

# Lymphatic system

A second vessel system exists in the body which carries lymph instead of blood.

There are two classes of cells:

1. **The specific immune cells:** T and B lymphocytes
2. **The non-specific immune cells:** tissue macrophages, the endothelium of liver, the spleen and marrow sinusoids, the alveolar macrophages in the lungs, the Langerhans cells in the skin, and the microglia.

## Lymphatic tissue found in the body as

- A. Single cells for example diffuse lymphatic tissue and lymph nodules
- B. Aggregates of cells such as tonsils
- C. Complex organ such as thymus, lymph nodes and spleen

## Thymus

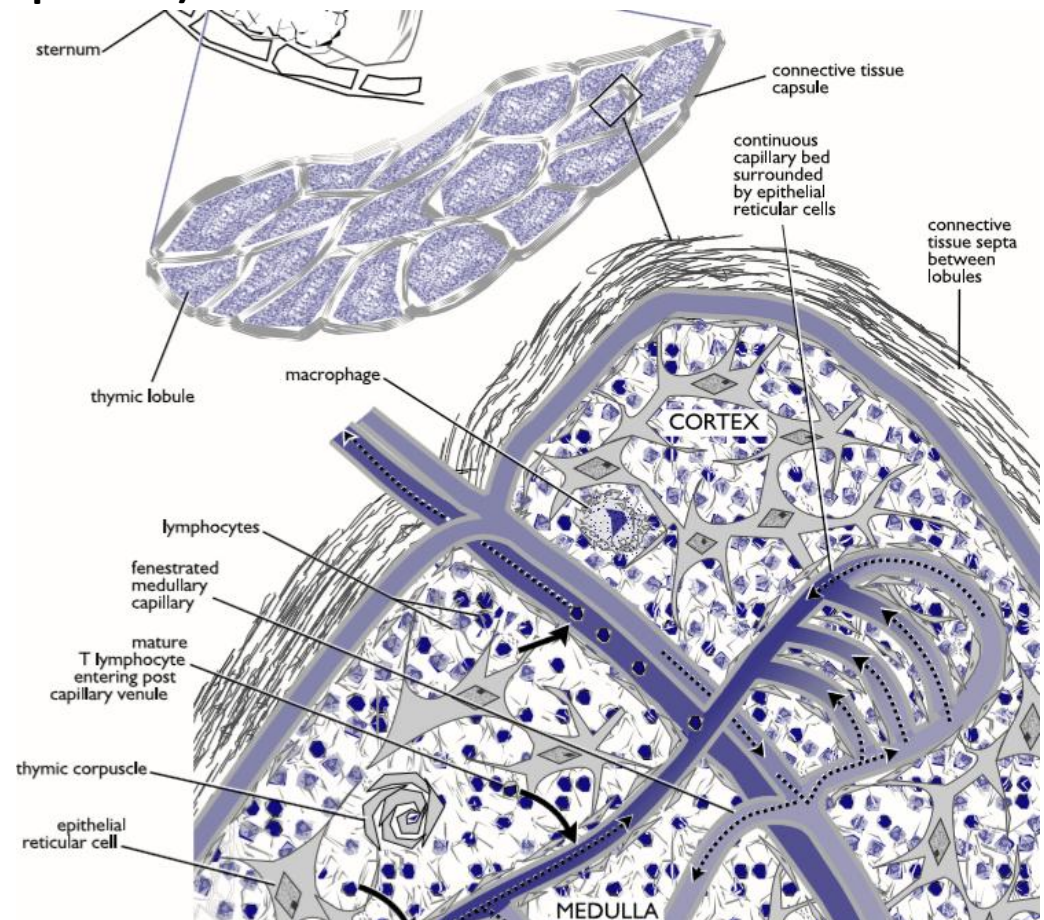
- The thymus is a primary lymphoid organ which is located in the neck and extends into the thorax within the cranial mediastinum.
- The organ is comprised of lobes covered by a connective tissue capsule.
- Each lobule has a cortical and a medullary region.
- The thymus is most prominent in young animals and regresses later in life.

## Cortex of the Thymus

1. **Stellate epithelial reticular cells** form the framework of the cortex.
2. **Thymocytes (maturing T lymphocytes)**
3. **Phagocytic cells called tingible body macrophages** are interspersed among the lymphocytes.

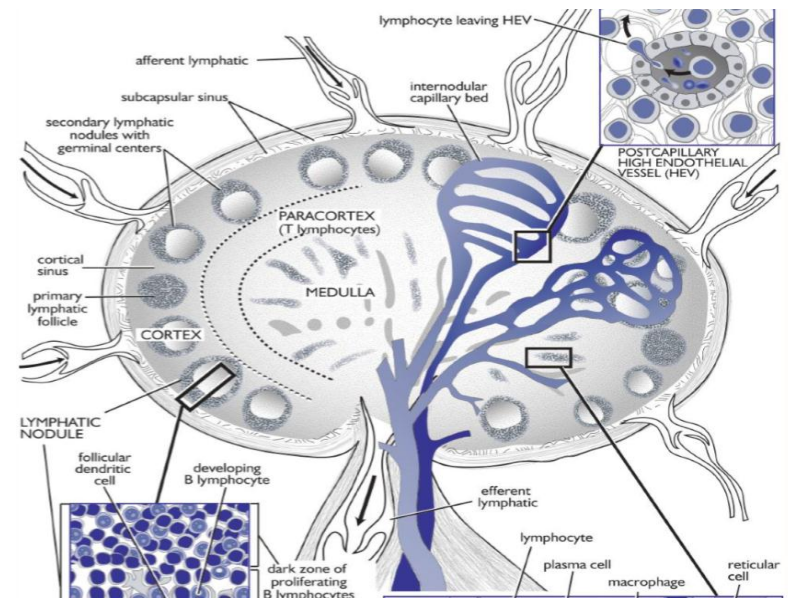
## Medulla of the Thymus

- **Medullary epithelial reticular cells**, which are somewhat larger than their cortical counterparts
- **Unique thymic corpuscles (Hassall's corpuscles)** of unknown function are also located in the medulla.



# Lymph nodes

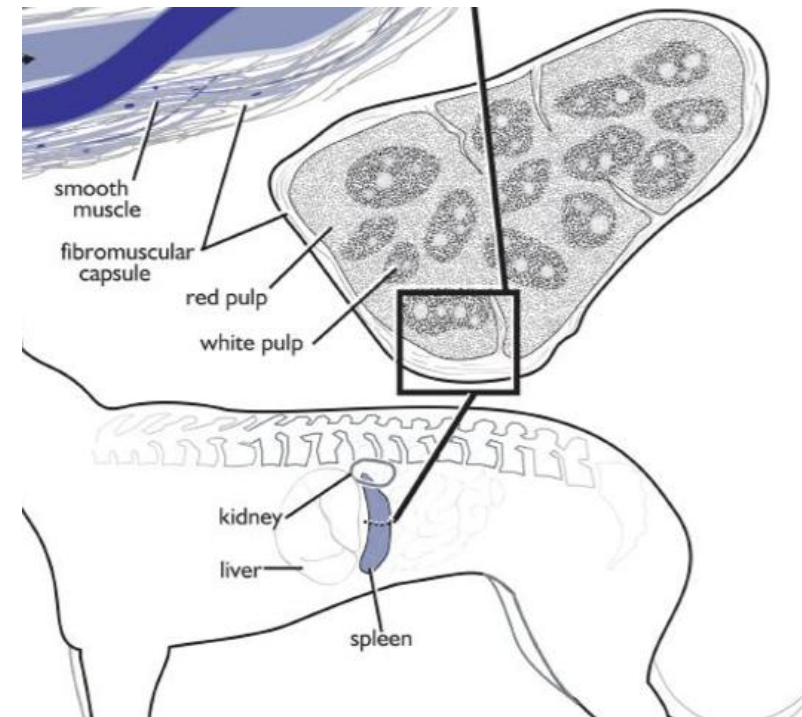
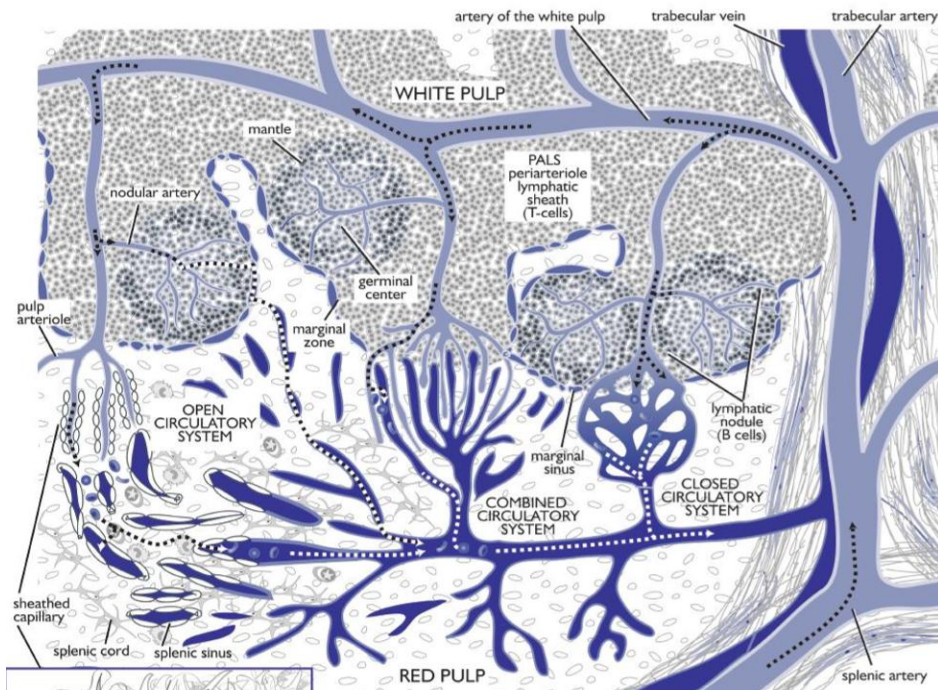
- They filter lymph and produce lymphocytes and scattered throughout the body.
- Lymph nodes contain multiple lymphatic nodules which are aggregates of lymphocytes. Macrophages, reticular cells, follicular dendritic cells and other dendritic cells are also found in the node.
- Lymphatic nodules, cortical and medullary sinuses and medullary cords are the structural elements of the lymph node.
- The germinal centre of a lymphatic nodule is comprised of maturing B lymphocytes surrounded by supporting follicular dendritic cells.
- Medullary cords contain plasma cells, macrophages and reticular cells.
- Lymphocytes enter hemal nodes via the blood.
- Hemal lymph nodes filter both blood and lymph in the same sinus.





# Spleen

- It filters and stores blood, participates in blood cell formation in the fetus, and removes spent erythrocytes.
- Lymphatic nodules are scattered throughout the parenchyma of the spleen.
- The spleen is organized as
  - **Red pulp:** it is consisted of blood-filled sinuses and cords of splenic cells.
  - **White pulp:** It is comprised of periarteriolar lymphatic sheaths (PALS) and lymphatic nodules with associated efferent lymphatic, it has large numbers of lymphocytes
  - **Marginal Zone of the Spleen** is located between the red and white pulp.
- The spleen is surrounded by a connective tissue capsule with variable amounts of smooth muscle, connective tissue trabeculae extend from the capsule into the parenchyma.



# Mucosa-Associated Lymphatic Tissue

- Lymphatic tissue is distributed in many other locations throughout the body besides the lymph nodes, spleen and thymus.

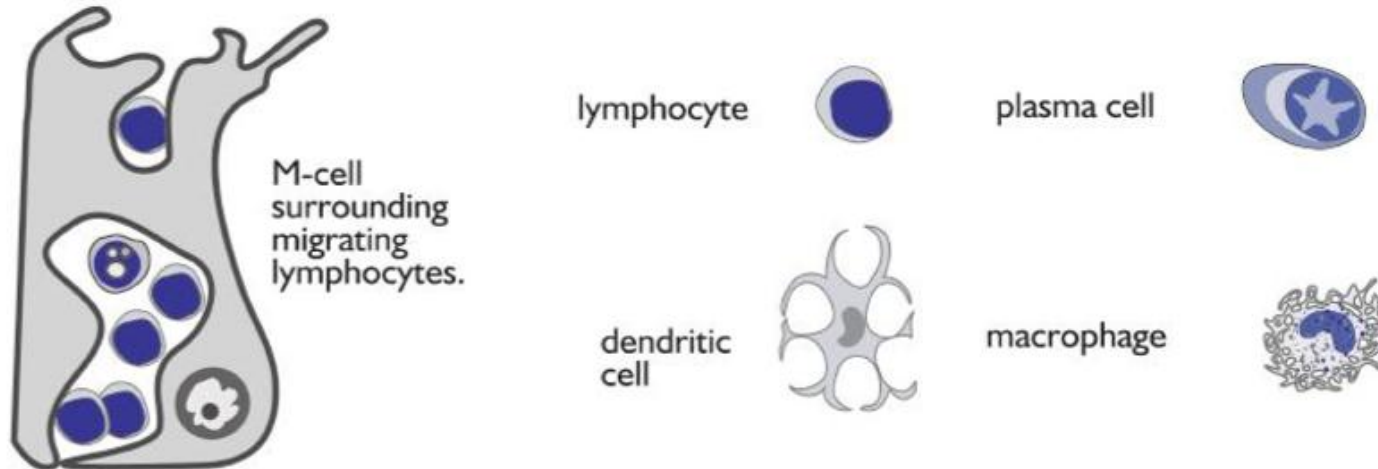
## A. Diffuse Mucosal Lymphatic Tissue

- Populations of lymphocytes are found within the epithelium or the lamina propria.

## B. Gut-Associated Lymphatic Tissue (GALT)

- Solitary and aggregated lymphatic nodules are located along the digestive tract.
- In the small intestine, aggregated lymphatic nodules (Peyer's patches) are most numerous in the ileum.
- **M cells (microfold cells)** which are located among other intestinal absorptive cells.
- Follicular B and T lymphocytes comprise the rest of the lymphatic nodules.

### CELLS OF MUCOSA-ASSOCIATED LYMPHATIC TISSUE



### **C. Bronchiolar-Associated Lymphatic Tissue (BALT)**

- Lymphatic nodules are also found in the walls of the bronchi and bronchioles

### **D. Tonsils Palatine**

- Tonsils are located at the junction of the oral cavity and oropharynx.

### **Cloacal Bursa in Avians**

- Most birds do not have lymph nodes.
- The function of mammalian nodes is taken over by diffuse lymphatic tissues and a lymphatic organ in the dorsal wall of the cloaca called the cloacal bursa (bursa of Fabricius).
- B cell precursors migrate to the bursa early in development and lymphopoiesis occurs in the folds of the organ.
- Surface epithelium of the bursa has the ability to present antigen to the underlying developing lymphocytes.