

Lymphatic System

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Lymphatic System

- The **lymphatic system** is part of the circulatory and immune system.
- It is comprising a network of lymphatic vessels that carry a clear fluid called lymph (from Latin, **lymph** meaning "water") directionally towards the heart.
- **Important Terms:**
- **Lymph** - a fluid that contains white blood cells that defend against germs
- **Lymph vessels** - vessels that carry lymph throughout your body. They are different from blood vessels.
- **Lymph Node**- glands found throughout the lymph vessels. Along with your spleen, these nodes are where white blood cells fight infection

Lymphatic System

Basic Function of Lymphatic System

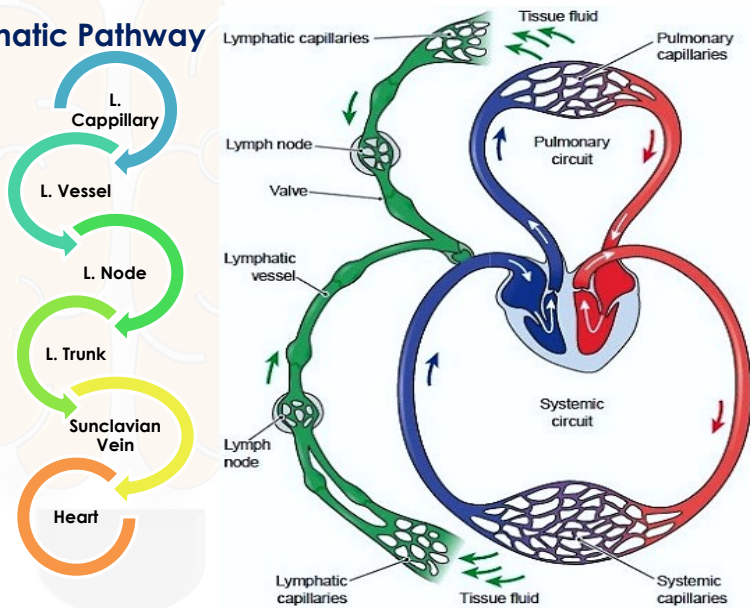
- 🔦 **Defense System:** Protects body against foreign material
- 🔦 **Fluid Balance:** Assists in circulation of body fluids between cells and bloodstream
- 🔦 Transports dietary fats

Components of Lymphatic System

- 🔦 Lymph
- 🔦 lymph vessels
- 🔦 lymph nodes
- 🔦 lymph organs, e.g. spleen and thymus
- 🔦 Diffuse lymphoid tissue, e.g. tonsils
- 🔦 bone marrow

Lymphatic System

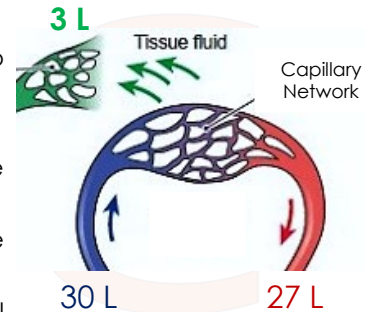
Lymphatic Pathway



Lymphatic System

1. Lymph = Clear Fluids

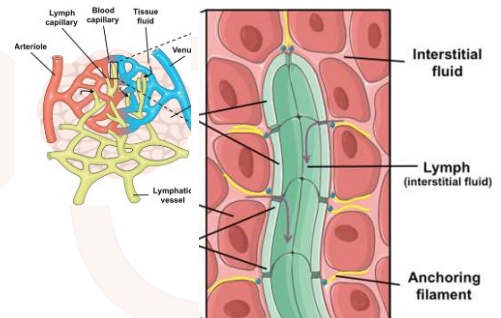
- Lymph is a clear watery fluid, similar in composition to plasma
- Contains more white blood cells than plasma
- Additionally it contains large substances that are too large to pass through blood capillary walls.
- Lymph transports the plasma proteins that seep out of the capillary beds back to the bloodstream.
- It also carries away larger particles, e.g. bacteria and cell debris from damaged tissues, which can then be filtered out and destroyed by the lymph nodes.
- In the lacteals of the small intestine, fats absorbed into the lymphatics give the lymph (now called chyle), a milky appearance.
- Flows through node in one direction



Lymphatic System

2. Lymph Capillaries

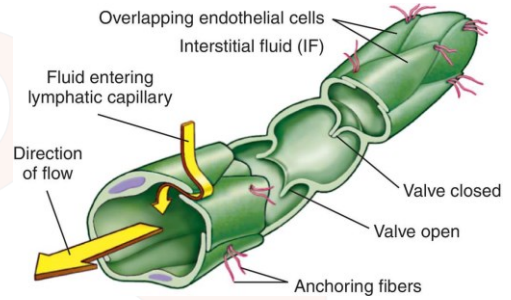
- Lymph capillary starts from intercellular spaces and form a network in intercellular spaces of most of the tissues of the body.
- The wall of lymph capillaries are made of single layer of endothelial cells.
- The lymph capillaries are different from blood capillaries in following respect:
 1. Begin blindly in intercellular spaces
 2. Have bigger lumen which is less regular
 3. Are permeable to bigger molecules .
- The sites where lymph capillaries are absent- Epidermis, Hair, Nails, Cornea, Articular cartilage, Brain and spinal cord, splenic pulp



Lymphatic System

3. Lymph Vessels

- Lymph capillaries further make lymph vessels, which carry the lymph toward the vein in unidirection.
- Their walls are about the same thickness as those of small veins and have the same layers of tissue,
 - Outer: a fibrous covering,
 - Middle layer: smooth muscle and elastic tissue
 - Inner lining: endothelium
- It has move forward the lymph by
 - Constriction of vessels
 - Skeletal muscle pump
 - Respiratory pump

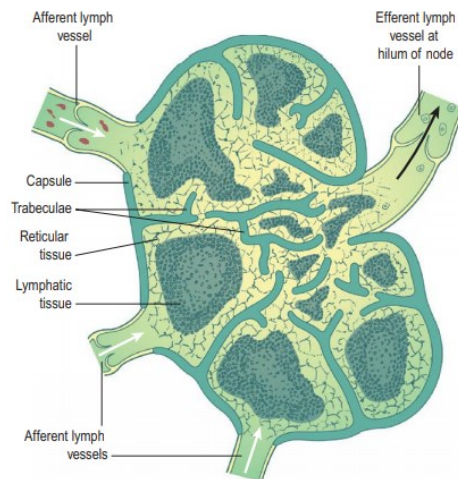


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Lymphatic System

3. Lymph Node

- Lymph nodes are oval or bean-shaped, made up masses of lymphatic tissue and located along length of lymphatic vessels.
- The lymph drains through a number of nodes, usually 8–10, before returning to the venous circulation.
- These nodes vary considerably in size: some are as small as a pin head and the largest are about the size of an almond.
- There are two main region: Cortex (Outer region) and Medulla (inner region).



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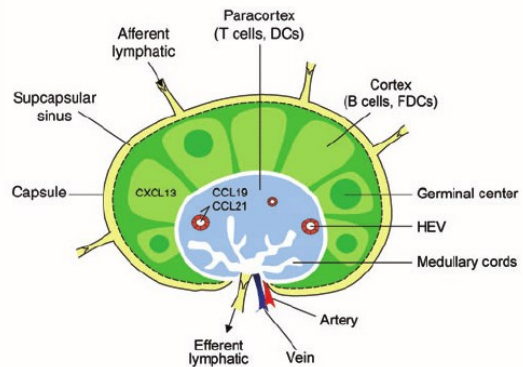
Lymphatic System

3. Lymph Node

- There are two main region: Cortex (Outer region) and Medulla (inner region).
- Cortex contains densely packed lymphocytes arranged in masses called follicles - outer rim of follicle contains T cells, macrophages, and follicular dendritic cells (aid in T cell activation)
- In medulla, lymphocytes are arranged in strands called medullary cords - contain macrophages and plasma cells

Function:

- Proliferation of lymphocytes:** Activated T- and B-lymphocytes multiply in lymph nodes. Antibodies produced by sensitised B-lymphocytes enter lymph and blood draining the node



Lymphatic System

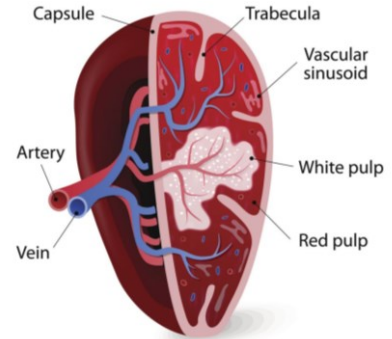
3. Lymph Node

- Filtering and phagocytosis:**
- Lymph passes through node wherein bacterial and others materials are trapped by reticular fibers within the node- then phagocytized by macrophages
- Lymph node also contains Lymphocytes (B & T Cell) which helps in defense system.
- Major lymph node:
 - Cervical (neck area): filter lymph from head and neck
 - Axillary (armpit)- filter lymph from hand, arm, breast
 - Inguinal (groin area)- filter lymph from lower extremities and external genital organs
 - Mesenteric (abdominal peritoneum)- filter lymph from abdominal cavity

Lymphatic System

4. Spleen

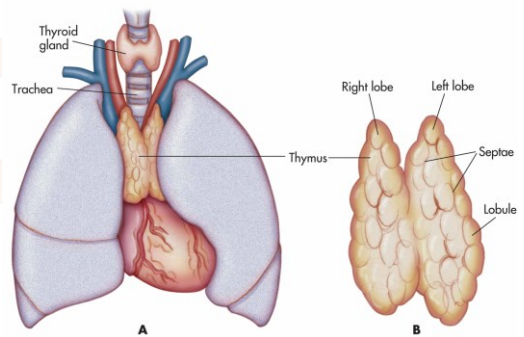
- The spleen is slightly oval in shape with the hilum on the lower medial border
- **Function:**
- Phagocytosis of bacteria and worn out or damaged red blood cells and platelets
- Stores and releases blood in times of demand, e.g., hemorrhage
- Functions in immunity as a site of B cell proliferation into plasma cells
- Erythropoiesis: The spleen and liver are important sites of fetal blood cell production



Lymphatic System

5. Thymus Gland

- **Function:**
- Bone marrow produce immature T cells, which migrate to thymus via blood
- in thymus, cells develop into mature T cells for release into circulation
- Thymic hormones aid in maturation of T cells
- mature T cells responsible for cell-mediated immune responses



Lymphatic System

6. Bone Marrow

- The Red Bone Marrow is a key element of the lymphatic system
- Being one of the primary lymphoid organs that generate lymphocytes from immature hematopoietic progenitor cells
- The bone marrow and Thymus constitute the primary lymphoid tissues involved in the production and early selection of lymphocytes

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