

LYMPHATIC ORGANS

by

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stage 1

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LYMPHATIC ORGANS :

Lymphatic organs are divided into

1- primary (central) and

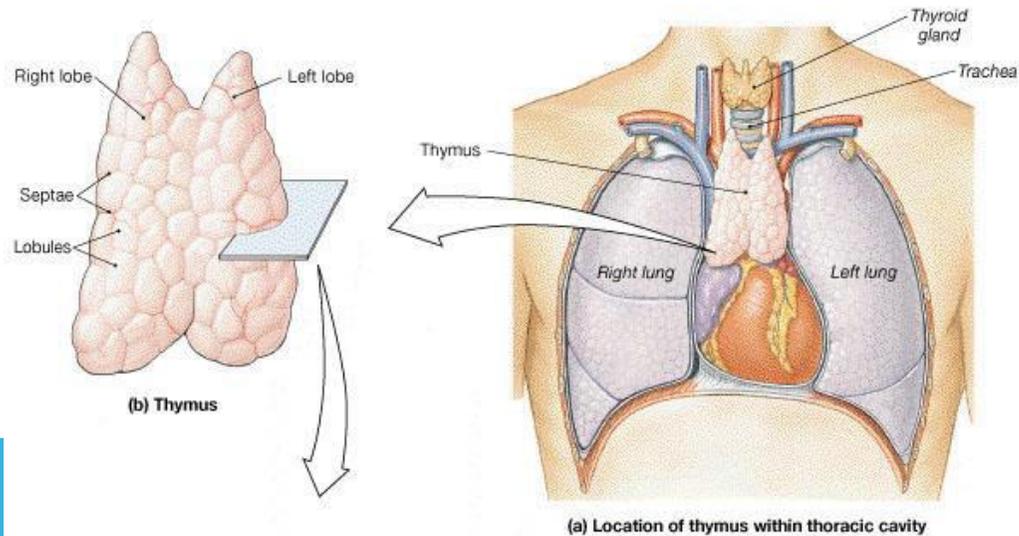
2- secondary (peripheral) organs.

Primary lymphatic organs are the first to develop and include the thymus and the bone marrow .

The ***secondary lymphatic organs*** are the lymph nodes, spleen, tonsils.

Thymus

The thymus is a bilobed, encapsulated lymphatic organ located in the upper anterior mediastinum and lower part of the neck. . The thymus is the only primary lymphatic organ and is the first organ of the embryo to become lymphoid . Unlike the spleen and lymph nodes, it is well developed and relatively large at birth, after which the organ undergoes progressive involution and is partially replaced by fat and connective tissue

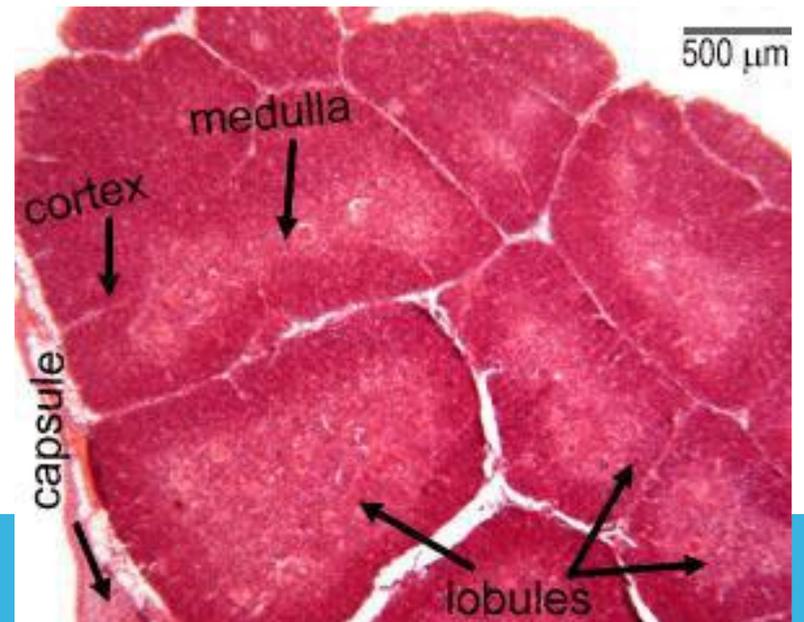
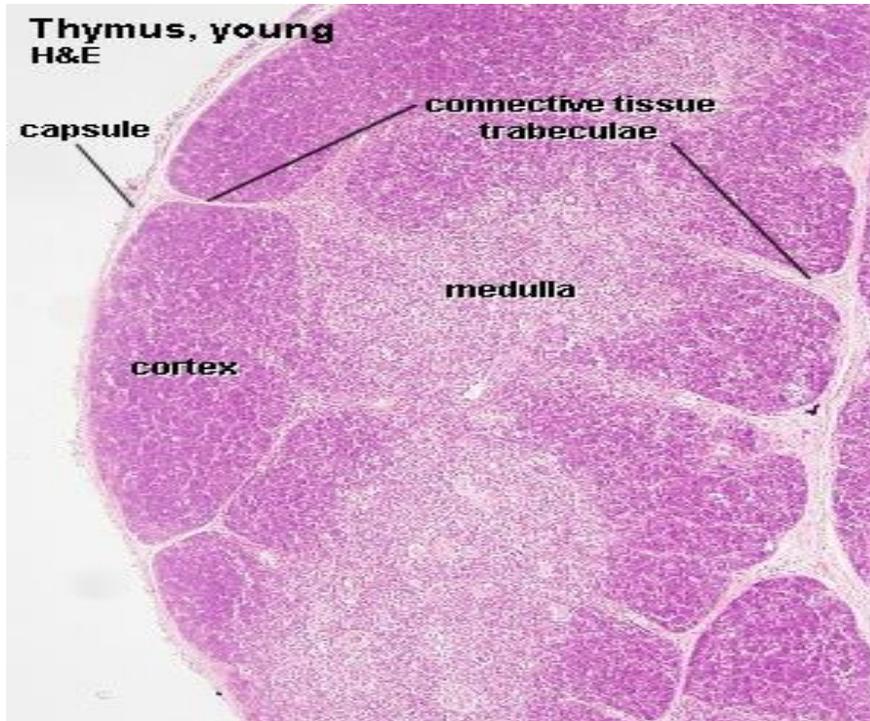


Structure:

The thymus consists of two **lobes** joined by connective tissue. A thin capsule of loosely connective tissue surrounds each lobe and provides **septa** that extend into the thymus, subdividing each lobe into a number of irregular **lobules**.

Each lobule consists of :

- cortex ,
- medulla.



Cortex :

under the capsule is a dark-staining **cortex** with a network of interconnecting spaces. These spaces become colonized by **immature lymphocytes** that migrate from hemopoietic tissues to undergo maturation and differentiation . The epithelial cells of the thymus gland provide structural support for the increased lymphocyte population

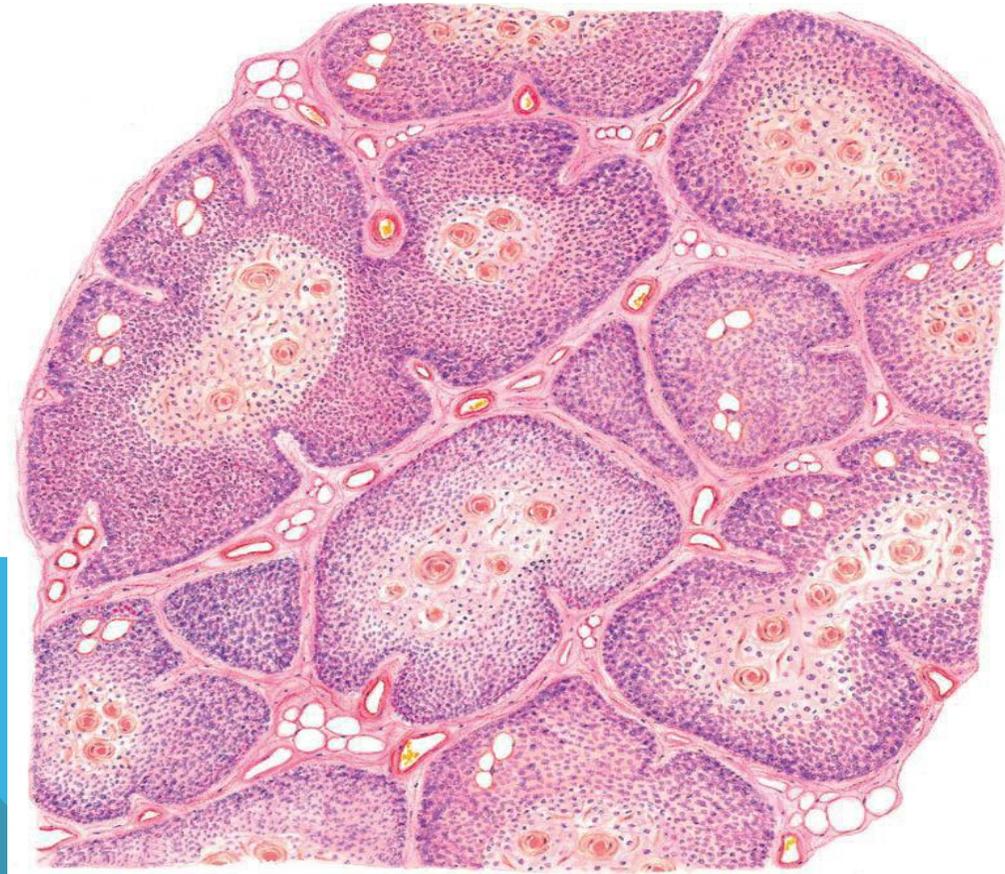
Medulla :

it appears to be isolated within a lobule, surrounded by a complete layer of cortex.

Lymphocytes are less numerous than in the cortex, it appear lighter-staining . The epithelial cells form a coarser framework that contains fewer lymphocytes and whorls of epithelial cells that combine to form **thymic (assall' corpuscles**, which are the charecteristic feature of medulla of thymus gland.

HASSALL'S CORPUSCLES

The **thymic (Hassall's)** corpuscles are oval structures consisting of round or spherical aggregations (whorls) of flattened epithelial cells. The thymic corpuscles also exhibit calcification or degeneration centers that stain pink or eosinophilic. The functional significance of these corpuscles remains unknown. Blood vessels and adipose cells are present in both the thymic lobules and in trabeculae.



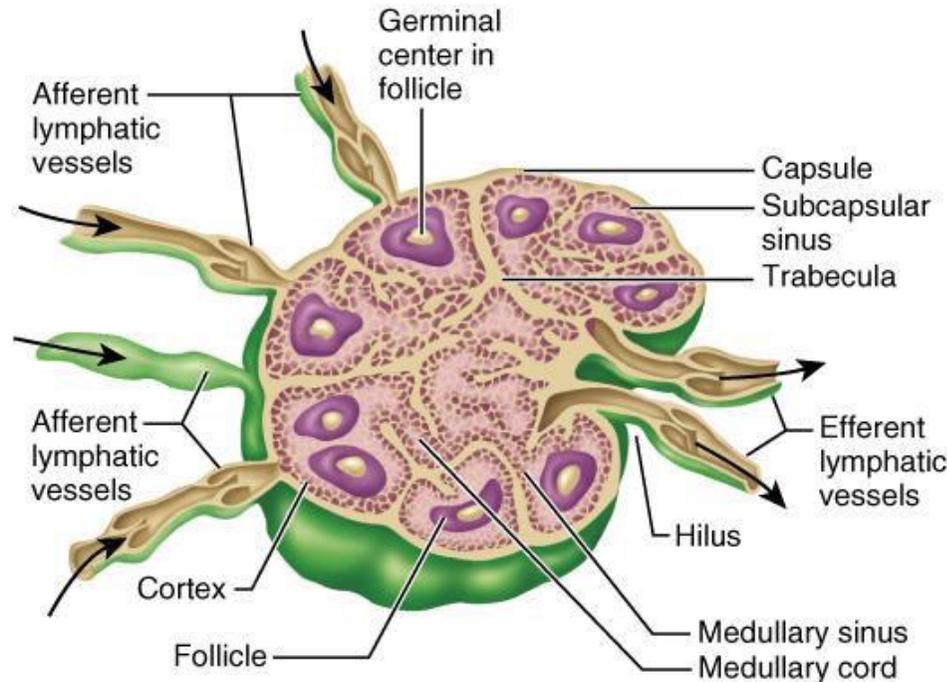
FUNCTIONAL CORRELATION

The thymus gland performs an important role early in childhood in immune system development. Undifferentiated lymphocytes are carried from bone marrow by the bloodstream to the thymus gland. In much of the thymic cortex, the epithelial reticular cells, also called **thymic nurse cells**, surround the lymphocytes and promote their differentiation, proliferation, and maturation.

As maturation progresses in the cortex, the cells are presented by antigen-presenting cells with self and foreign antigens. Lymphocytes that are unable to recognize or that recognize selfantigens die and are eliminated by macrophages (negative selection), which is about 95% of the total. Those lymphocytes that recognize the foreign antigens (positive selection) reach maturity, enter the medulla from the cortex, and are then distributed in the bloodstream. the lymphocytes mature into immunocompetent T cells, helperT cells, and cytotoxic T cells, they acquire their surface receptors for recognition of antigens. After maturation, the T cells leave the thymus gland via the bloodstream and populate the lymph nodes, spleen, and other thymusdependent lymphatic tissues in the organism

LYMPH NODES

Lymph nodes are small encapsulated lymphatic organs set in the course of lymphatic vessels. They are prominent in the neck, axilla, groin, and mesenteries and along the course of large blood vessels in the thorax and abdomen. They appear as flattened, ovoid or beanshaped structures with a slight indentation at one side, the **hilus**, through which blood and lymphatic vessels enter or leave



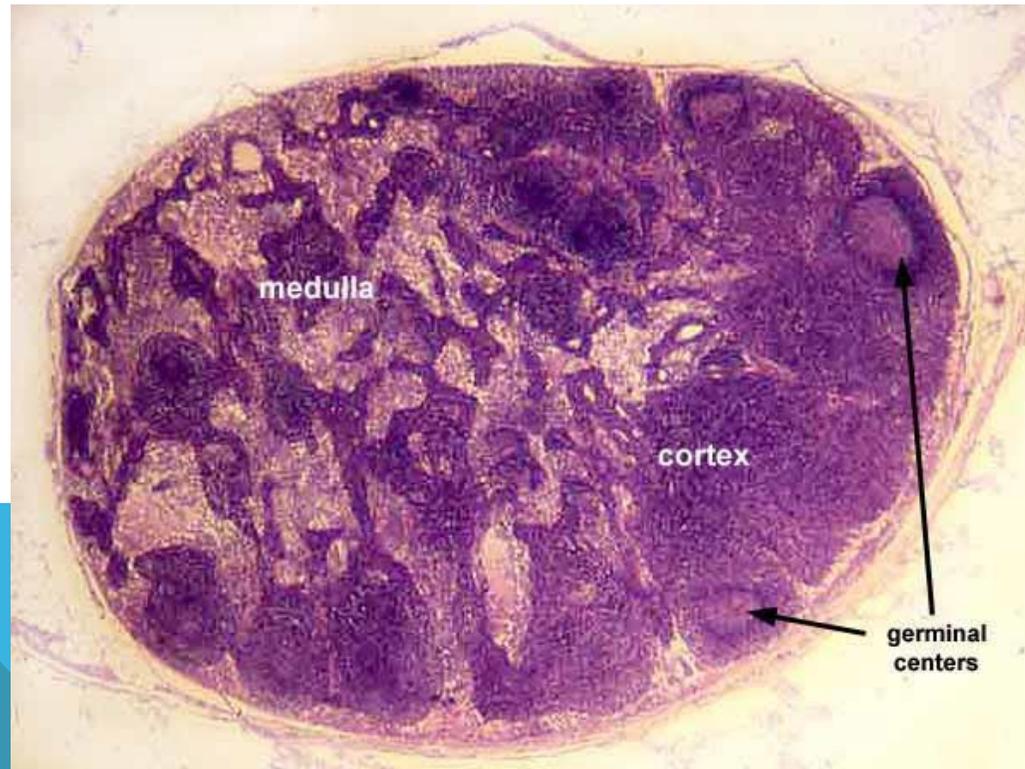
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Lymph nodes are the **only** lymphatic structures that are set into the lymphatic circulation and thus are the only lymphatic organs to have afferent and efferent lymphatics.

Afferent lymphatics enter the node at multiple sites, anywhere over the convex surface; **efferent lymphatics** leave the node at the hilus. Both sets of vessels have **valves** that allow unidirectional flow of lymph through a node.

Lymph node



Structure:

lymph nodes consist of **diffuse** and **nodular lymphatic tissue** enclosed in a capsule that is thick at the hilus. The **capsule** consists of closely packed collagen fibers, with few elastic fibers.

From the inner surface of the capsule, **trabeculae** of dense connective tissue extend into the node. Trabeculae subdividing the cortex into several irregular "compartments."



CORTEX

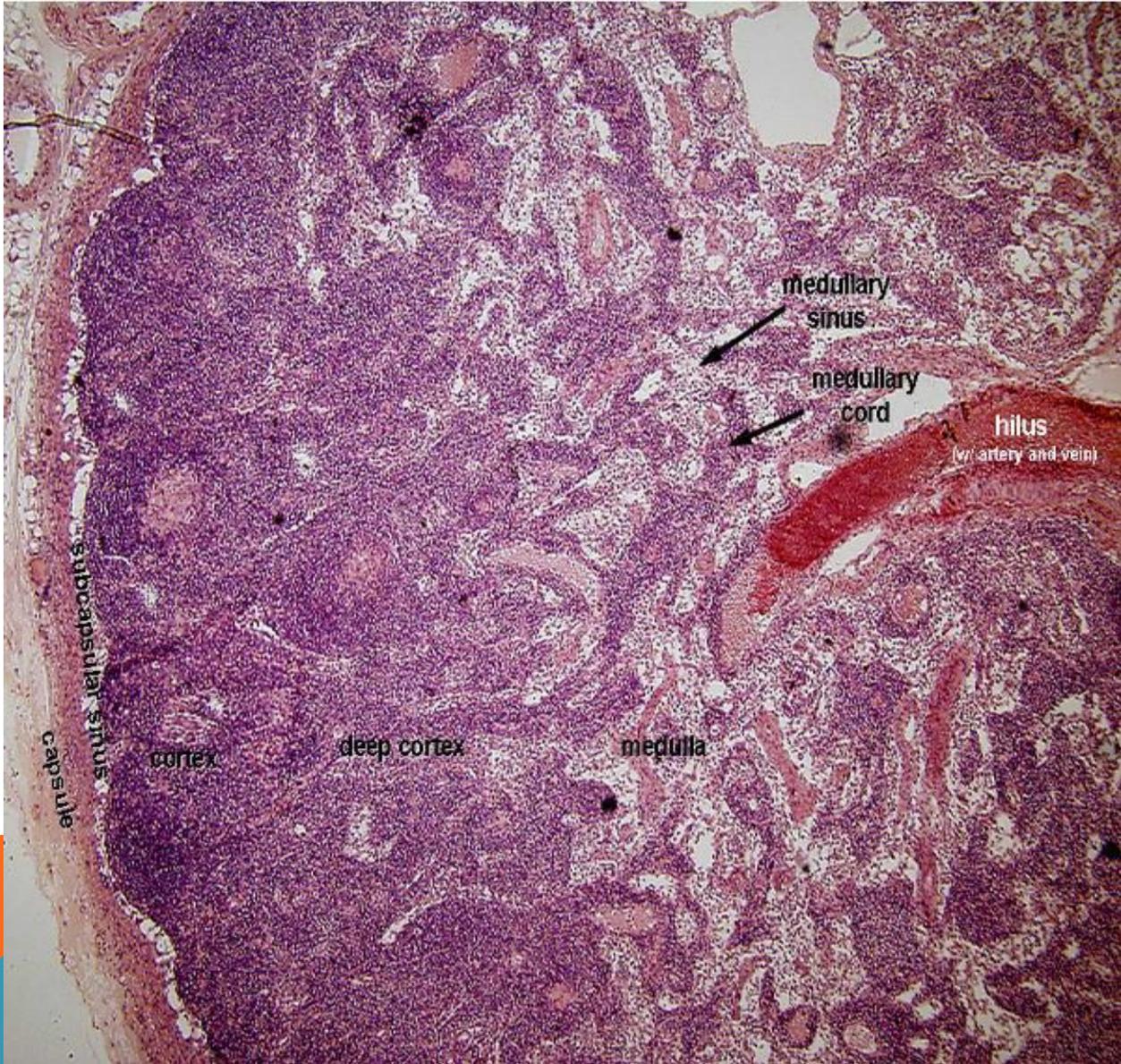
The cortex forms a layer under the capsule. The cortex is divided into an **outer cortex** that lies under the capsule and contains nodular and diffuse lymphatic tissue, and a **deep (inner) cortex** that consists of **diffuse** lymphatic tissue only. A network of reticular fibers and spherical, aggregations of lymphocytes called **lymphoid nodules** characterize the cortex. Some of them exhibit **germinal centers**.

medulla

The medulla appears as a paler area of variable width, surrounding the hilus . It consists of diffuse lymphatic tissue arranged as irregular **medullary cords**. Medullary cords are networks of reticular fibers filled with plasma cells, macrophages, and lymphocytes separated by capillary-like channels called **medullary sinuses**.

Lymph Sinuses

Within the lymph node is a system of channellike spaces, the lymph sinuses, through which lymph percolates. Lymph enters the node through afferent lymphatic vessels and empty into the **subcapsular (marginal sinus)** which separates the cortex from the capsule. present as a wide space extending beneath the capsule. It is continuous with the **cortical (trabecular) sinus**. which extend into the cortex, usually along the trabeculae. These become continuous with **medullary sinuses** that run between the medullary cords and trabeculae of the medulla. Sinuses in the cortex are less numerous than in the medulla and narrow . They run in the medullary parenchyma as irregular cordlike arrangement .



capsule

subcapsular sinus

cortex

deep cortex

medulla

medullary sinus

medullary cord

hilus
(w/ artery and vein)

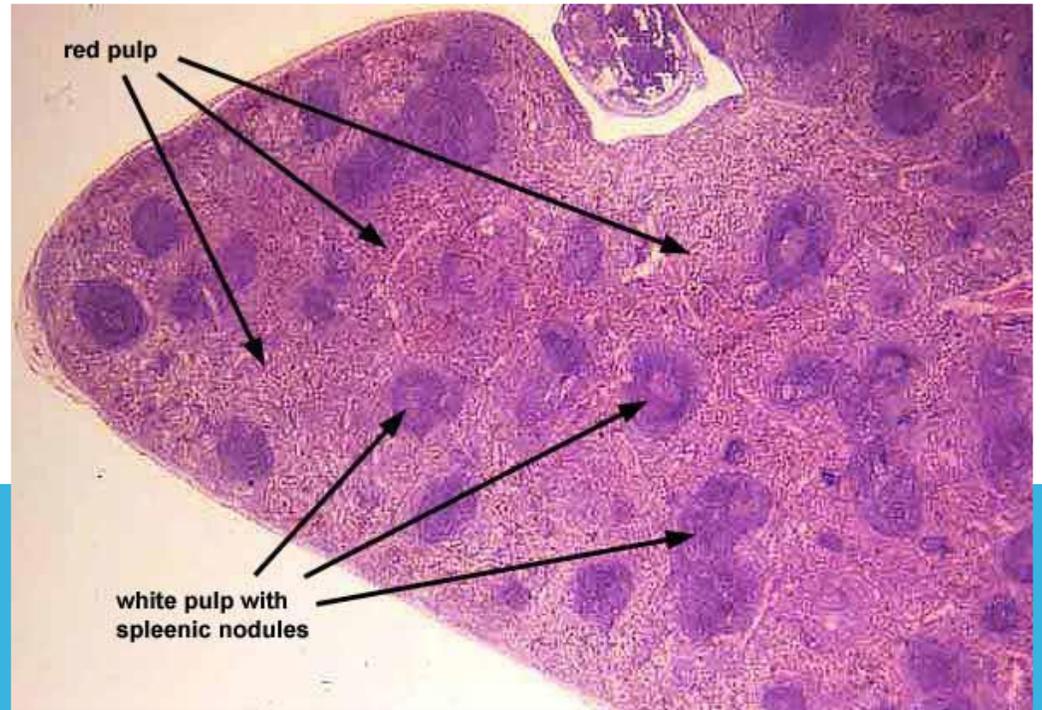
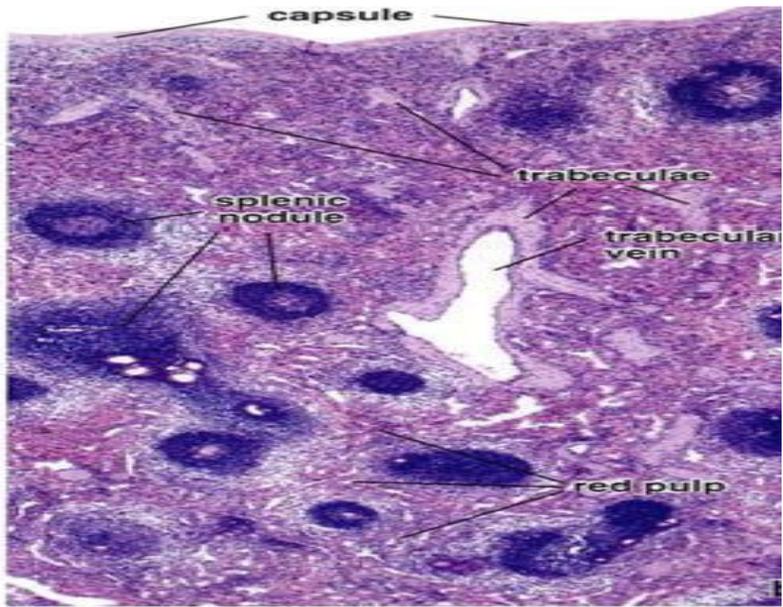
Spleen

The spleen is a large lymphoid organ with a rich blood supply. The spleen is enclosed by a capsule of dense connective tissue(fibro-elastic

connective tissue, some smooth muscle, and an outer covering mesothelium .). On the medial surface of the spleen, the capsule is form a cleftlike hilus through which blood vessels, nerves, and lymphatics enter or leave the spleen. Broad bands of connective tissue, the trabeculae, extend from the inner surface of the capsule, the trabeculae subdivide the organ into compartments. The main trabeculae enter the spleen at the hilus and extend throughout the organ. Located within the trabeculae are trabecular arteries and trabecular veins .The spaces between trabeculae are filled by a reticular network of fibers and associated reticular cells. The substance of the spleen is called the splenic

pulp . the splenic pulp is consist of : - the light areas form the white pulp and

consist of diffuse and nodular lymphatic tissue. - The dark red tissue is the red pulp and consists of diffuse lymphatic tissue **that is suffused with blood.**



White pulp :

The spleen is characterized by numerous aggregations of **lymphatic nodules** , they contain mainly **B cells**. The lymphatic nodules also contain **germinal centers** that decrease in number with age. Passing through each lymphatic nodule is a blood vessel called a **central artery** that is located in the periphery of the lymphatic nodules . Central arteries are branches of trabecular arteries that become ensheathed with lymphatic tissue as they leave the connective tissue trabeculae . The cells found in the periarterial lymphatic sheath are mainly T cells. **Antigen-presenting cells** and **macrophages** reside within the white pulp. These cells detect trapped bacteria and antigens and initiate immune responses against them. As a result, T cells and B cells interact, become activated, proliferate, and perform their immune response.

RED PULP :

red pulp is red because of its extensive vascular tissue. The red pulp also contains

- **pulp arteries** ,
- **venous sinuses** , and
- **splenic cords (of Billroth)** .

The splenic cords appear as diffuse strands of lymphatic tissue between the venous sinuses and form a spongy meshwork of reticular connective

tissue. They are thin aggregations of lymphatic tissue containing small lymphocytes, associated cells, and various blood cells.

Venous sinuses are dilated vessels lined with modified endothelium of elongated cells .

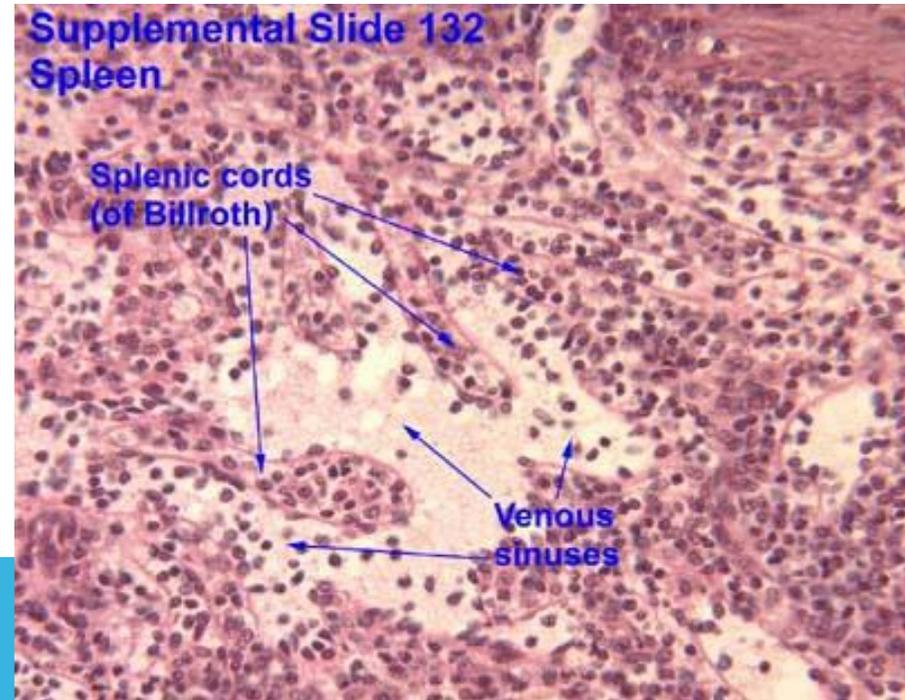
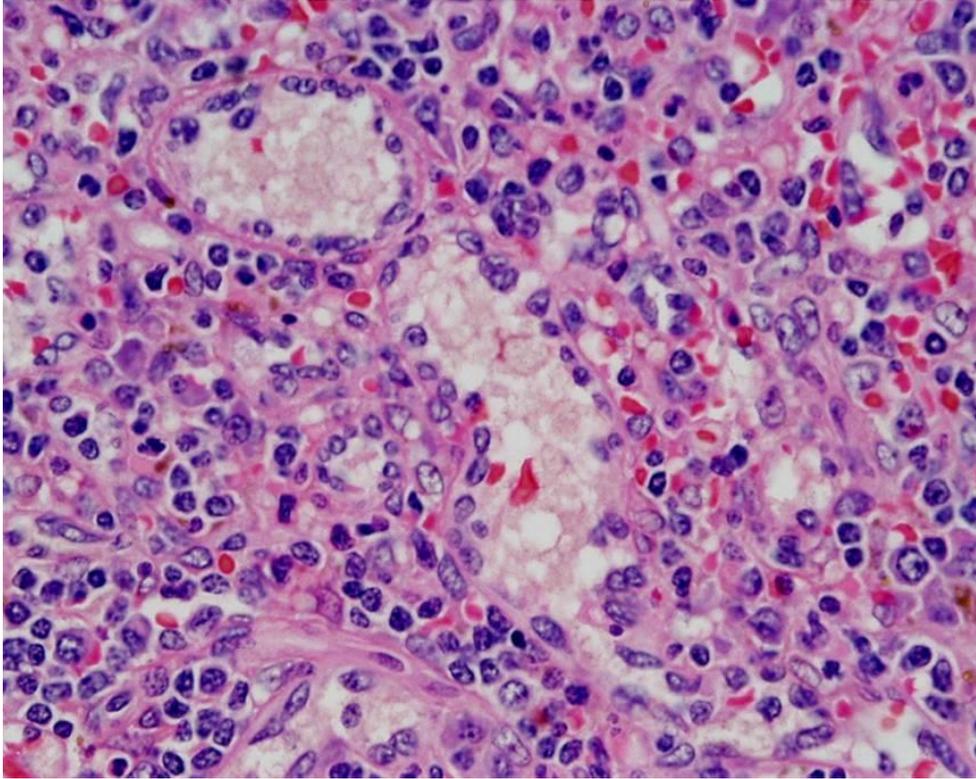
pulp arteries represent the branches of the central artery after it leaves the lymphatic nodule . Capillaries and pulp (venules) are also present

The main function of the red pulp is to filter the blood. It removes antigens, microorganisms, platelets, and aged or abnormal erythrocytes

from the blood. The spleen does not exhibit a distinct cortex and a medulla, as seen in lymph nodes. However, lymphatic nodules are found throughout the spleen. In addition, the spleen contains venous sinuses , in contrast to lymphatic sinuses that are

found in the lymph nodes. The spleen also does not exhibit subcapsular or trabecular sinuses. The capsule and trabeculae in the spleen are thicker than those around the lymph nodes .

VENOUS SINUSES & SPLENIC CORDS



TONSILS :

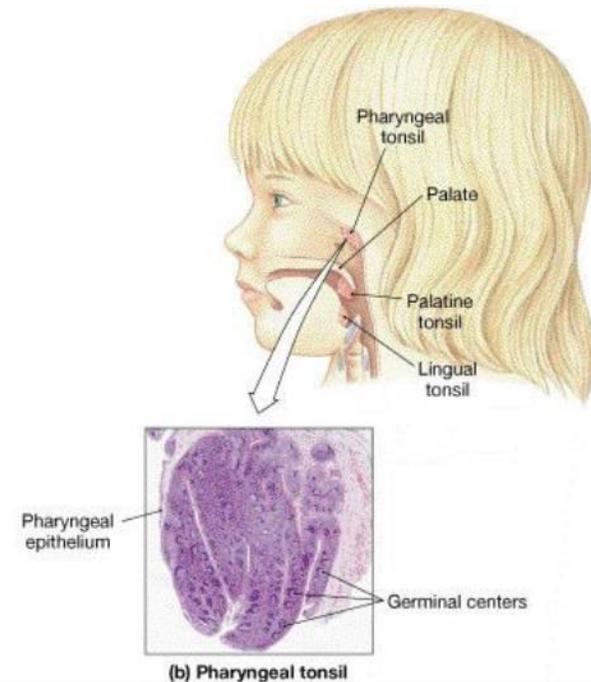
Tonsils are aggregates of lymphatic nodules associated with the pharynx and oropharynx.

These structures are spread through different areas - oropharynx, nasopharynx, and tongue - and form the

1- palatine,

2- pharyngeal, and

3- lingual tonsils .



PALATINE TONSILS

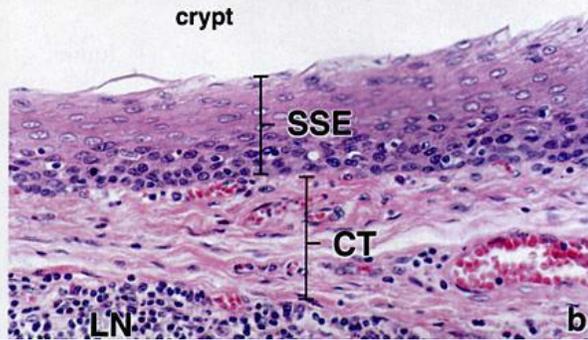
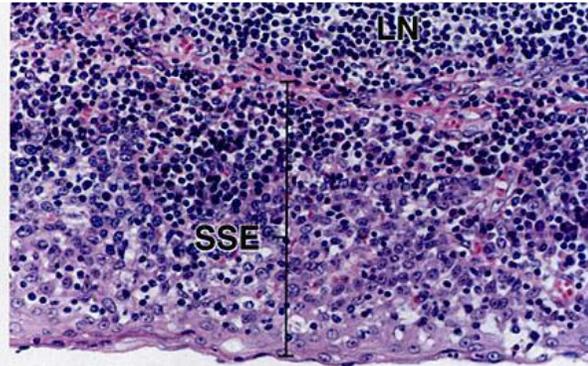
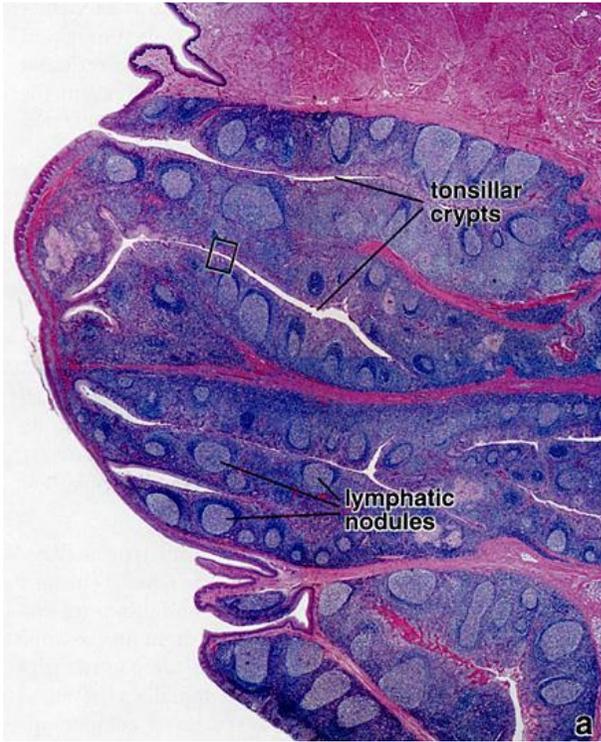
The palatine tonsils are paired, oval lymphatic organs located laterally at the junction of the oral cavity and oropharynx.

A **stratified squamous epithelium** covers the free surface of the tonsil and is very closely associated with the lymphatic tissue. Deep invaginations of the epithelium form the tonsillar

crypts that reach almost to the base of the tonsil. Lymphatic nodules, many with germinal centers, usually are arranged in a single layer beneath the epithelium, embedded in a mass of diffuse lymphatic tissue. A **partial capsule** beneath the basal surface of the tonsil separates it from surrounding structures. Septa of loose collagen fibers extend from the capsule into the tonsillar tissue and partially divide the crypts and their lymphatic tissue from one another.

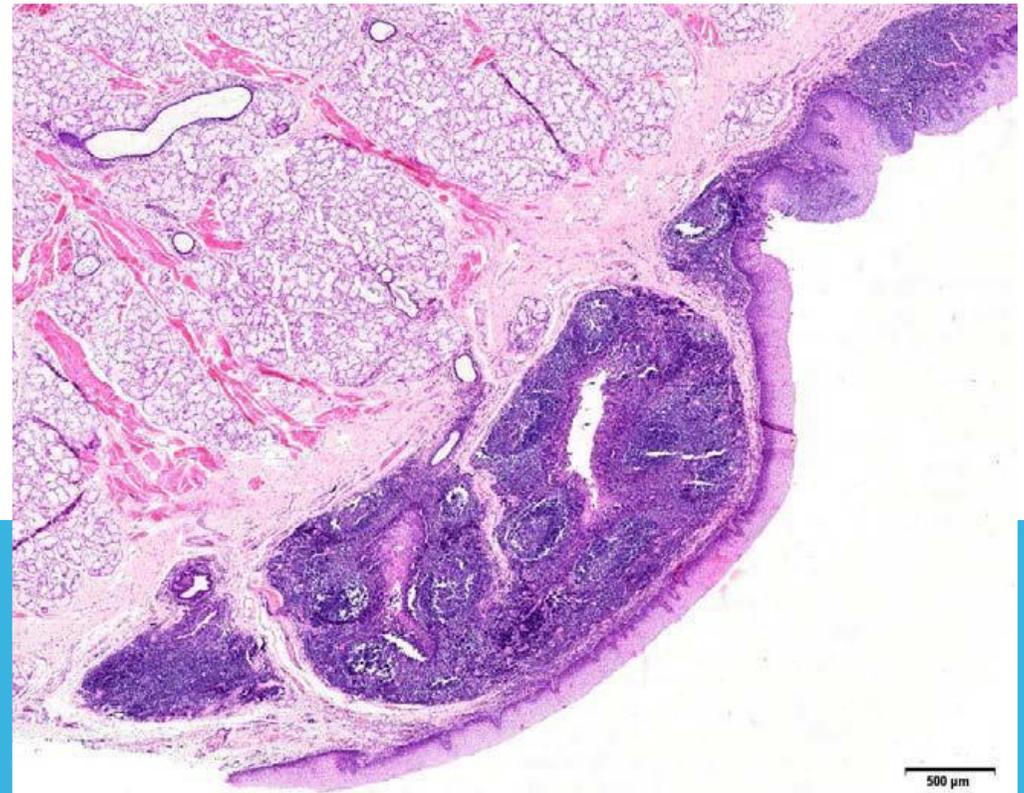
The connective tissue is infiltrated by lymphocytes, plasma cells, and mast cells.

Neutrophil may be present and are numerous during inflammation of the tonsils.



LINGUAL TONSILS:

The lingual tonsils form nodular bulges in the root of the tongue, and their general structure is similar to that of the palatine tonsil. **Crypts** are deep, and are lined by **stratified squamous epithelium** that invaginates from the surface. The associated lymphatic tissue consists of diffuse and nodular types.



PHARYNGEAL TONSIL :

The pharyngeal tonsil is located on the posterior wall of the nasopharynx. Its surface epithelium is a **ciliated pseudostratified columnar epithelium** that contains goblet cells. Patches of stratified squamous epithelium may be present . crypts are not as deep as in the palatine tonsils . A thin capsule separates the pharyngeal tonsil from underlying tissues and provides fine septa that extend into the substance of the tonsil.

Mucosa associated lymphoid tissue (MALT) :

can be found in various locations of digestive or respiratory systems. Lymphatic nodules are always located within the connective tissue under the lining epithelium (lamina propria).

The nodules are prominent by their size and deep blue staining of nuclei of lymphocytes, the germinal centers of these nodules contain some developing plasma cells and supporting c.t. cells.

MALT

