from the lymphosarcoma grossly in that the gland capsule limits the growth, surrounding tissues are not invaded, the process more often affects lymph structures throughout the body without involving any other tissue, there is never a single large mass of tumor tissue, while it may be soft yet it does not yield a milky fluid from the cut surface, and necrosis and hemorrhage are seldom seen. Microscopically the sarcoma shows a far more atypical structure; the round cells are usually almost alone, stroma formation is slight, and the endothelium-like formations are generally absent; hemorrhages, necrosis, and karyokinesis are much more abundant. As can be easily understood, it is at times very difficult, perhaps impossible, to make any distinction between the benign and the malignant forms of growth.

Tuberculous adenitis usually offers no difficulty because of the characteristic caseation, the typical zone arrangement, and the giant cells; but quite a number of cases have been described in which with a gross and minute structure corresponding to lymphadenoma, and without any evidences of tuberculosis, staining and inoculation have revealed tubercle bacilli. This fact leaves the neoplastic nature of lymphadenoma always in doubt.

Leukæmic glands offer to the naked eye no essential differences from those of lymphadenoma, and some authorities, as Ziegler, speak of a "leukæmic lymphadenoma," and a "pseudoleukæmic lymphadenoma." The fundamental difference in the process is that in leukæmia the new-formed cells leave the gland to form leucocytes, while they remain within the reticulum in lymphadenoma. Usually the structure is more atypical in leukæmia, the round cells predominating, but the only visible difference may be the presence of abundant leucocytes in the blood of sectioned vessels. Grossly the glands show few differences, although they are likely to be softer and exude milky fluid on section in leukæmia; the lymphoid accumulations in the viscera are of course quite characteristic.

The etiology is quite unknown, as in the case of a true tumor, but that the growth is of infectious origin seems most probable in view of the simultaneous involvement of so many lymph glands, and the difficulty of distinguishing it from the generalized tuberculous adenitis that has been so frequently observed in recent years. In favor of its being a true tumor are mentioned its frequent change to malignancy and the narrow demarcation from lymphosarcoma, the abnormal nuclear forms seen in the large cells, and the progressive course. Various organisms have been described, but too inconstantly to be entitled to consideration. The growth occurs oftenest in young adults, particularly males, without predisposing causes being recognizable, as a rule.

The course is almost inevitably downward in the cases of generalized glandular enlargements, *i.e.*, Hodgkin's disease. In the cases of localized glandular tumors the growth may be very slow, and after reaching a certain size, become stationary. It has been said that they may cicatrize and heal spontaneously, but considering the difficulty in distinguishing them clinically from tuberculous glands, such statements are open to question.

*H. Gideon Wells.*

[1] E. R. Le Count: Lymphoma, a Benign Tumor Representing a Lymph Gland in Structure. Journal of Experimental Medicine, iv., 559, 1899.
[2] Sternberg: Zeitschrift für Heilkunde, xix., 1898.
[3] T. R. Crowder: New York Medical Journal, 1899.

**LYMPH VESSELS AND NODES, SURGICAL AFFECTIONS OF.**—ANATOMY AND PHYSIOLOGY.—In order to make the subject of this article clear, the writer desires to recur for a few moments to the anatomy and physiology of the lymphatic system. This system comprises the lymphatic vessels or channels and the nodes or ganglions which are commonly spoken of as glands. The vessels are analogous to veins in their structure. They





are distributed almost universally throughout the body. There are, however, three principal groups, viz., those which ramify in the subcutaneous cellular tissue, those which accompany the great vessels, and those in association with the various internal organs. The first and second of these groups are of special interest to the surgeon, whilst the third, being largely inaccessible during life, will not here be considered.

The nodes (or glands) are collections of specially arranged lymphoid tissue situated in the course of the lymphatic vessels. They are in some instances solitary, but more frequently arranged in groups. The more important groups are in close proximity to the great blood-vessels. The nodes are surrounded by loose connective tissue, and in the case of the extremities they are found chiefly at the flexures of the joints.

The lymphatic system is sometimes spoken of as the absorbent system, inasmuch as one of its chief functions

DIAGRAMS SHOWING THE CHIEF GROUPS OF EXTERNAL LYMPH NODES, AND THE SOURCES FROM WHICH THEIR LYMPH SUPPLY COMES. (THE NAMES OF THE NODES ARE PRINTED IN ITALICS.)