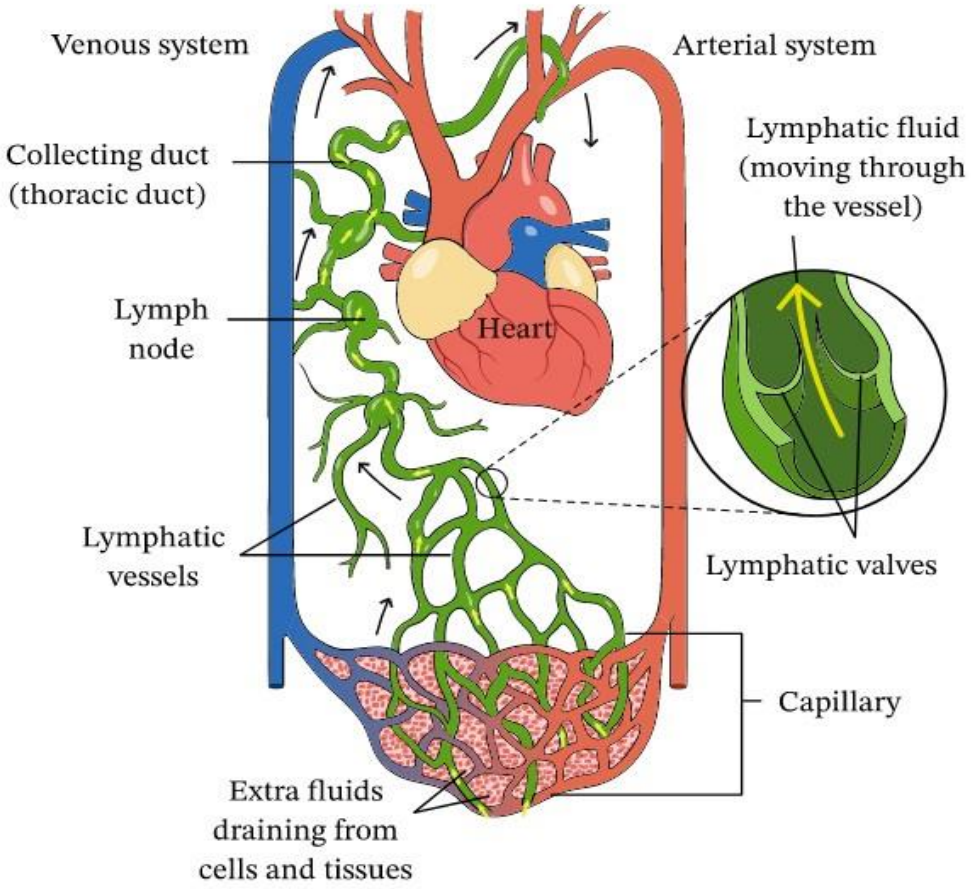
General Histology / Year 2



circulatory system
Lymphatic System
Lecture 4

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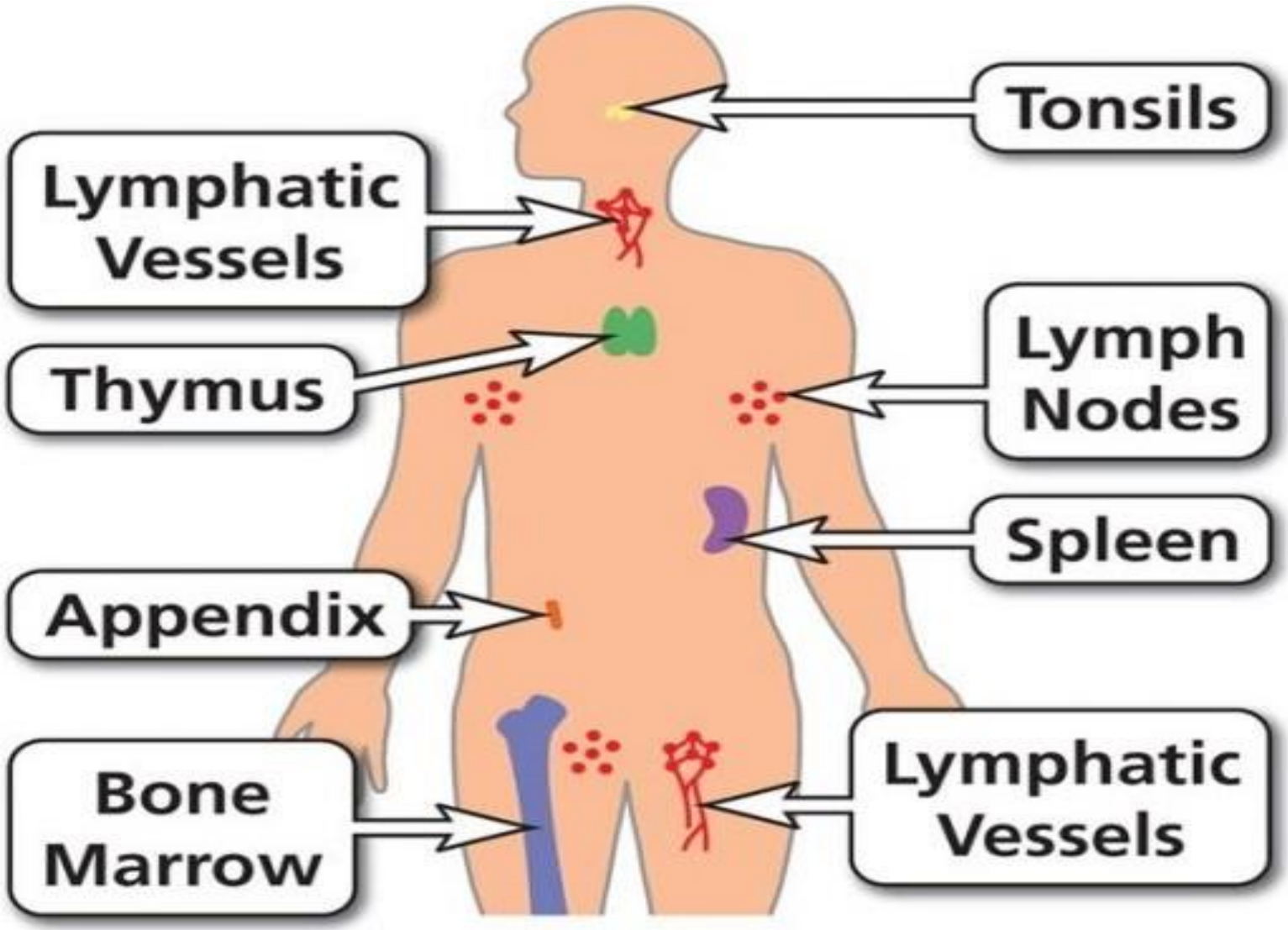
Lymphatic system

- **The lymphoid system includes all cells, tissues, and organs in the body that contain aggregates (accumulations) of immune cells called lymphocytes.**
- **The lymphatic system consists of two semi-independent parts:-**
- **1-A network of lymphatic vessels.**
- **2-Lymphoid organs scattered throughout the body.**
- **Included in this system are the diffuse lymphatic tissue, lymphatic nodules, lymph nodes, spleen, bone marrow, and thymus.**


Tonsils
Lymphatic Vessels
Lymph Nodes
Thymus
Spleen
Appendix
Lymphatic Vessels
Bone Marrow

Function of the Lymphatic system

- **The lymphatic system supports the function of the cardiovascular and immune systems of the body.**
- **It is a one way system, in which lymph flows towards the heart.**
- **It is a system of drainage vessels that collect the excess protein-containing interstitial fluid (lymph) and return it to the bloodstream.**
- **These vessels collect a fluid called lymph from the loose connective tissue around blood capillaries and carry this fluid to the great veins. The fluid arises from blood filtered through the capillary walls. Tissue fluid is continuously leaving and re-entering the blood capillaries. This amounts to about 3 liters a day.**

Function of the Lymphatic system

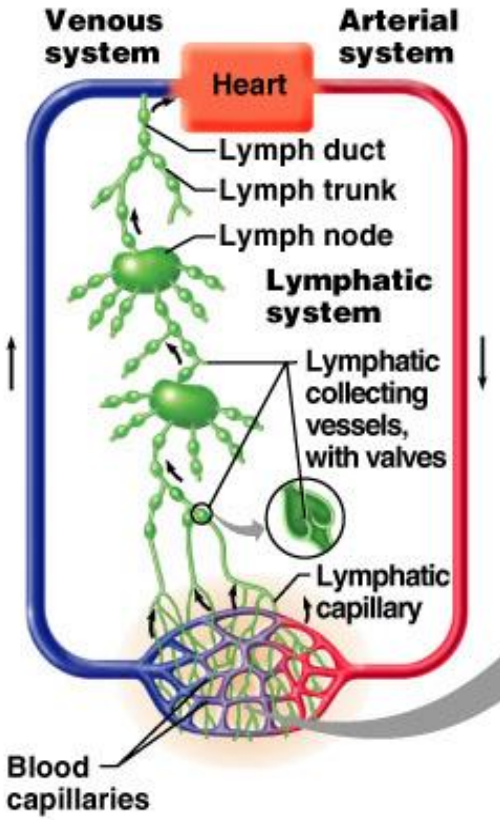
- **Any blockage of the lymphatic vessels causes the affected body region to swell with excess tissue fluid resulting in edema.**
- **The main components of the immune system (lymphocytes, lymphoid tissue, and lymphoid organs) fight infections and confer immunity to disease.**
- **network of tissues, organs and vessels that help to maintain the body's fluid balance & protect it from pathogens.**
- **Transport dietary lipids (through lacteals) eventually into the bloodstream.**

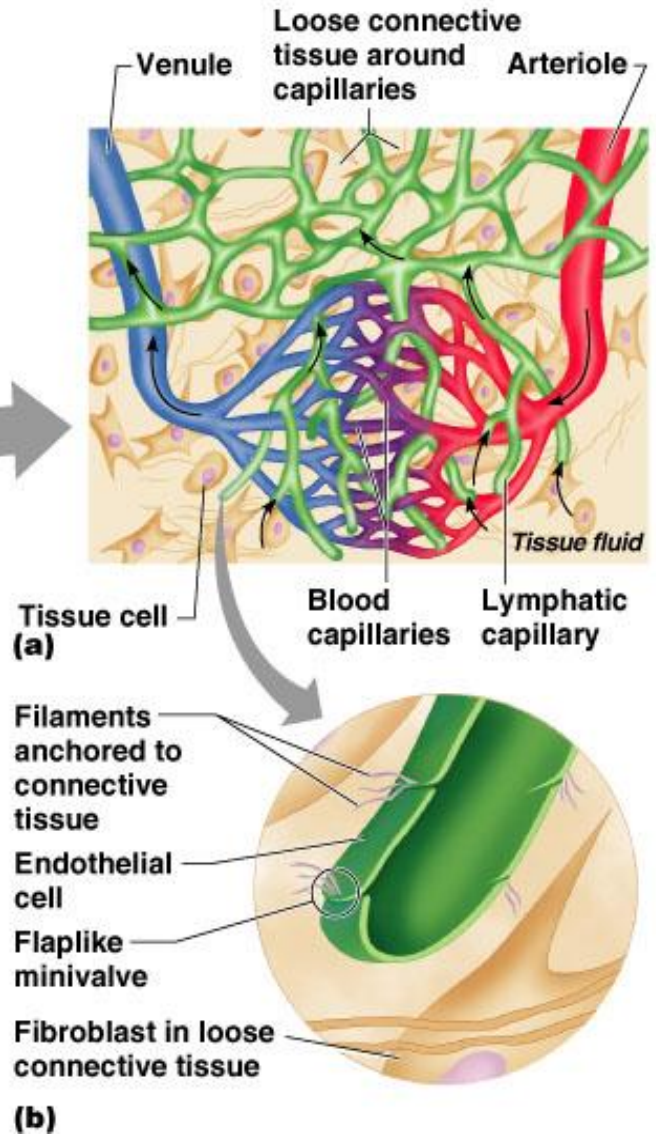
Lymph

- **Tissue fluid (interstitial fluid) that enters the lymphatic vessels.**
- **Tissue fluid consists of small molecules of blood plasma, water, various ions, nutrient molecules, and respiratory gases.**
- **Lymph is a clear watery fluid that resembles blood plasma but: has fewer proteins its composition varies depending on organs that it drains.**
- **Contains more White blood cells than plasma.**

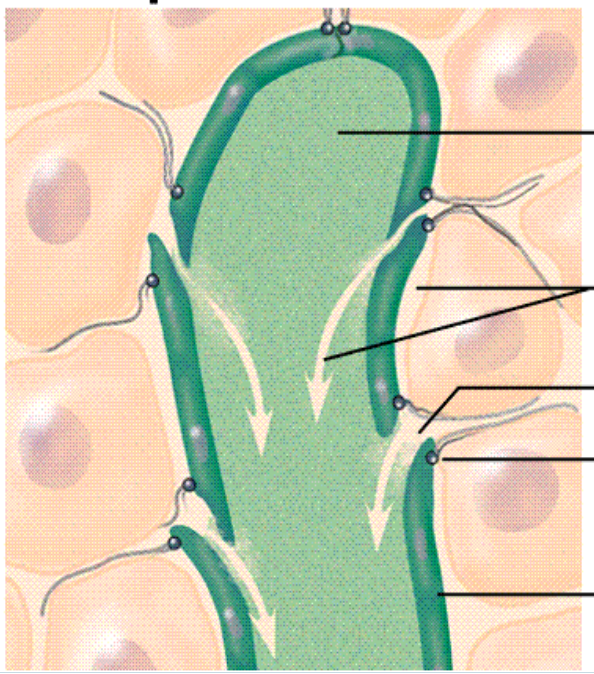
Lymphatic Capillaries

- **The lymphatic network begins with microscopic vessels called lymphatic capillaries.**
- **Lymphatic capillaries are widespread, but are absent in: bones, bone marrow, teeth, CNS.**
- **Structure of lymphatic capillaries:-**
- **Similar to a blood capillaries in that its wall is a single layer of endothelium.**
- **Lymphatic capillaries can also be larger in diameter than blood capillaries, an incomplete basal lamina, and have overlapping endothelial cells.**
- **Anchoring filaments help hold these endothelial cells to the nearby tissues therefore preventing vessels from collapsing.**
- **Unlike blood capillaries, lymphatic capillaries lack closely associated pericytes.**
- **One end of a lymphatic capillary ends blindly, whereas both ends of a blood capillary join other vessels.**



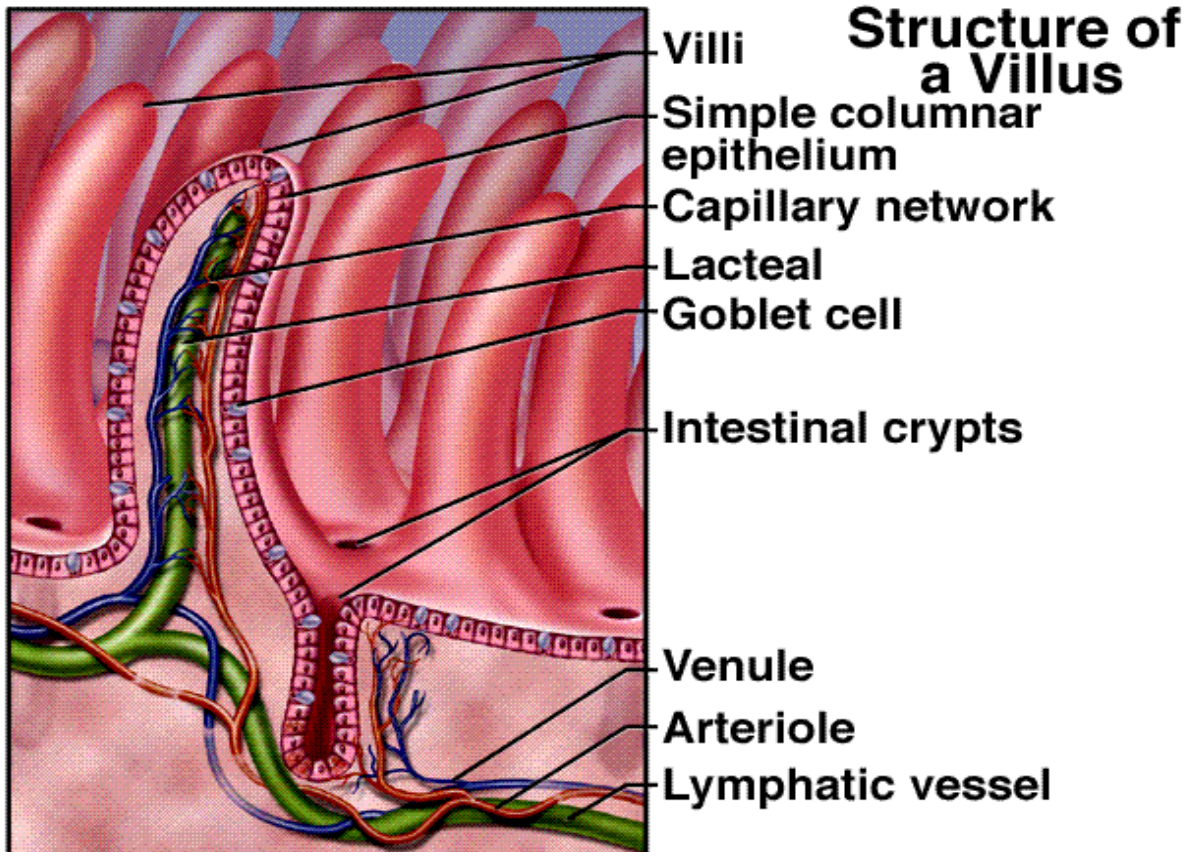


Lymphatic Vessels — Uptake of Tissue Fluid



Lymphatic Capillaries

- **Lacteals: specialized lymph capillaries present in the finger-like villi of the intestinal mucosa, that absorb digested fat and deliver fatty lymph (chyle) to the blood.**

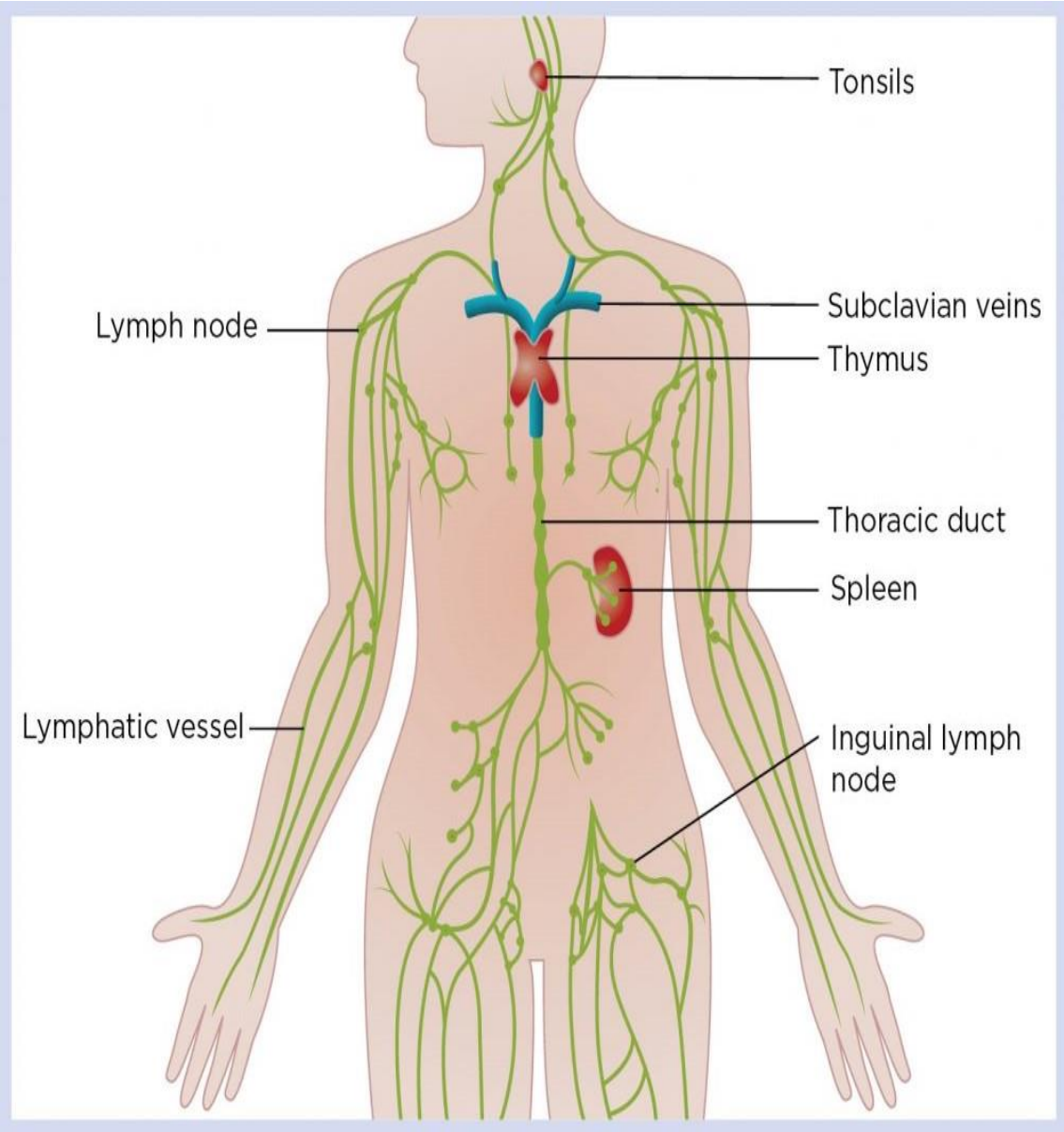


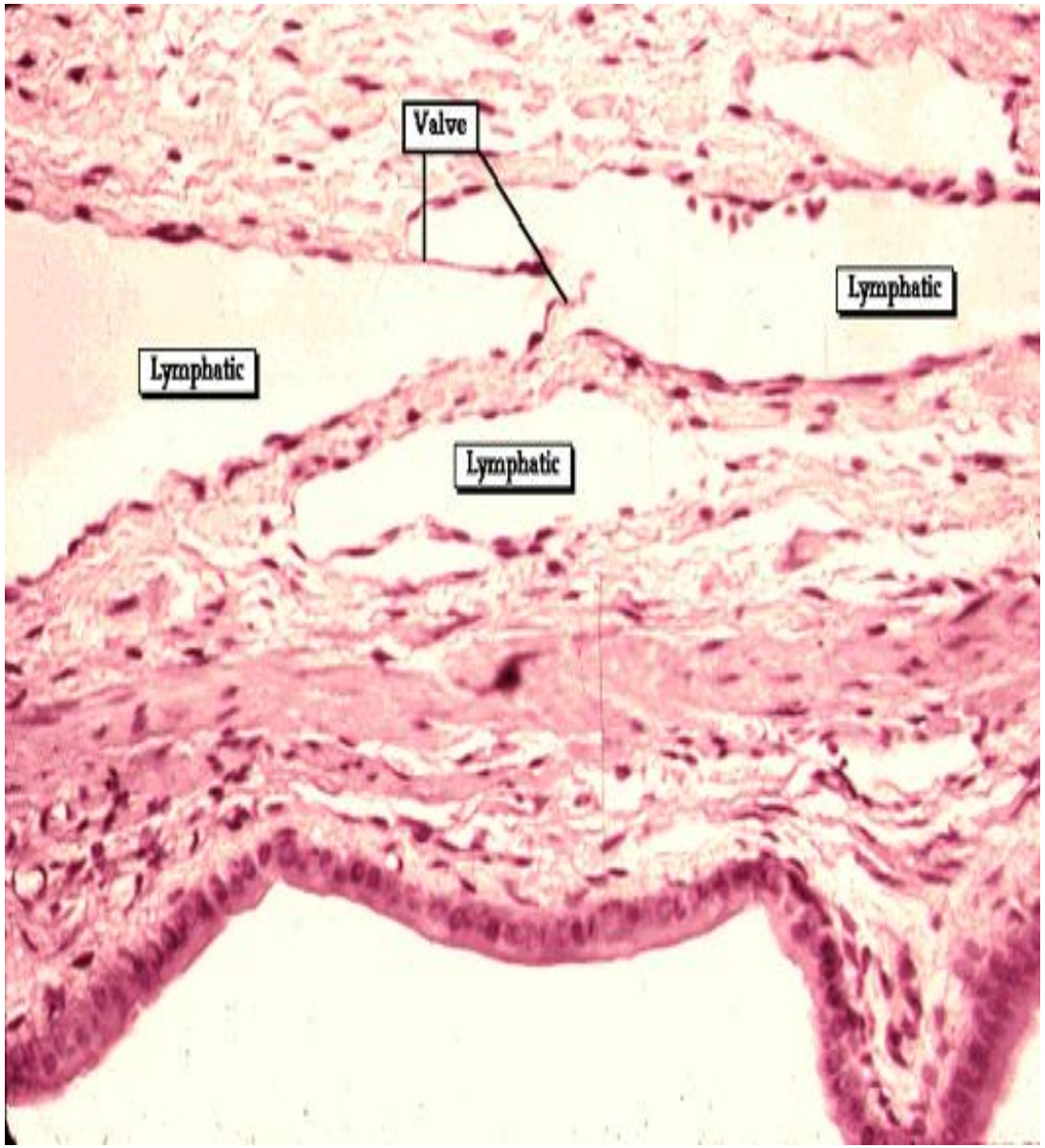
Lymphatic vessels

- **transport excess lymph fluid back to circulatory system.Located in almost all tissues and organs.**
- **Only move in one directions (from body towards heart).**
- **Valves prevent backward flow.**
- **The valves of the lymphatic vessels are formed of thin layers of fibrous tissue covered on both surfaces by endothelium which the same arrangement as on the valves of veins.**
- **Structure of lymphatic vessels:-**
- **The larger lymphatic vessels are each composed of three layers (intima, media, and adventitia).**
- **The internal layer is thin, consists of The endothelium, is composed of an inner lining of single, flattened epithelial cells (simple squamous epithelium). This layer mechanically transports fluid.**

Lymphatic vessels

- **The next layer is smooth muscles arranged in a circular fashion around the endothelium that alters the pressure inside the lumen (space) inside the vessel by contracting and relaxing.**
- **The outermost layer is the *adventitia,* consisting of fibrous tissue. It is made primarily out of collagen and serves to anchor the lymph vessels to structures within the body for stability.**
- **In the smaller vessels there are no muscular or elastic fibers, and the wall consists only of a connective tissue layer, lined by endothelium.**


Tonsils
Lymph node
Subclavian veins
Thymus
Thoracic duct
Spleen
Lymphatic vessel
Inguinal lymph node


Valve
Lymphatic
Lymphatic
Lymphatic

Cells of the Lymphatic System

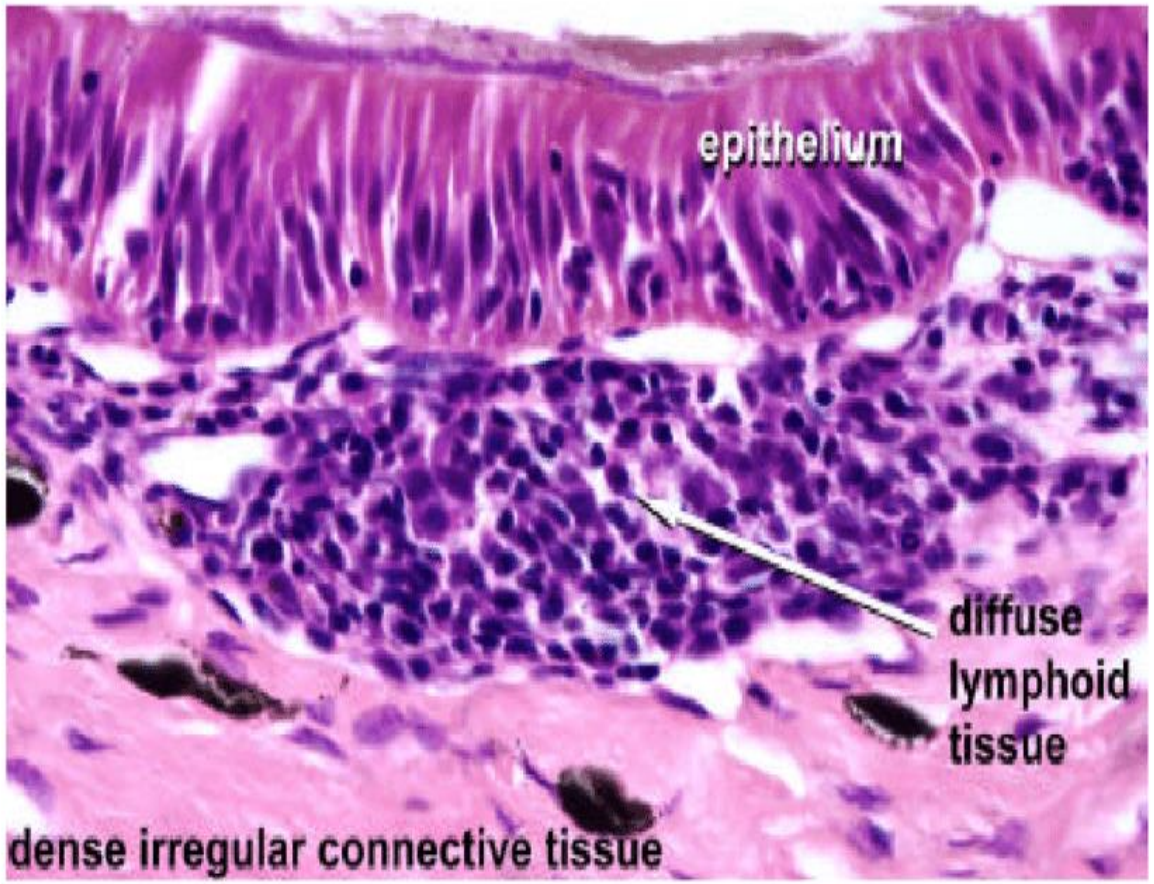
- **Different types of lymphocytes are present in various organs of the body. Morphologically, all types of lymphocytes appear very similar, but, functionally, they are very different.**
- **Lymphoid cells include:**
- **Three major types of lymphocytes are recognized: T lymphocytes (T cells), B lymphocytes (B cells), and natural killer (NK) cells.**
- **Supporting cells interact with lymphocytes and play important roles in the presentation of antigen to lymphocytes and the regulation of immune responses.**
- **These cells include monocytes, macrophages, neutrophils, basophils, eosinophils, reticular cells, dendritic cells, follicular dendritic cells, Langerhans' cells, and epithelia reticular cells.**

Cells of the Lymphatic System

- **(T cells) arise from lymphocytes that are carried from the bone marrow to the thymus gland. Here, they mature, differentiate, and acquire surface receptors and immunocompetence before migrating to take up residence in peripheral lymphoid tissues and organs.**
- **(B cells) mature and become immunocompetent in bone marrow. After maturation, blood carries B cells to the nonthymic lymphoid tissues, such as the lymph nodes, spleen, and connective tissue.**
- **(K cells) develop from the same precursor cells as B and T cells and are the third type of lymphocytes that are especially genetically programmed to recognize and kill certain altered cells.**

Lymphoid tissues

- **Lymphoid tissue is connective tissue characterized by a rich supply of lymphocytes.**
- **It exists free within the regular connective tissue or is surrounded by capsules, forming the lymphoid organs.**
- **Lymphoid tissues are basically made up of free cells, typically with a rich network of reticular fibers.**
- **The lymphatic tissue can be divided into diffuse or nodular:-**
- **Diffuse lymphatic tissue is found in the loose connective tissue spaces beneath most epithelial membranes, such as those that line the gastrointestinal tract and respiratory system.**
- **Nodular lymphatic tissue is always found surrounded by diffuse tissue and it is much more organized. The typical example of nodular lymphatic tissue is the germinal center. A highly ordered collection of B-lymphocytes found in some lymphatic organs. Not all lymphatic organs will contain germinal centers.**


epithelium
diffuse
lymphoid
tissue
dense irregular connective tissue


lamina propria
lymph
nodule
esophageal
epithelium

Lymphoid Organs

1-The central (primary) lymphoid organs.
(thymus & bone marrow).

2-The peripheral (secondary) lymphoid tissues.
(lymph nodes, spleen, mucosal associated lymphoid tissue).