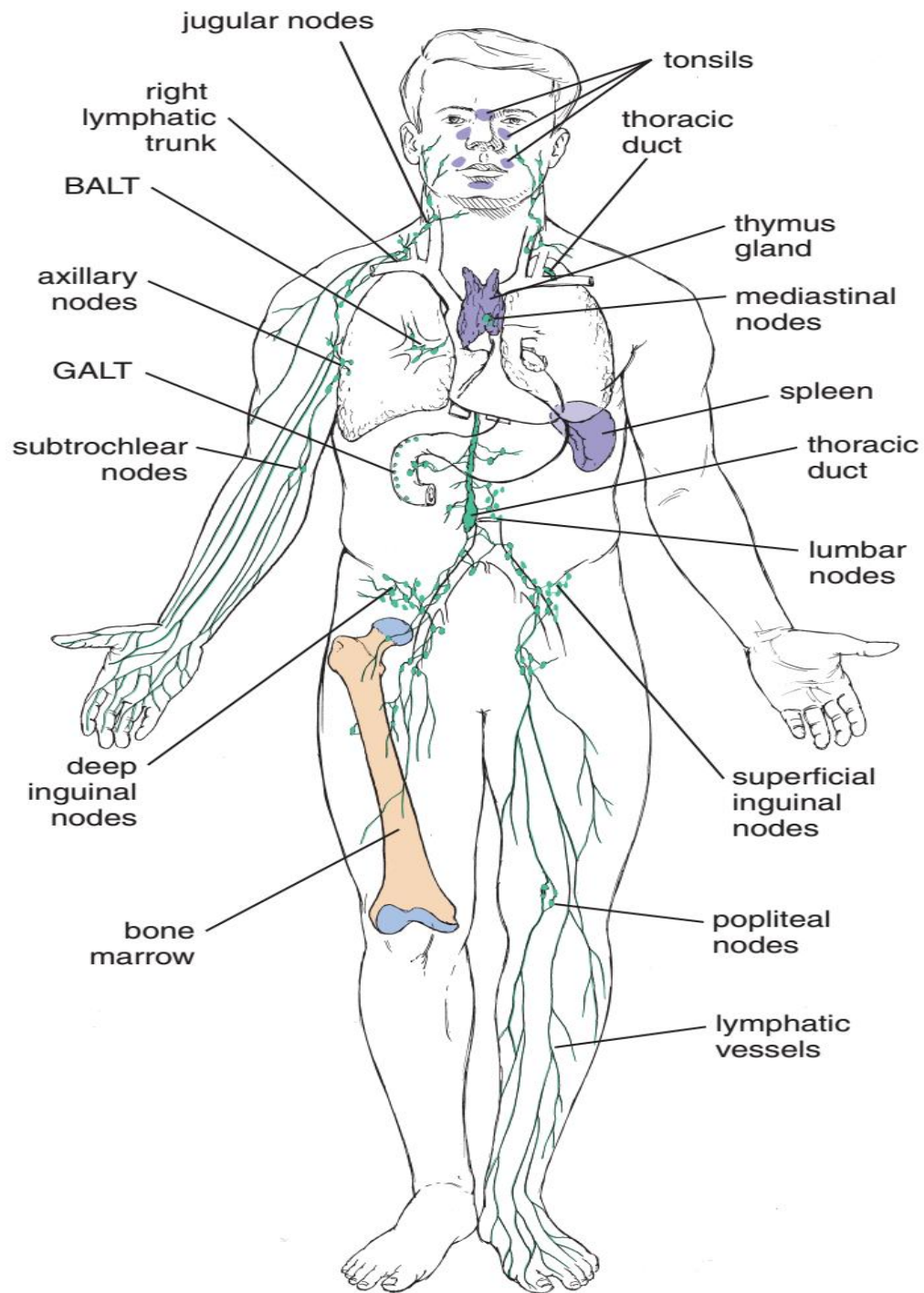


MICROSCOPIC ORGANIZATION OF LYMPHOID TISSUE

DR. BEDA OLABU

LYMPHOID TISSUE - INTENDED LEARNING OUTCOME:

1. State the components of the lymphatic system
2. Outline the functions of the lymphatic system
3. State the varieties and functions of cells of the lymphatic system
4. Give examples of the antigen presenting cells
5. State the types and functions of lymphatic vessels
6. State the structure and distribution of the diffuse lymphatic tissue and lymphatic nodule
7. Describe the microscopic organization and function of a lymph node, thymus and spleen
8. State the structure and types of bone marrow



COMPONENTS

- Lymphocytes
- Lymphatic vessels
- Diffuse lymphatic tissue
- Lymphatic nodules
- Lymph nodes
- Spleen
- Thymus
- Bone marrow



FUNCTIONS OF LYMPHATIC TISSUE

- Sites for proliferation, differentiation, and maturation of lymphocytes
- Sites for lymphocyte “education” to recognize and destroy specific antigens

CELLS OF THE LYMPHATIC SYSTEM

Lymphocytes

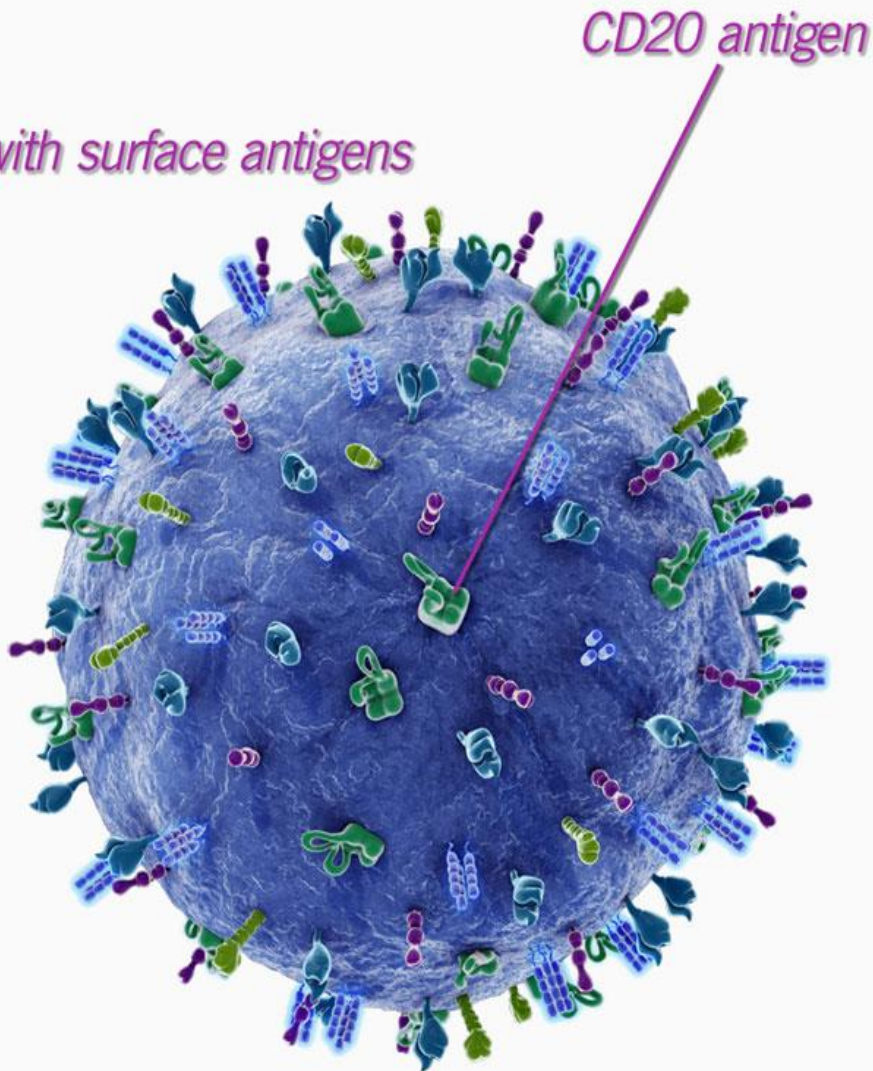
- The definitive cell type; function as the effector cells
- Include B cells, T cells, and NK cells

Supporting cells

- Involved in presentation of antigens to lymphocytes
- Regulation of immune responses
- Monocytes, macrophages, neutrophils, basophils, eosinophils, reticular cells, dendritic cells, follicular dendritic cells, Langerhans' cells, and epithelioreticular cells

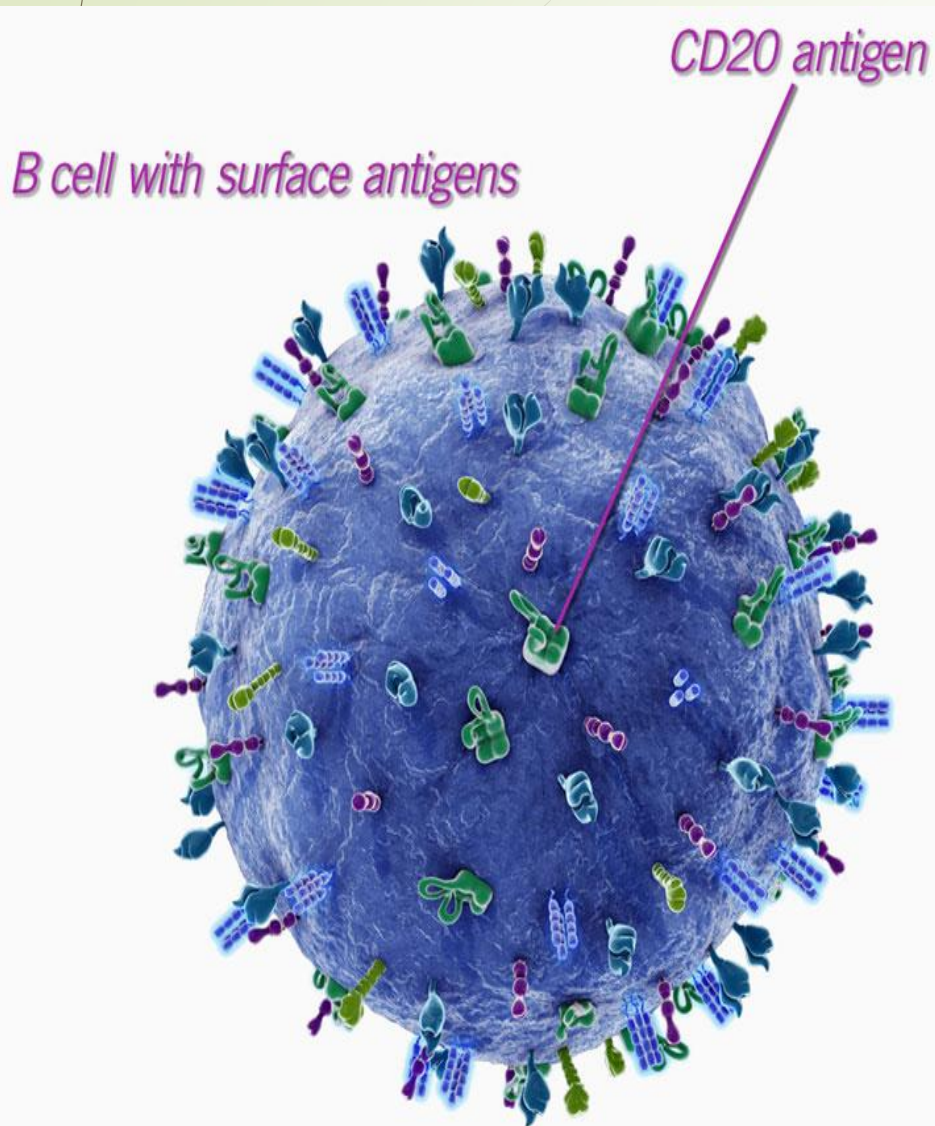
CLUSTER OF DIFFERENTIATION (CD) MARKERS

B cell with surface antigens



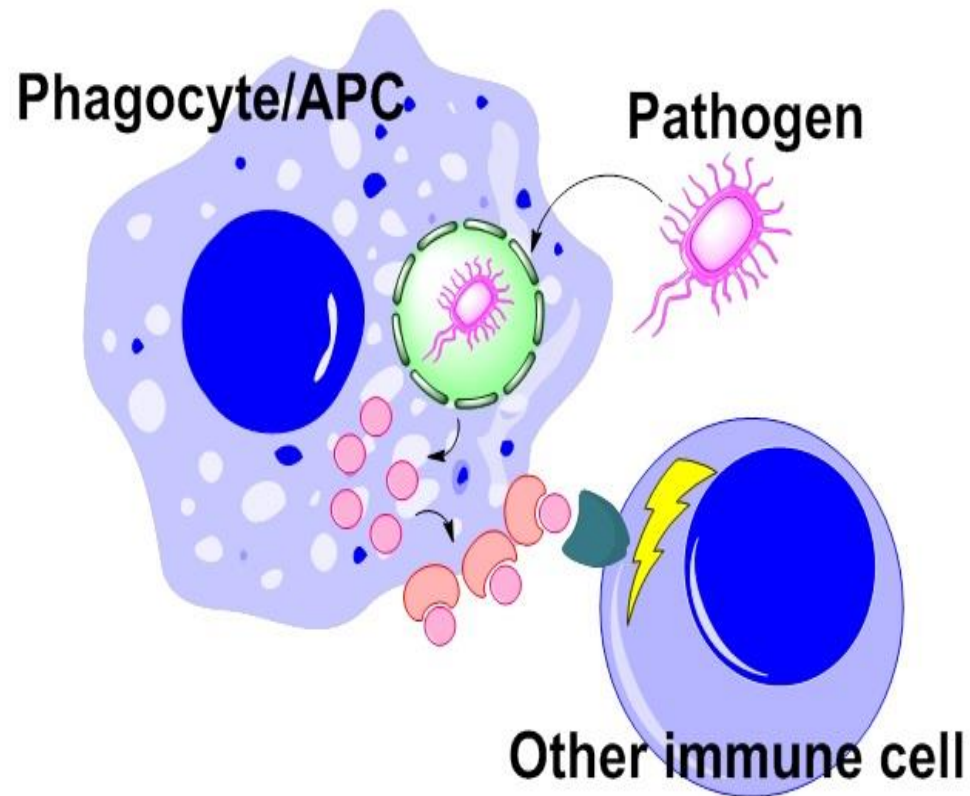
- Unique cell surface molecules on lymphatic and hematopoietic tissue cells
- Designated by numbers according to an international system
- Can be visualized by immunohistochemical methods hence are useful in identifying specific subtypes of cells

SOME CLINICALLY IMPORTANT CD MARKERS



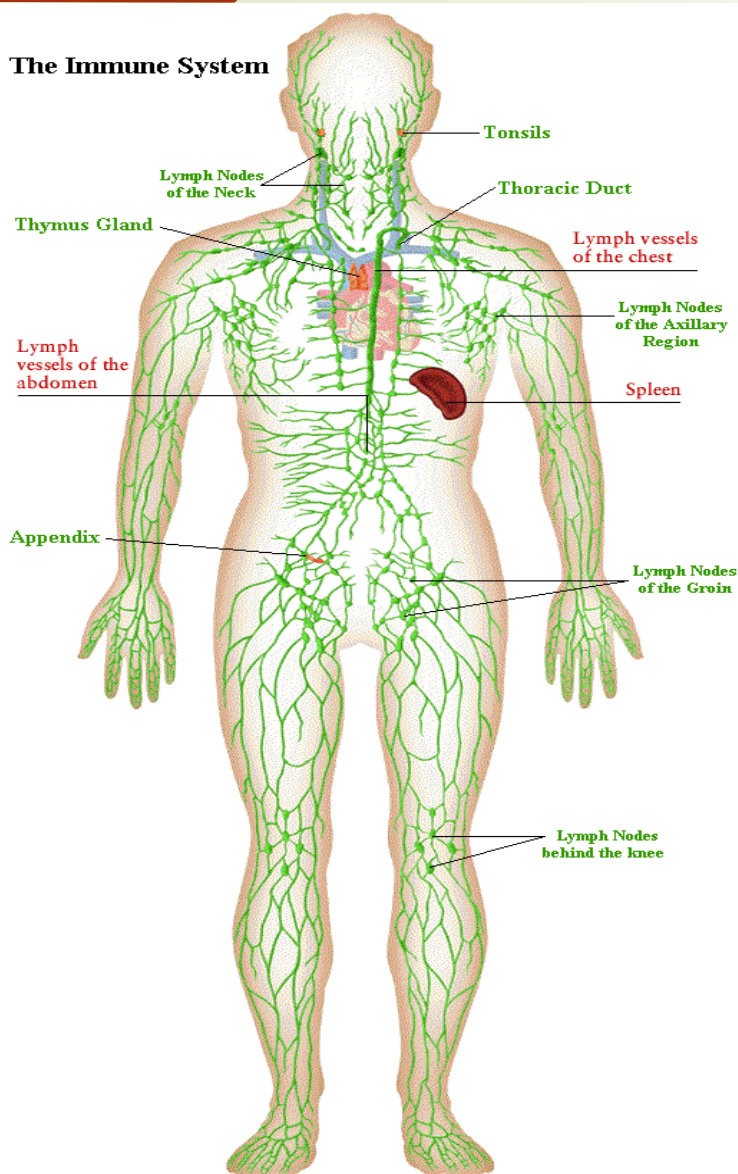
CD	Cellular marker/Clinical use
CD2	T cells
CD4	Helper T cells
CD7	T-cell leukemia stem cells
CD8	Cytotoxic T cells
CD10	Acute lymphoblastic leukemia
CD19	All stages of B-cell development
CD20	Mature B-cells
CD34	Haemopoietic stem cells
CD56	NK Cells
CD94	NK Cells

ANTIGEN-PRESENTING CELLS



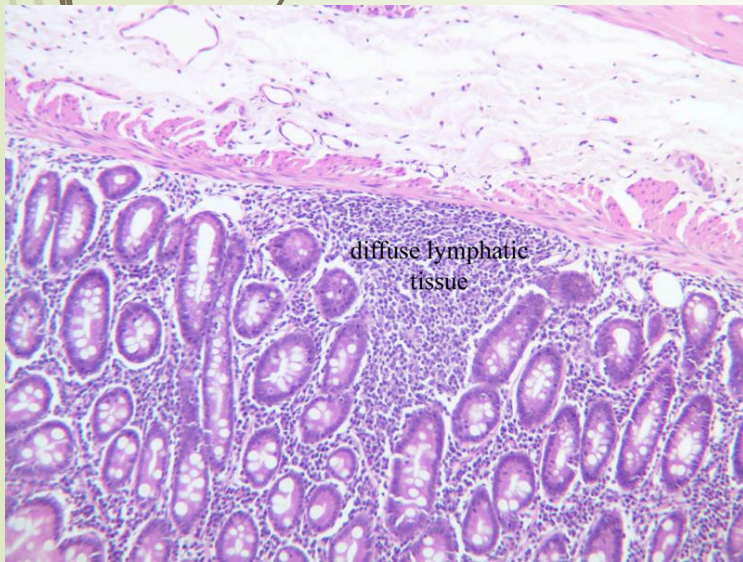
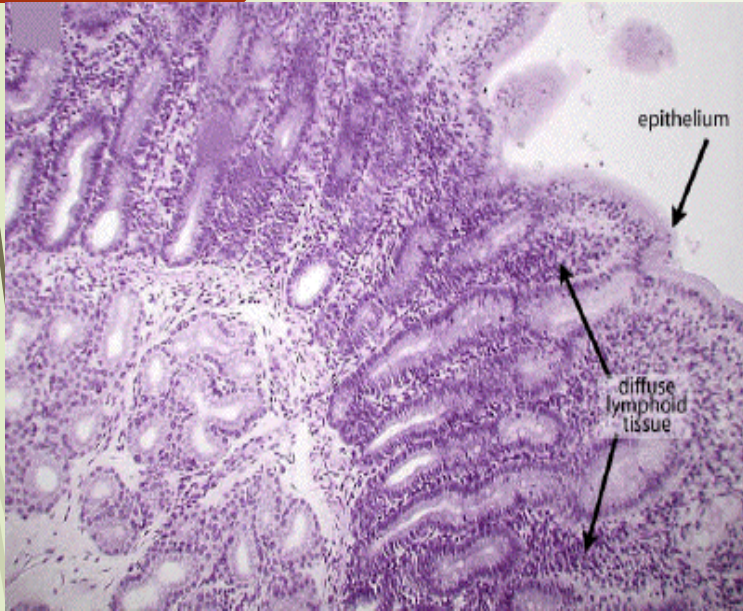
- Break down antigens into small peptides and present the fragments to T cells
- Mainly cells of the mononuclear phagocytic system
- Macrophages
- Kupffer cells
- Langerhans' cells
- Dendritic cells

LYMPHATIC VESSELS



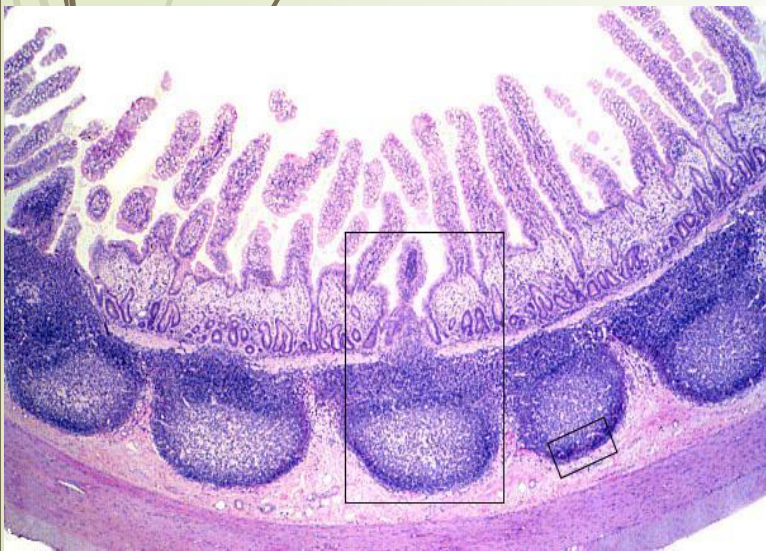
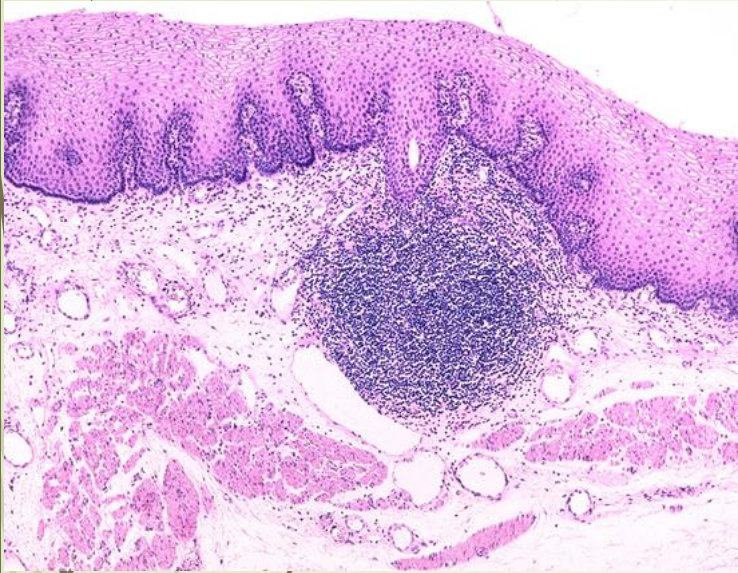
- Form the route by which cells pass from the tissue spaces back to the blood
- Begin as networks of blind capillaries in loose connective tissue
- Most numerous beneath the epithelium of skin and mucous membranes
- They enter lymph nodes via afferent lymphatic vessels and leave via efferent lymphatic vessels
- Largest are the right lymphatic trunk and the thoracic duct

DIFFUSE LYMPHATIC TISSUE



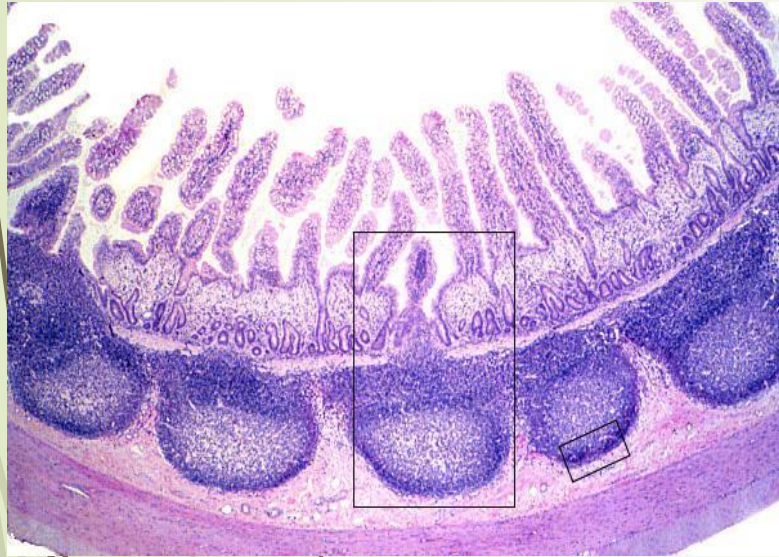
- Diffuse accumulations of lymphatic tissue without a covering capsule
- Found in the lamina propria of GIT, respiratory and genitourinary tracts
- Strategically located to intercept antigens and initiate an immune response
- Commonly called MALT – GALT and BALT

LYMPHATIC NODULES (LYMPHATIC FOLLICLES)



- Discrete, sharply defined accumulations of lymphatic tissue without a covering capsule
- Contained within a meshwork of reticular cells
- Specific aggregations are found in the tonsils, ileum and vermiform appendix
- Can be a primary or secondary nodule

SECONDARY LYMPHATIC NODULE



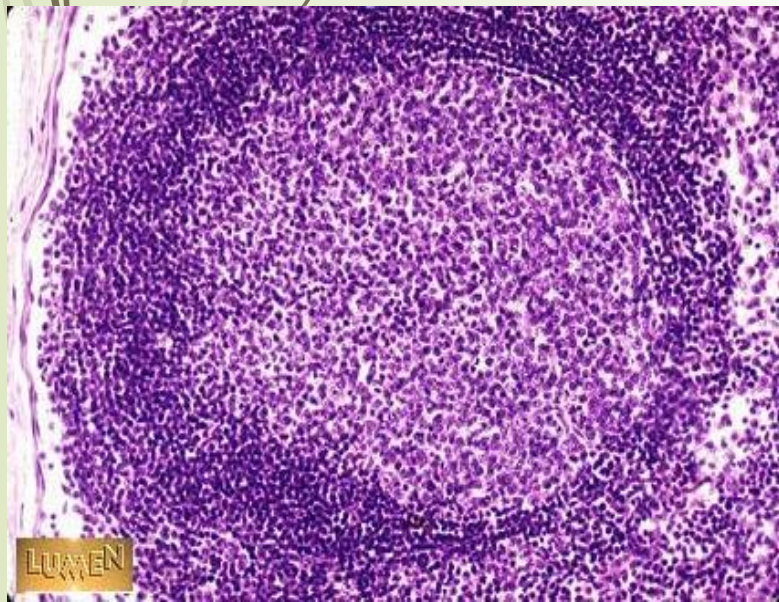
Distinctive features:

The germinal centre

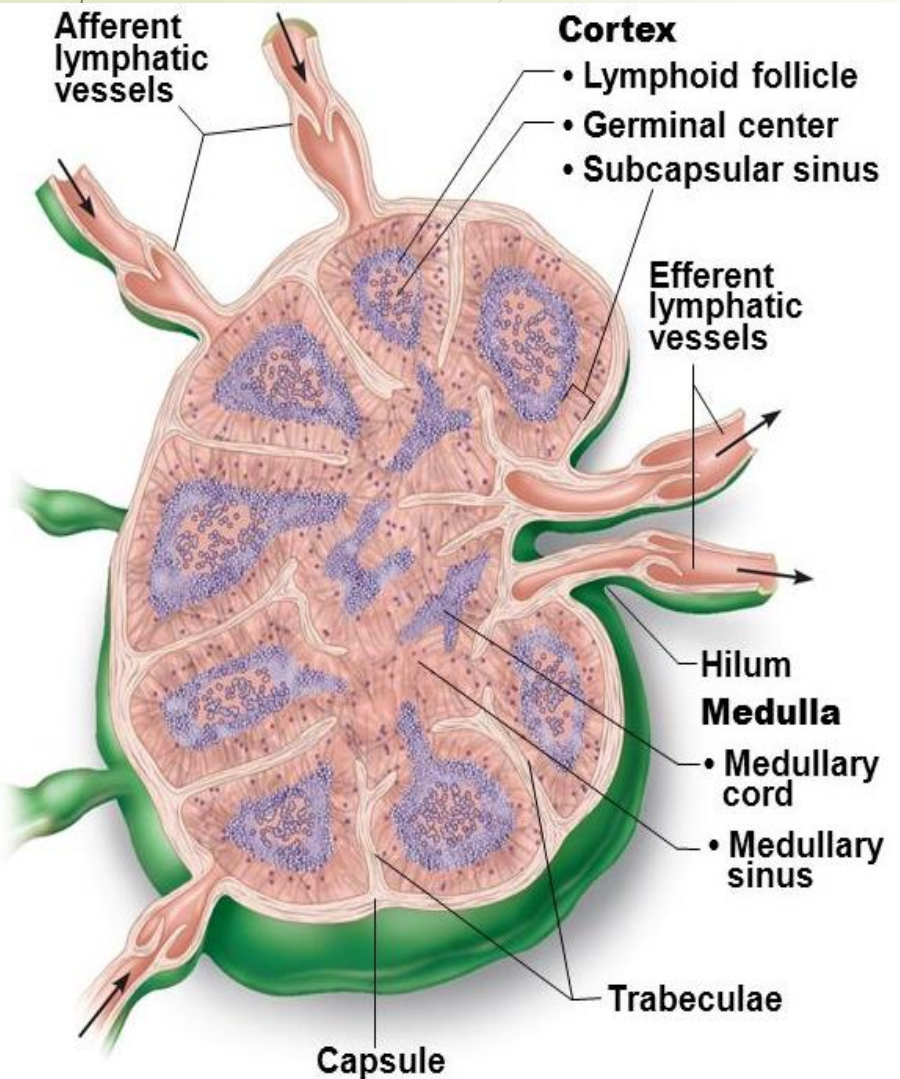
- Central lightly stained region of the nodule
- Morphologic indication of lymphatic tissue response to antigen
- Contains B lymphocytes and Follicular dendritic cells (FDCs)

The Mantle zone or corona

- Outer ring of small lymphocytes that encircles the germinal center

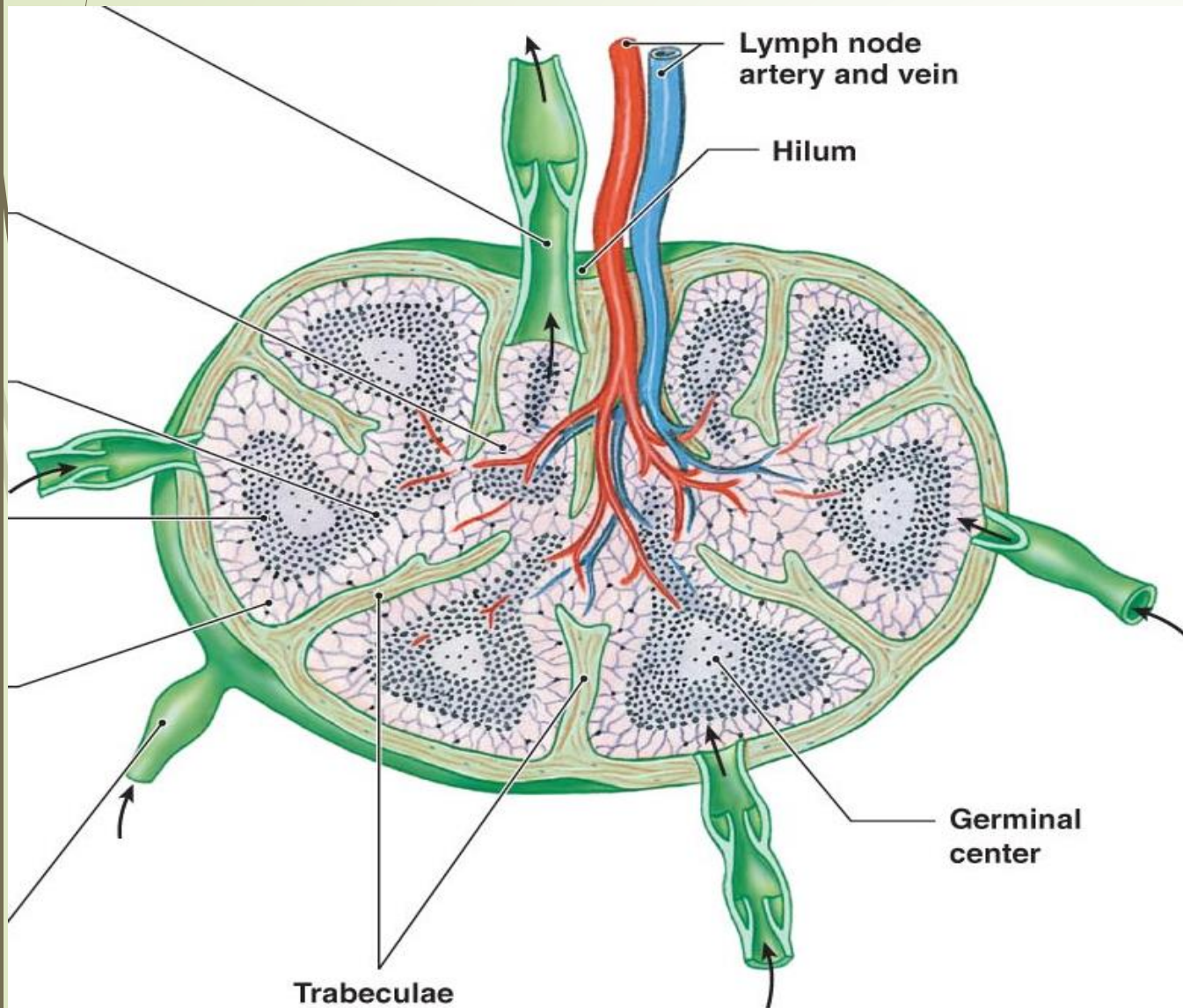


LYMPH NODES



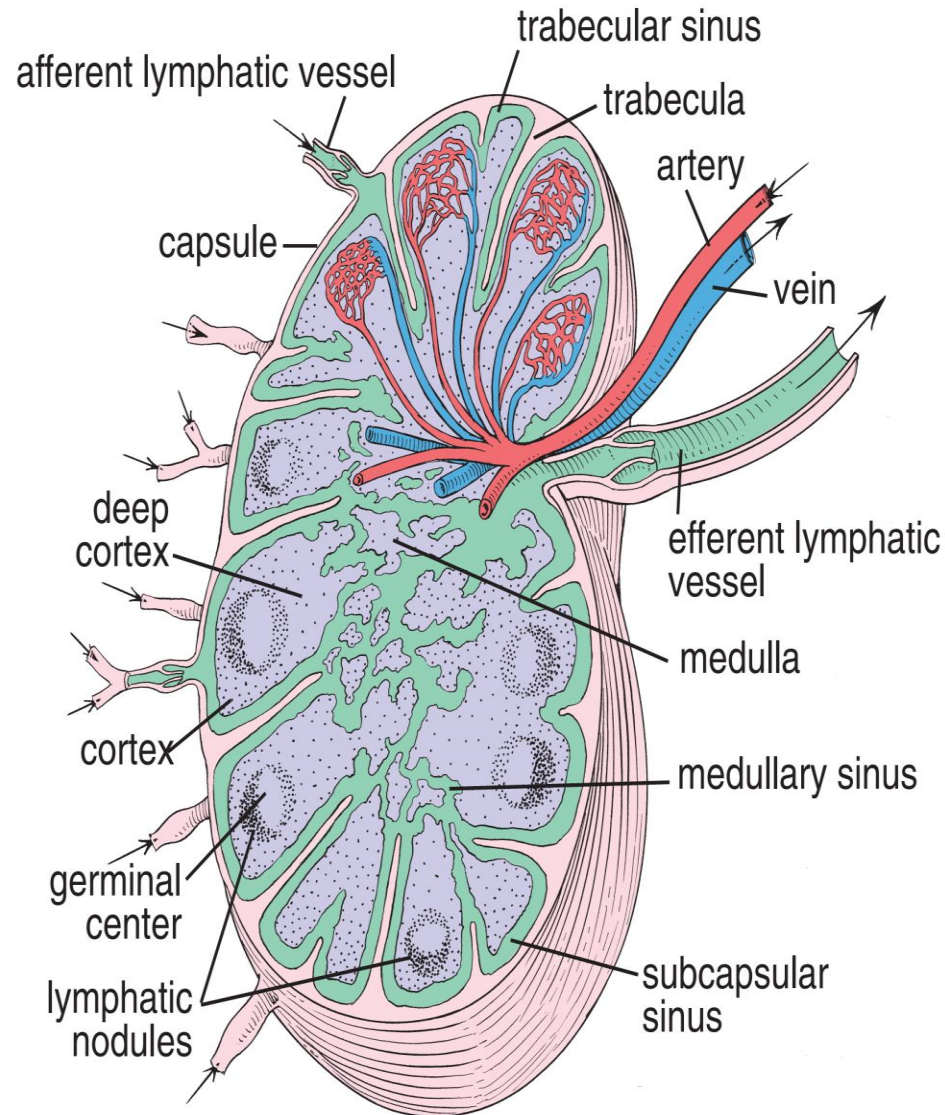
- Small, bean-shaped, encapsulated structures interposed along lymphatic vessels
- Variable sizes (1-20mm)
- Serve as filters through which lymph percolates on its way to the bloodstream
- Concentrated in certain regions such as the axilla, groin, and mesenteries
- Has afferent and efferent lymphatic vessels

LYMPH NODE STRUCTURE – THE STROMA



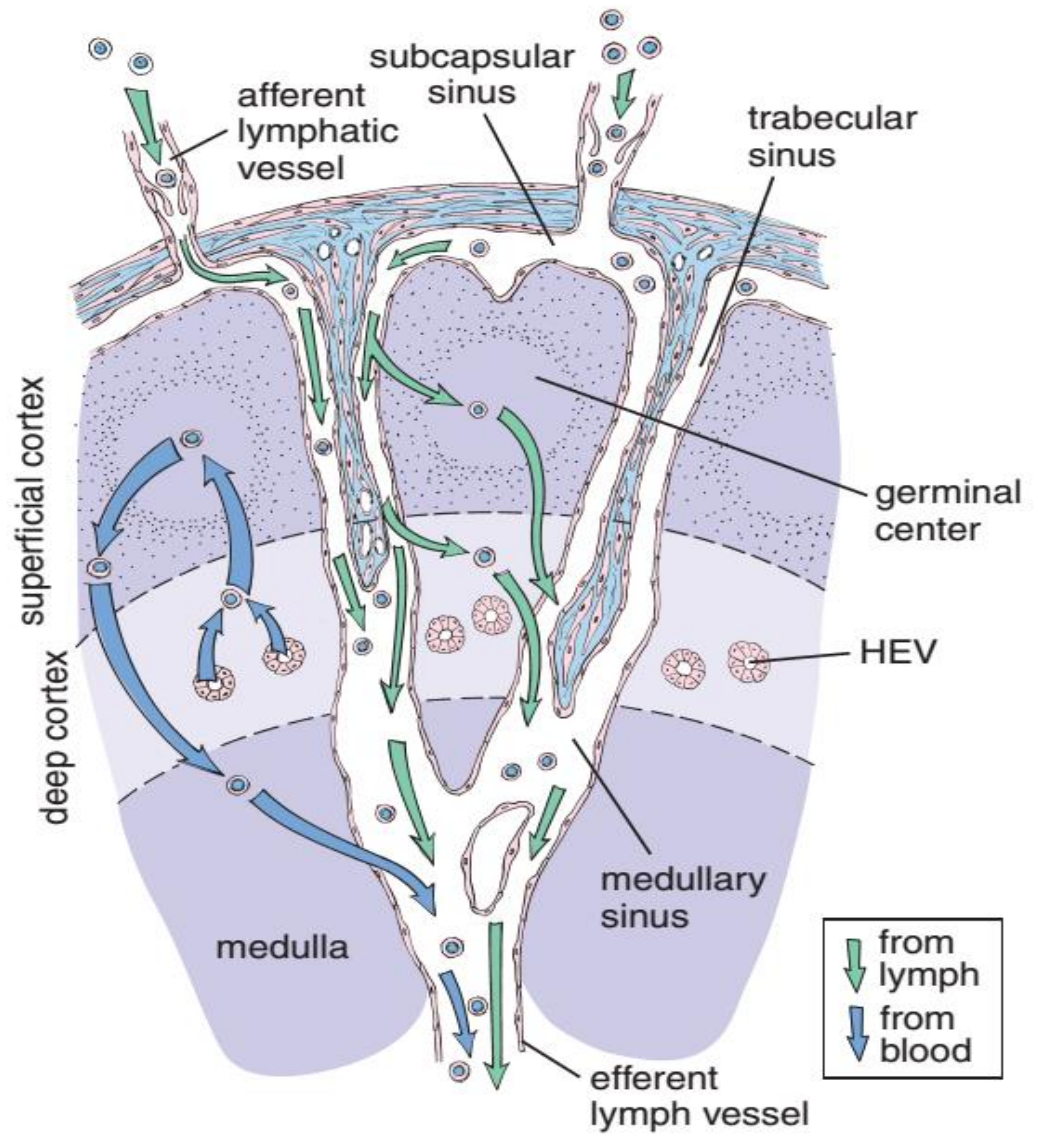
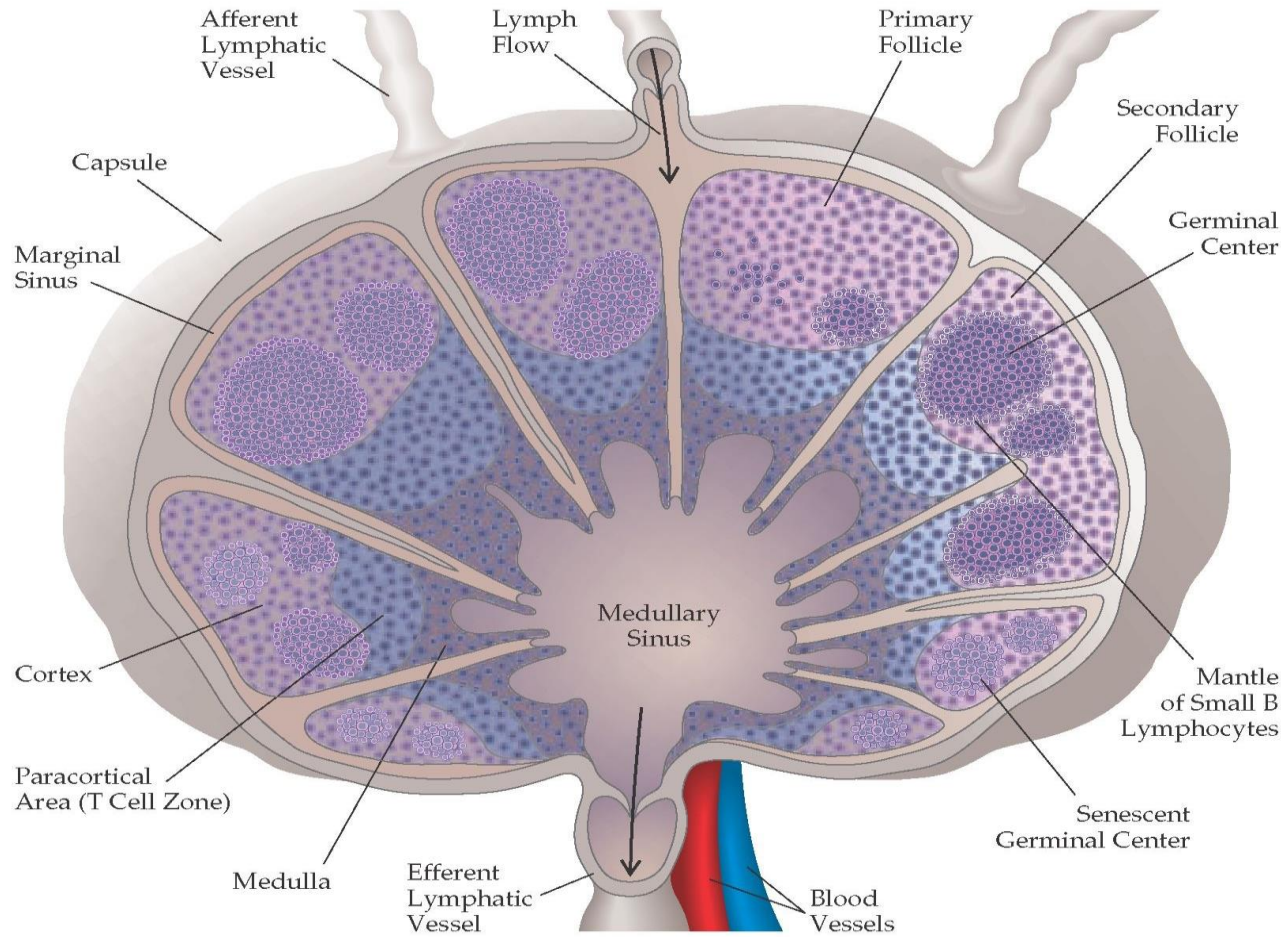
- Dense CT capsule
- Dense CT trabeculae
- Reticular tissue:
 - Reticular fibers
 - Cells of reticular meshwork - Reticular cells, Dendritic cells, Macrophages, Follicular dendritic cells (FDCs)

LYMPH NODE STRUCTURE – THE PARENCHYMA

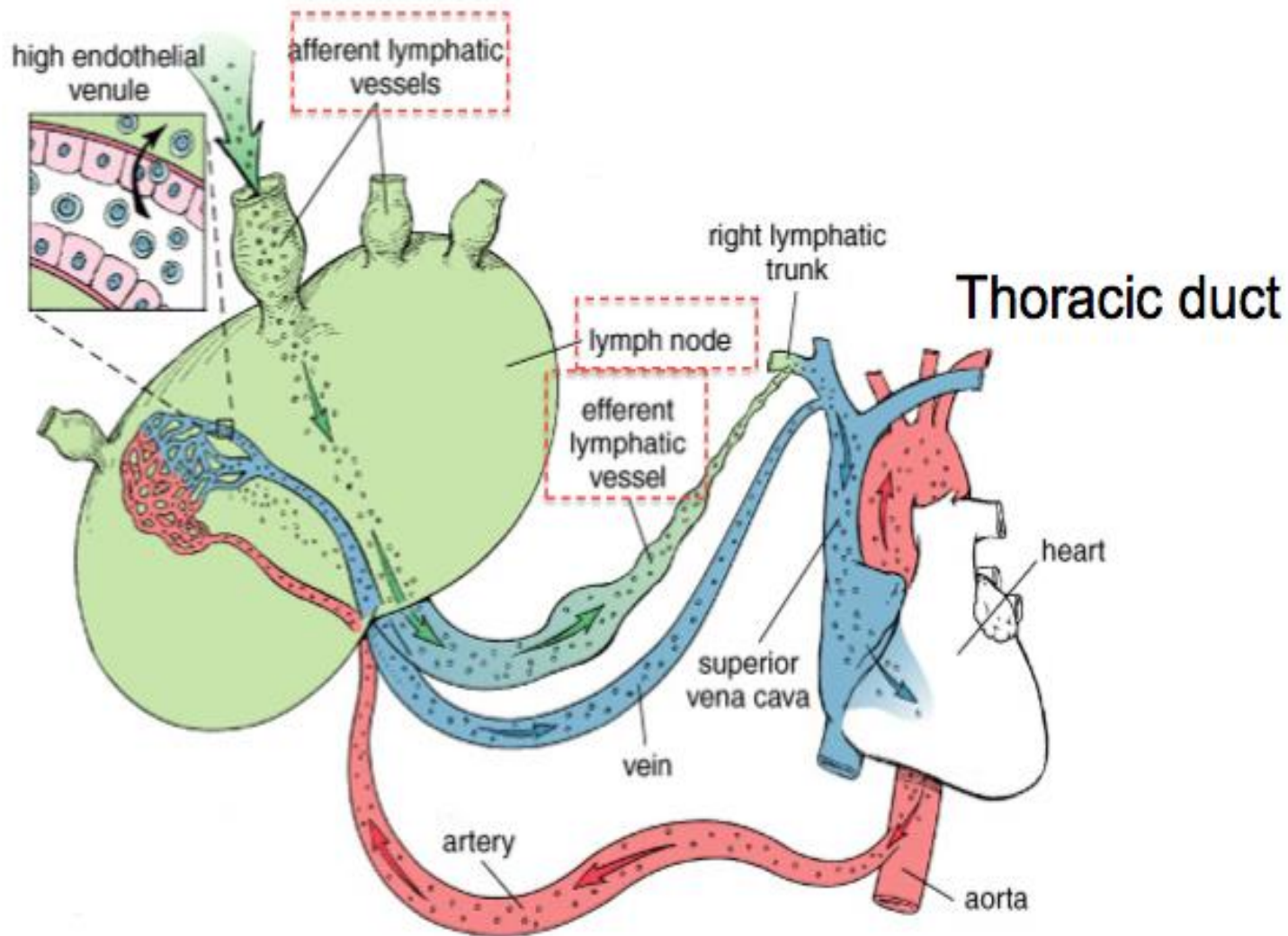


- Divided into a cortex and medulla
- Cortex – dense mass of lymphatic tissue and sinuses
- Outer cortex has nodules (hence called superficial or nodular cortex)
- Deep cortex lacks nodules – contains most T cells. Also called Thymus dependent cortex or paracortex
- Medulla consists of the medullary cords and medullary sinuses

LYMPHATIC CHANNELS WITHIN A LYMPH NODE

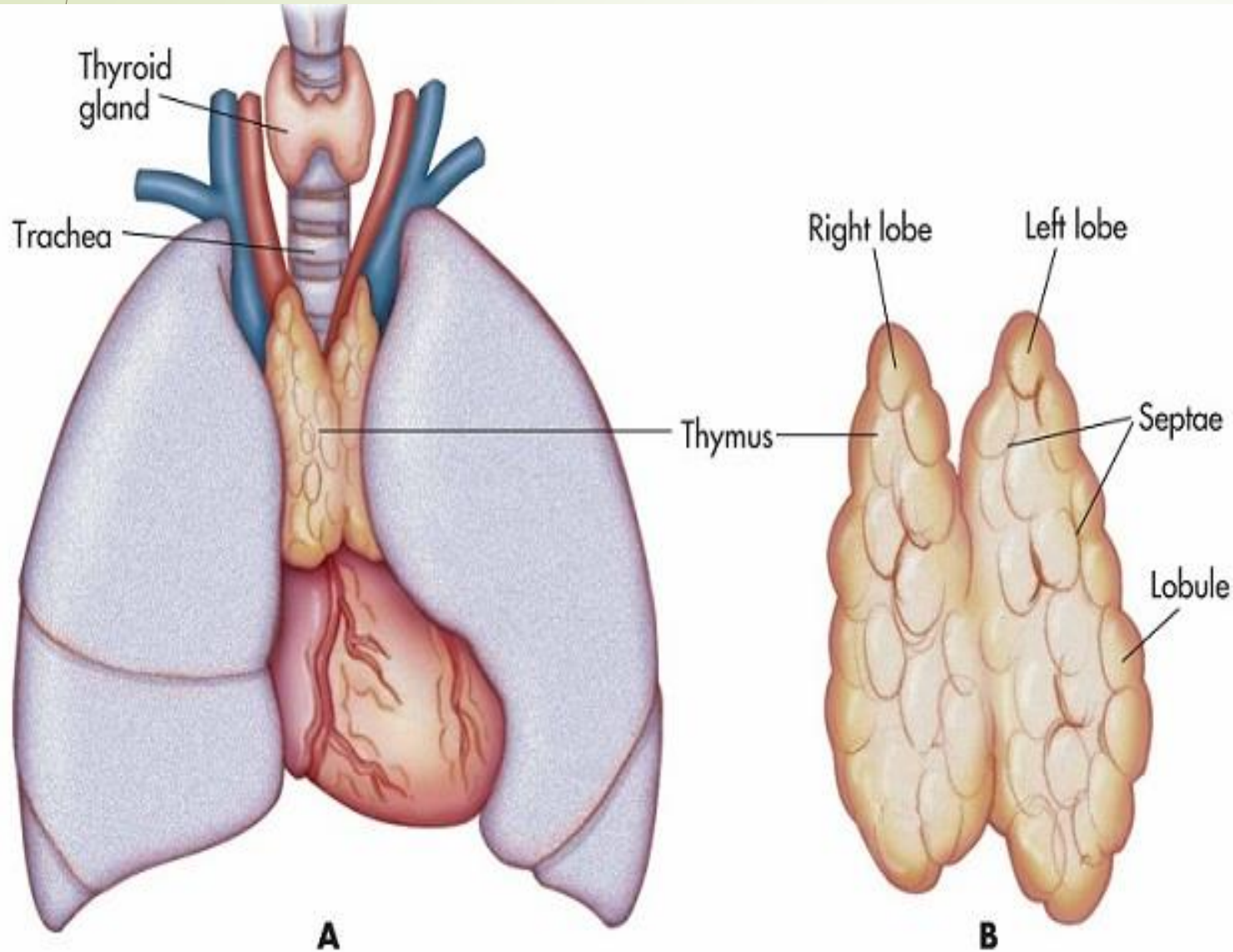


HIGH ENDOTHELIAL VENULES OF LYMPH NODES



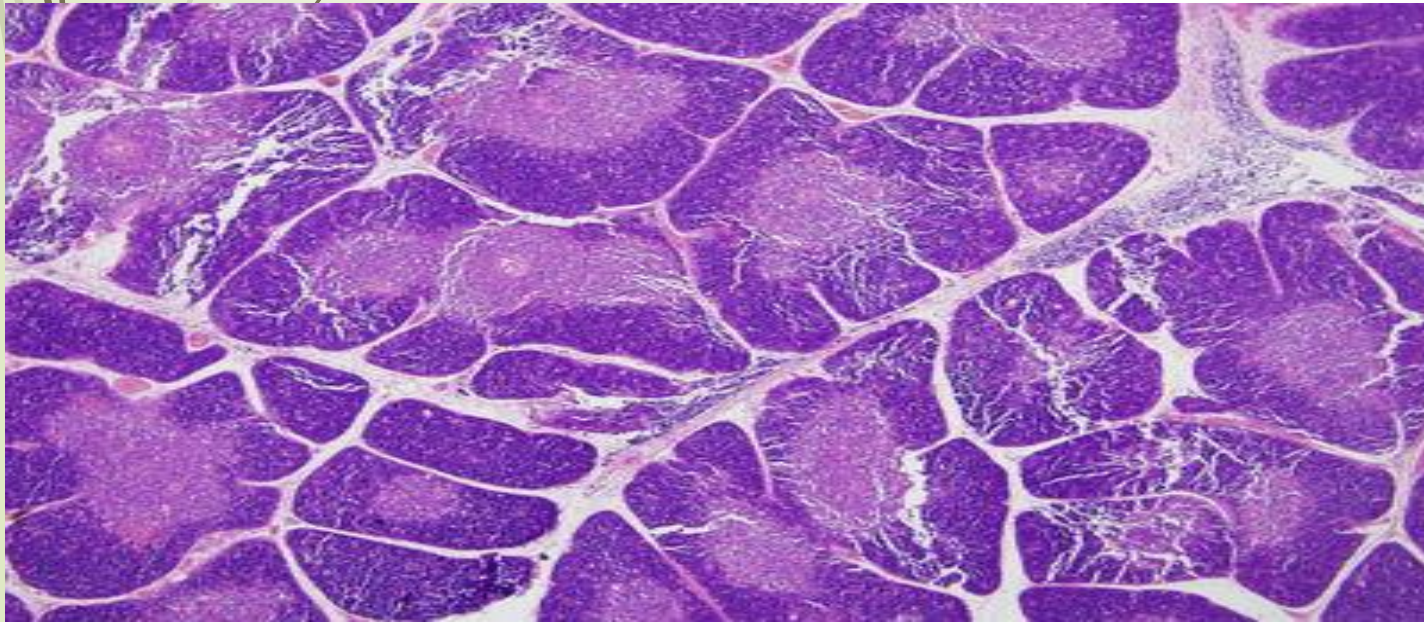
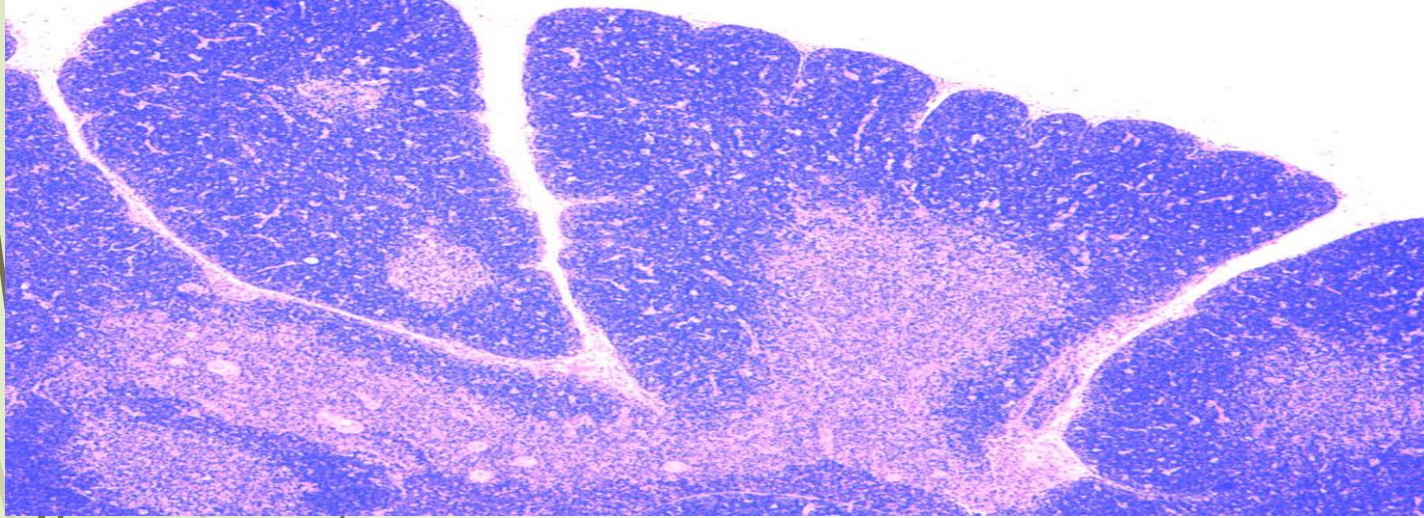
- Specialized postcapillary venules
- Lined by cuboidal or columnar endothelial cells
- Channel through which lymphocytes enter the lymph node
- Concentration of lymph

THE THYMUS



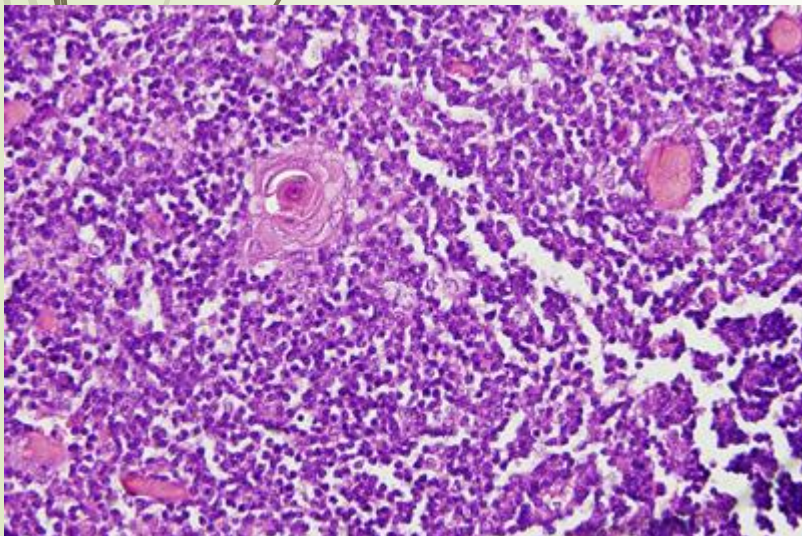
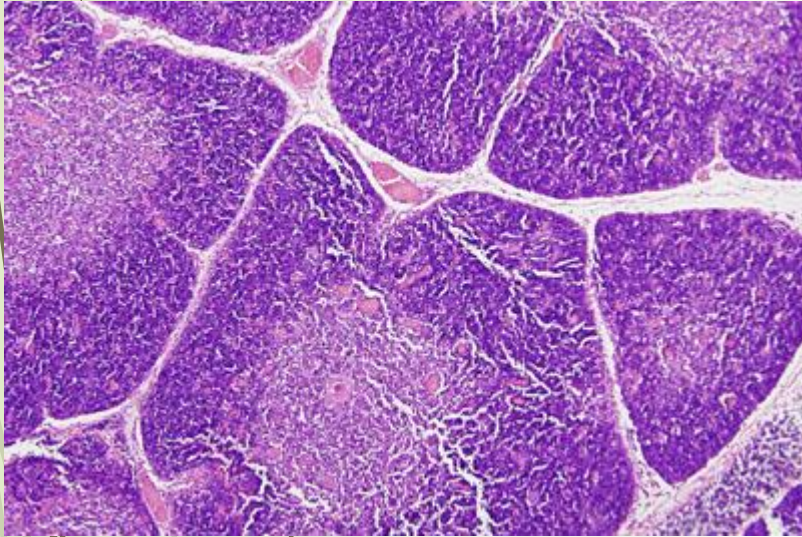
- Primary lymphoid organ
- Location?
- Embryonic origin?
- Functions?
- Thymic involution

THYMUS – THE STROMA



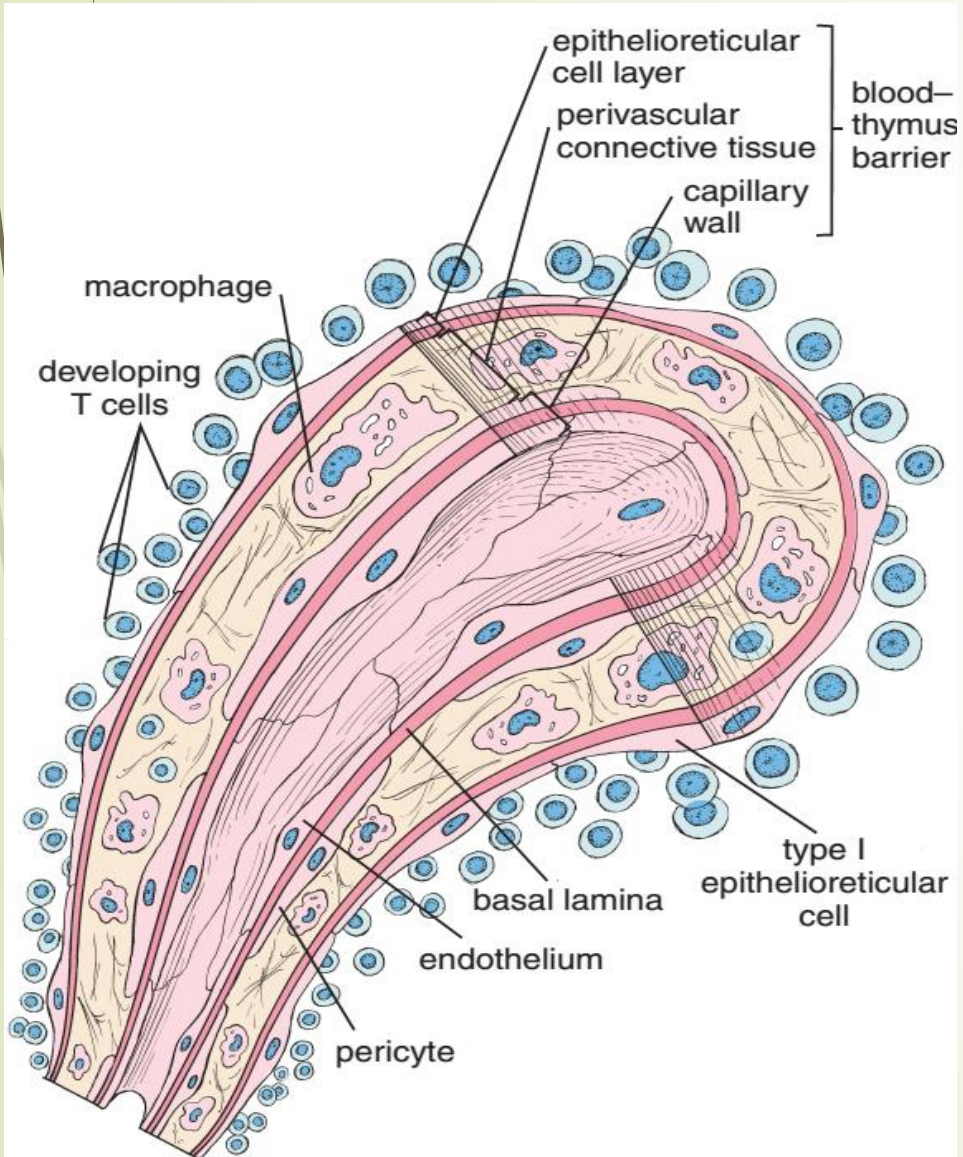
- ▶ Thin connective tissue capsule
- ▶ Trabeculae extend into the parenchyma
- ▶ Contain blood vessels and efferent lymphatics
- ▶ Trabeculae divide the thymus into incomplete lobules

THYMIC PARENCHYMA



- ▶ Contains developing T cells (thymocytes) in an extensive meshwork formed by epithelioreticular cells
- ▶ Each lobule has a cortex and a medulla
- ▶ Thymic cortex is basophilic (deeply staining)
- ▶ Contains thymocytes, ER cells I-III, macrophages
- ▶ Medulla is lightly staining
- ▶ Contains large lymphocytes, ER IV-VI
- ▶ Type VI epithelioreticular cells form the thymic (Hassall's) corpuscles

BLOOD-THYMUS BARRIER



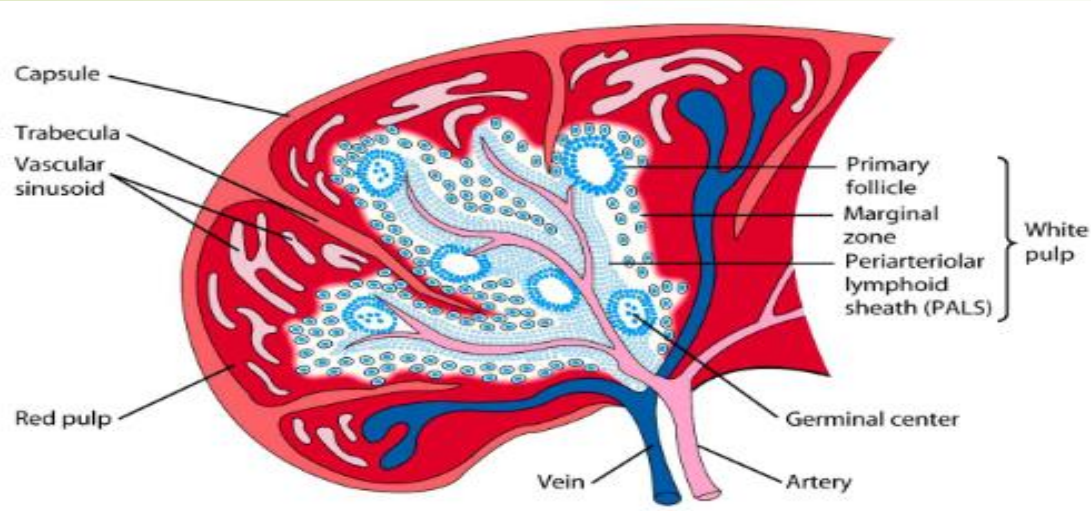
- Protects developing lymphocytes in the thymus from exposure to antigens
- Found between T cells and the lumen of cortical blood vessels
- Continuous endothelial lining of capillaries
- Occluding junctions between the endothelial cells
- Perivascular connective tissue macrophages
- Type I epithelioreticular cells with their occluding junctions

THE SPLEEN

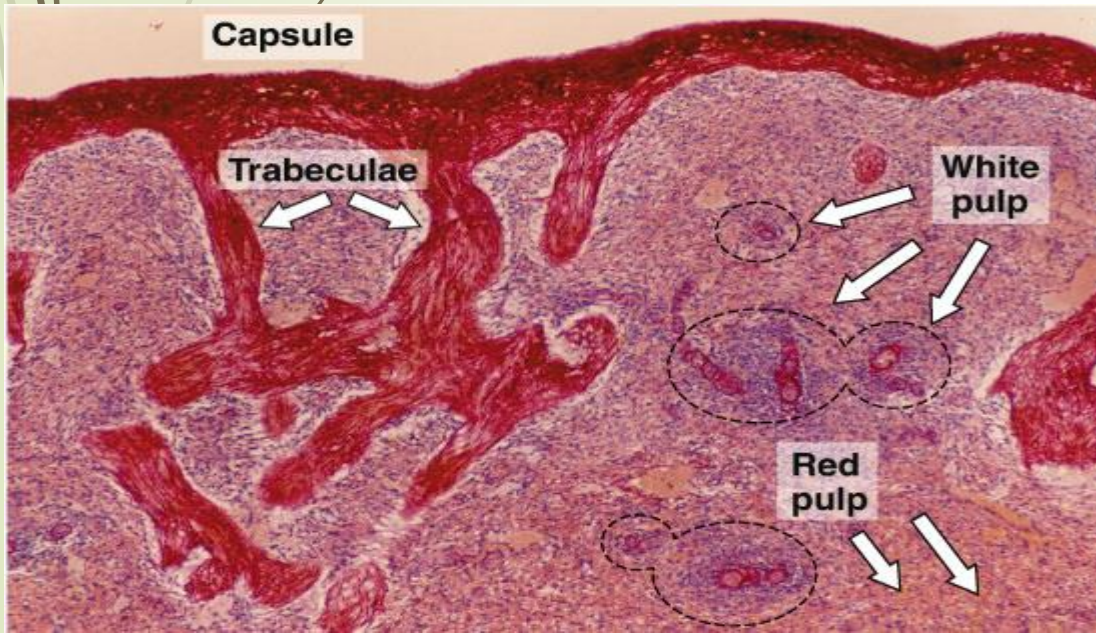


- Location?
- Gross anatomy?
- Relations?
- Peritoneal reflections?
- Functions?
- Complications due to asplenia?

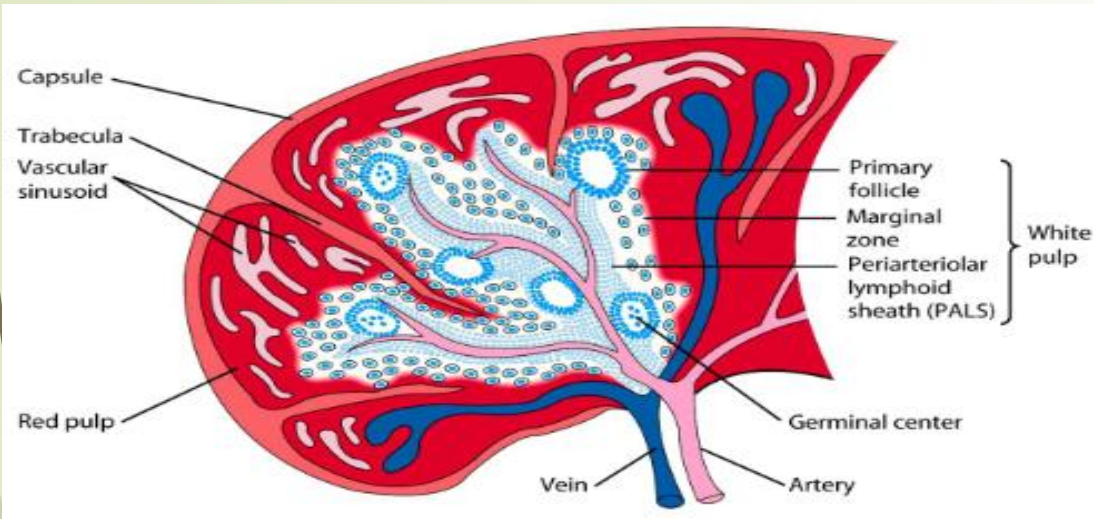
STRUCTURE OF SPLEEN – STROMA



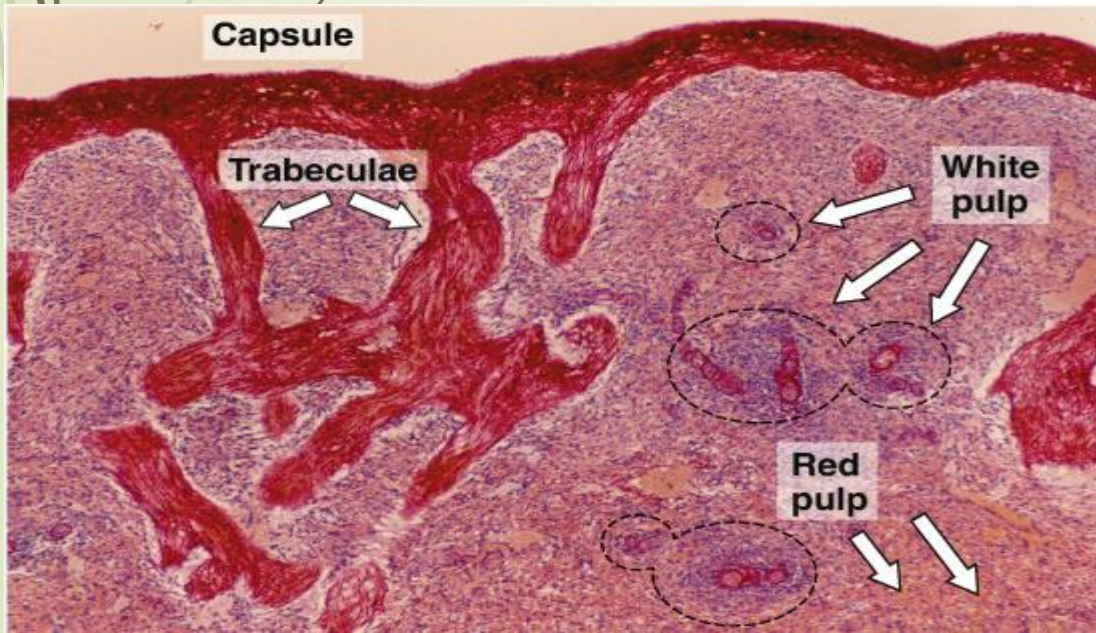
- Dense connective tissue capsule
- Discontinuous trabeculae extend into the parenchyma
- Contain myofibroblasts
- Traverse trabecular blood vessels



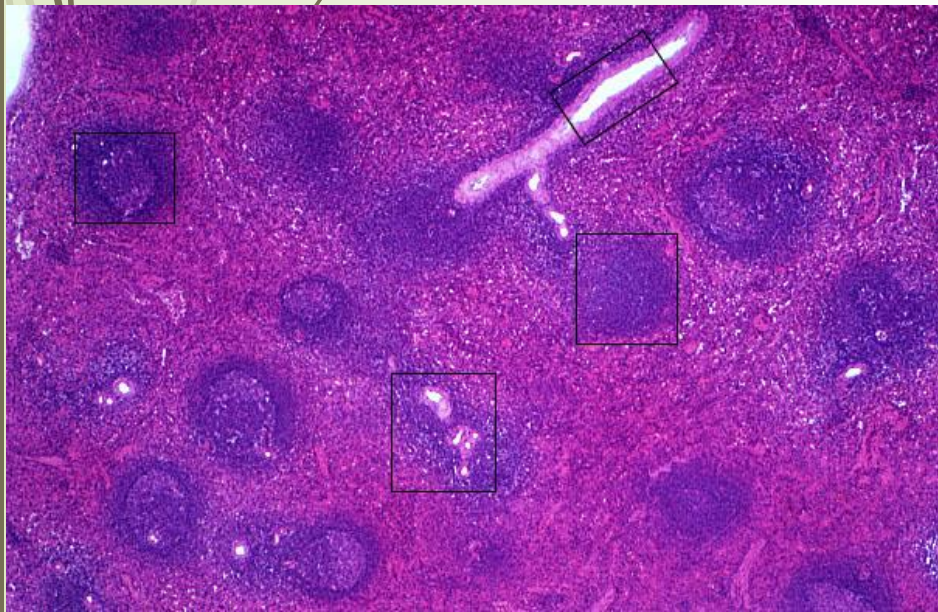
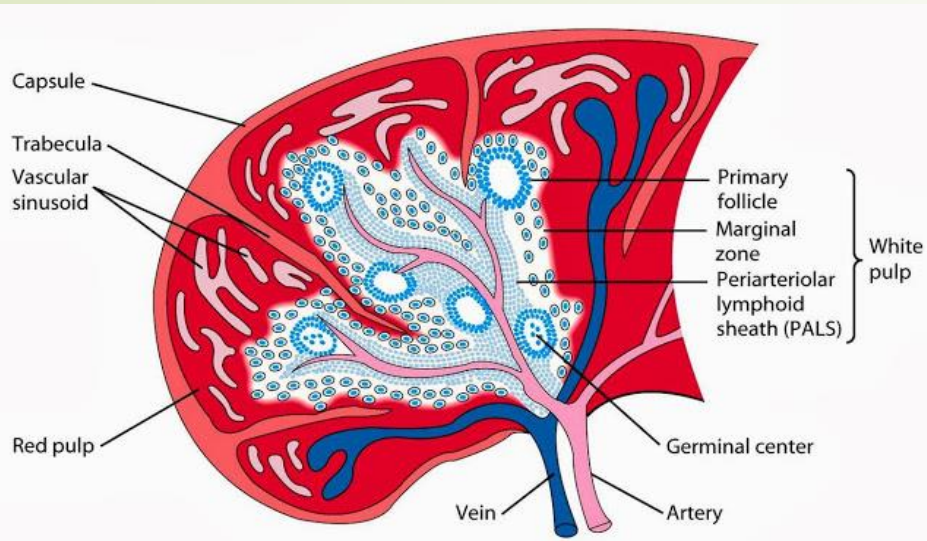
SPLENIC PARENCHYMA (SPLENIC PULP)



- Consist of red and white pulp
- White pulp appears as circular or elongated whitish gray areas surrounded by red pulp

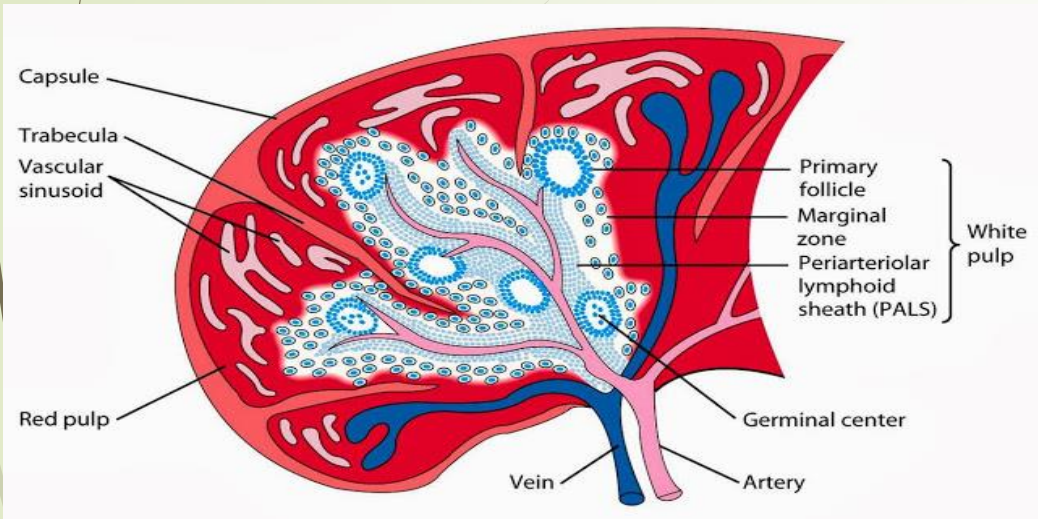


THE SPLENIC WHITE PULP

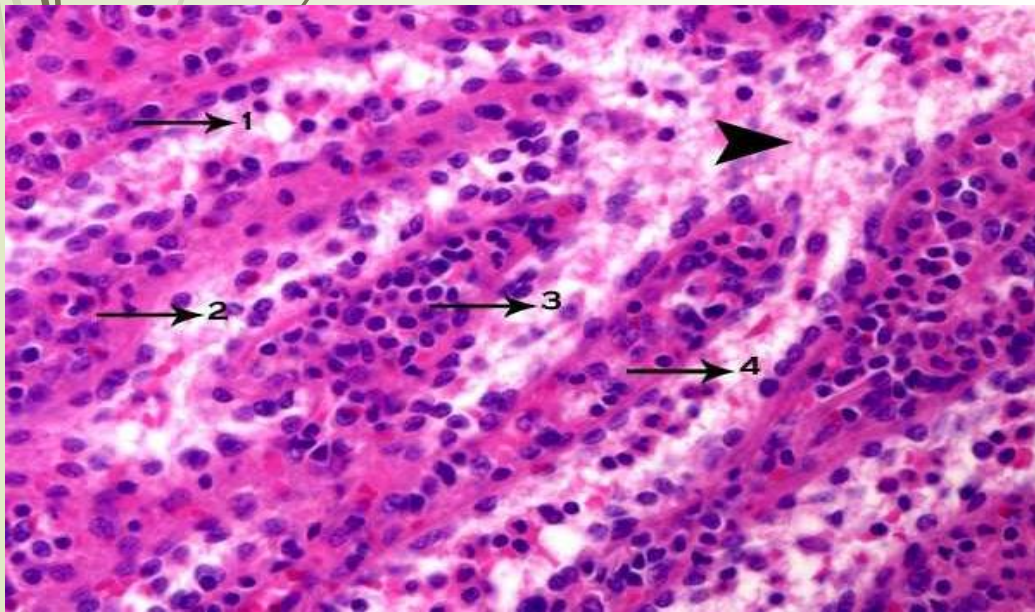


- Consists of lymphatic tissue, mostly lymphocytes
- Appears basophilic
- Contain lymphatic nodules, predominated by B cells
- Lymphocytes that aggregate around the central artery constitute the periarterial lymphatic sheath (PALS) – predominated by T cells

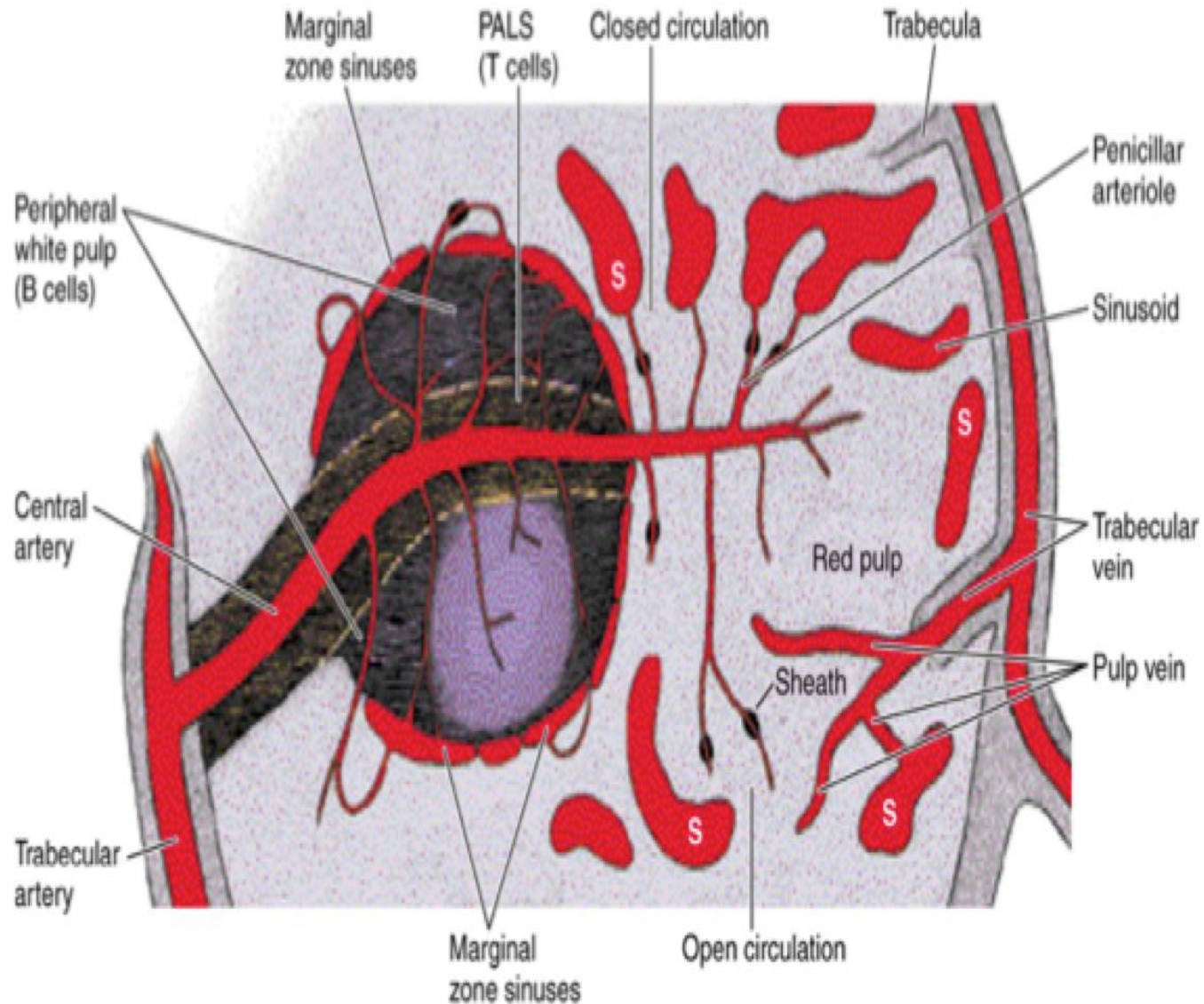
THE SPLENIC RED PULP



- Consists of splenic sinuses separated by splenic cords (of Billroth)
- Cords contain meshwork of reticular cells and reticular fibers, with RBCs, macrophages, dendritic cells, granulocytes
- Splenic venous sinuses are special sinusoidal vessels lined by rod-shaped endothelial cells
- Discontinuous basal lamina



SPLENIC MICROCIRCULATION



- Splenic artery
- Trabecular artery
- Central artery
- Periarterial lymphatic sheath
- Marginal sinuses
- Penicillar arterioles
- Sheathed capillaries
- Splenic sinusoids – closed circulation
- Open circulation

FUNCTIONS OF THE SPLEEN

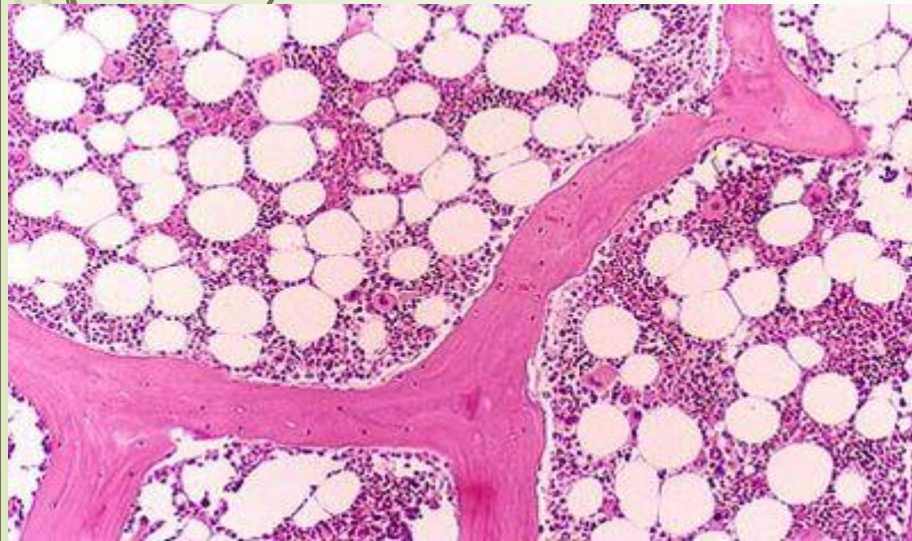
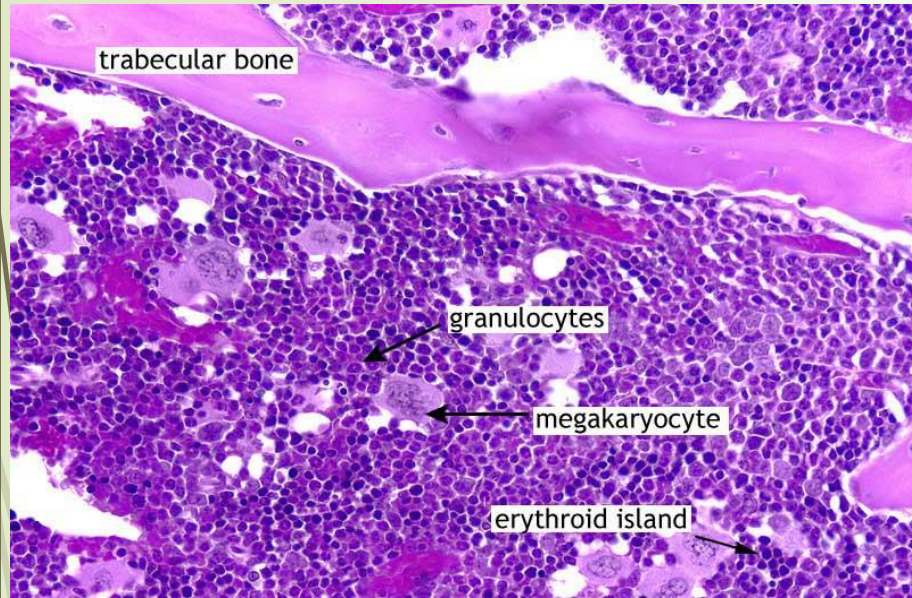
IMMUNOLOGIC FUNCTIONS

- Antigen presentation by APCs and initiation of immune response
- Activation and proliferation of B and T lymphocytes
- Production of antibodies
- Removal of macromolecular antigens from the blood

HEMOPOIETIC FUNCTIONS

- Removal and destruction of senescent, damaged, and abnormal erythrocytes and platelets
- Retrieval of iron from erythrocyte hemoglobin
- Formation of erythrocytes during early fetal life
- Storage of blood, especially red blood cells, in some species

THE BONE MARROW



- Soft pulpy tissue found in the marrow cavities of bones
- Has vascular and extravascular compartments, both enclosed within a bony framework
- Stroma - reticular fibres and reticular cells
- Occurs in two forms - red and yellow marrow
- Red marrow – framework of CT with several haemopoietic cells
- Yellow marrow - framework of CT with several adipocytes



THE END