Lymphoid organs 1

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Anatomy KGMC

Histology of lymphoid tissue

- **Objectives:**
- The objective of the lecture is to discuss the structure of lymphoid tissue; Lymphode, Spleen, Thymus, Palatine tonsil and Mucosa Associated Lymphoid Tissue (MALT)

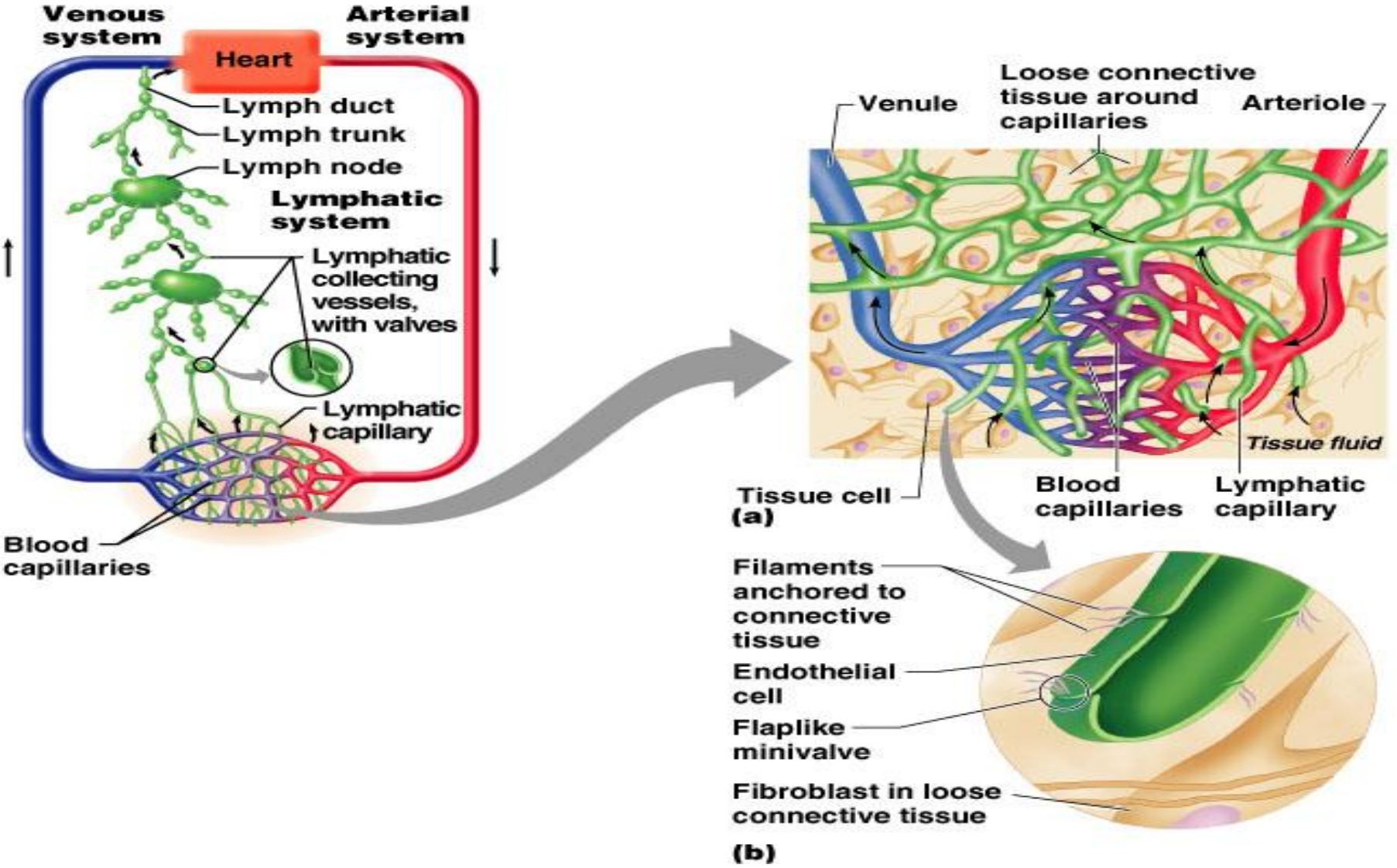
- **Learning outcomes:**
- 1 Define lymphatic system and explain its components and function.
- 2 Describe the microscopic anatomy of the lymph node.
- 3 Explain the microscopic structure of spleen.
- 4 Explain the histological features of thymus.
- 5 Describe the microscopic anatomy of the palatine tonsil.
- 6 List the different components of Mucosa Associated Lymphoid Tissues (MALT) like Peyer's patches

LYMPH

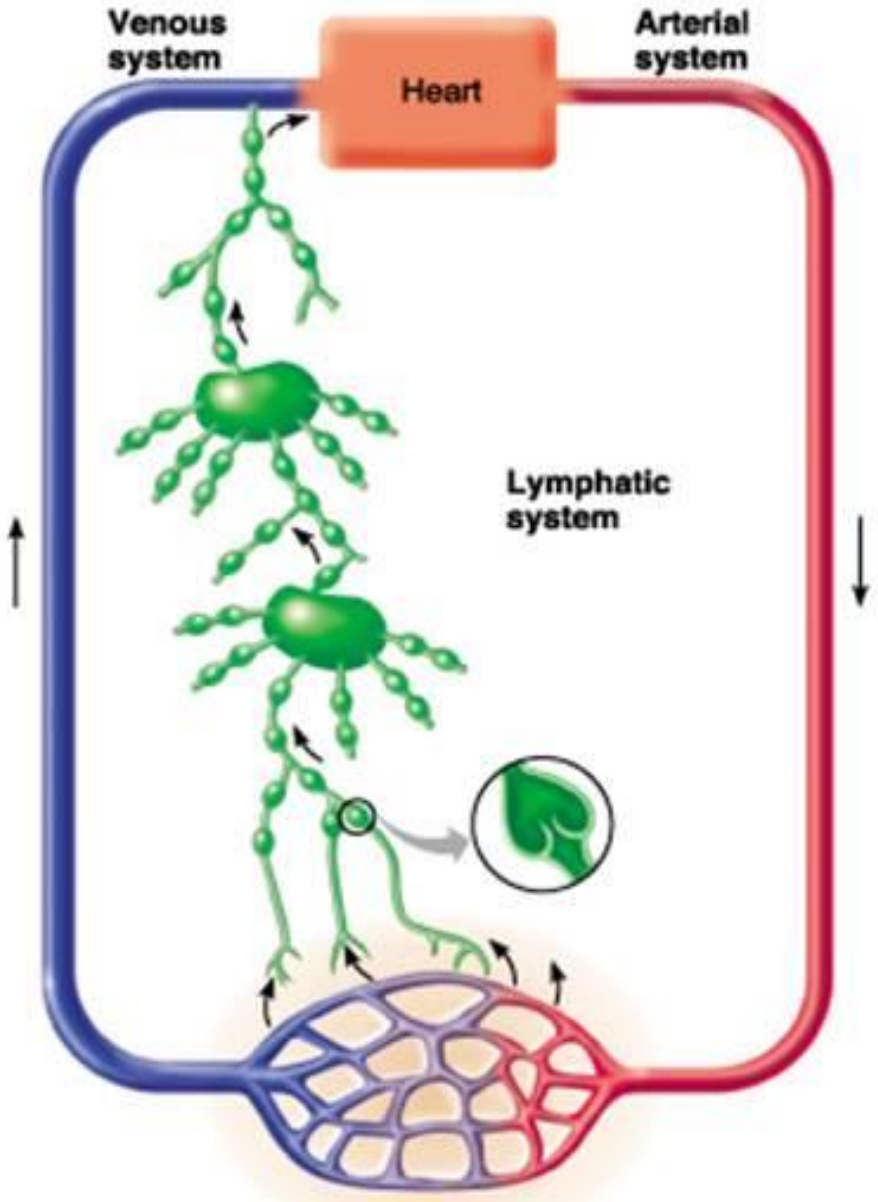
What is lymph ?

Tissue fluid (interstitial fluid) that enters the lymphatic vessels

FORMATION AND TRANSPORT OF TISSUE FLUID



LYMPHATIC SYSTEM

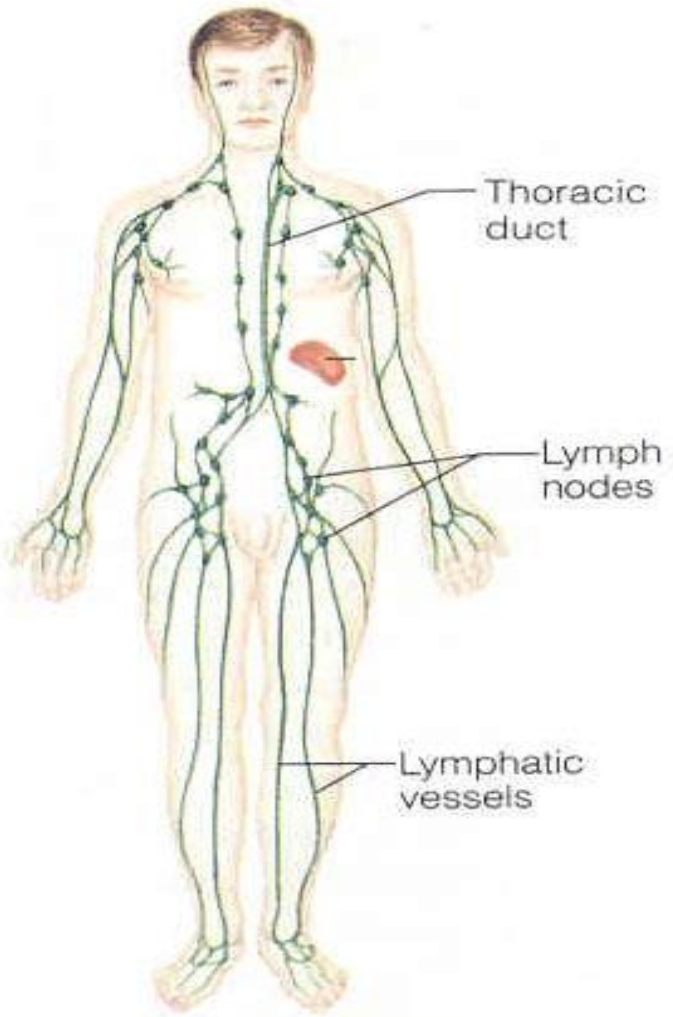


Essentially a drainage system accessory to venous system

larger particles that escape into tissue fluid can only be removed via lymphatic system

Components of the Lymphatic System

- Lymph
- Lymphatic Vessels
  - Lymphatic Capillaries
  - Lymphatic Vessels
  - Lymphatic Trunks
  - Lymphatic Ducts
- Lymphatic Organs
  - Thymus
  - Lymph Nodes
  - Spleen
  - Tonsils
  - MALT
- Lymphatic cells



Lymphatic system

Introduction

The immune system–

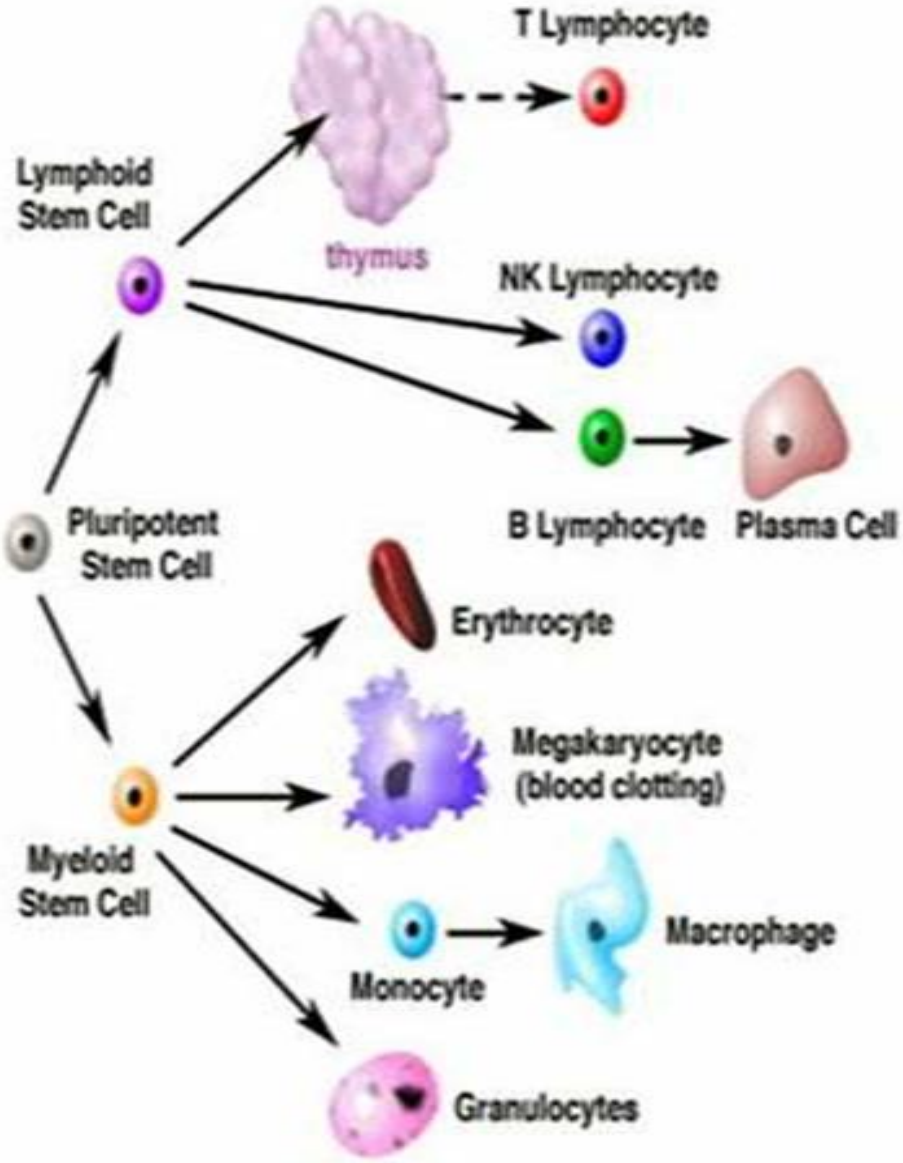
- Differentiate between self (own) and foreign structures – specificity
- Immune response - fights against pathogens
- Remember antigens over long period of time

Cells of the immune system:

- Lymphocytes :T, B
- Antigen presenting cells (APC): Dendritic cells, macrophages.

Lymphoid Cells

- Lymphocytes
  - T-cells
  - B-cells
- Macrophages
- Dendritic cells
- Reticular cells



LYMPHOID TISSUE

- **TWO TYPES OF LYMPHOID TISSUES**: (BASED ON COVERINGS)
  - **Encapsulated**: connective tissue capsule
    - spleen, thymus, lymph nodes
  - **Unencapsulated** (or partly encapsulated)
    - Tonsils, Peyer's patches, lymphoid nodules in GI tract, Respiratory tract, Urinary & Reproductive tracts

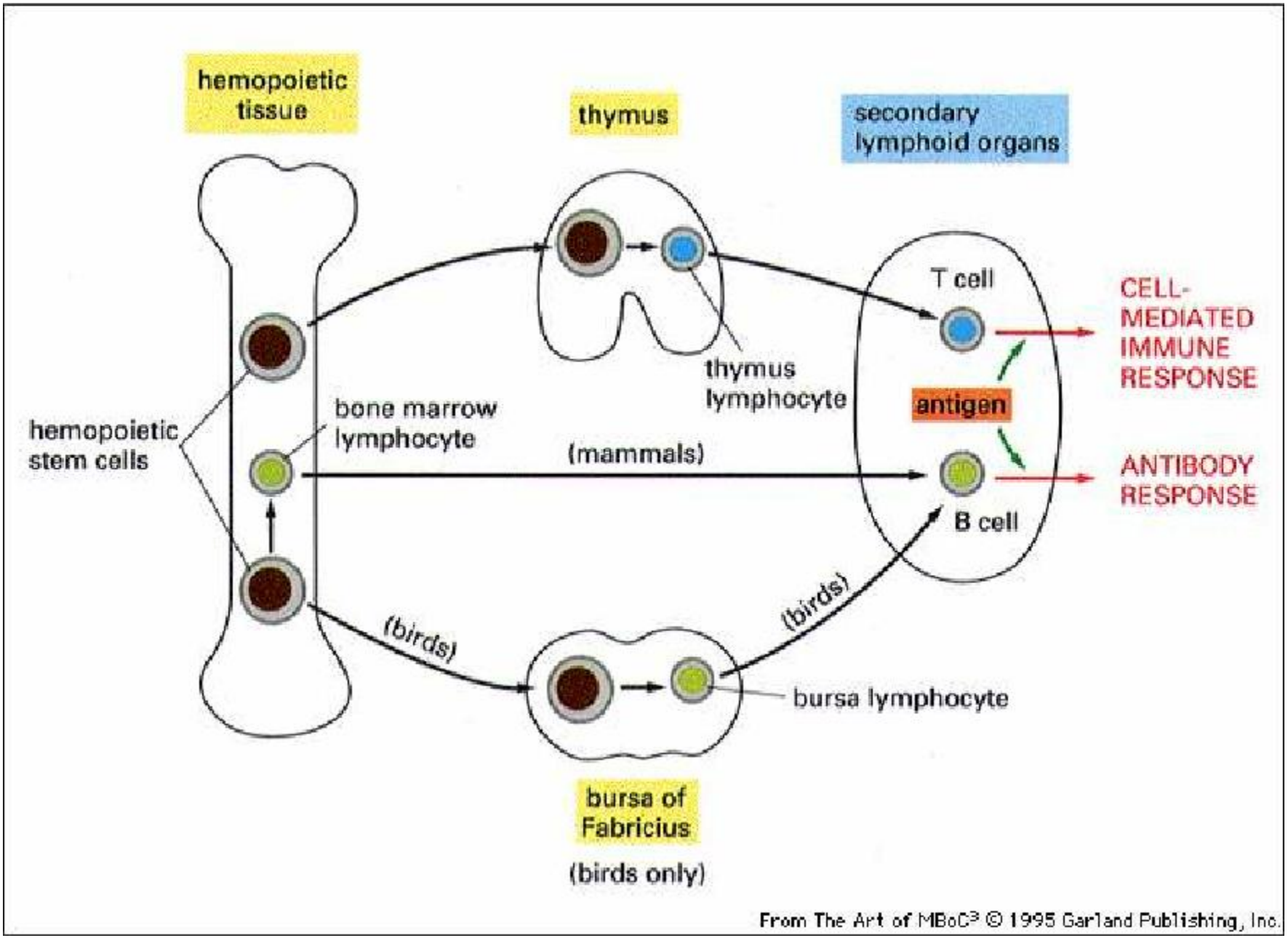
Lymphoid Organs

Central (primary) lymphoid organ: Where lymphatic cells are formed and matured I.e., the precursors

- T cells in thymus
- B cells in bone marrow

Peripheral (secondary) lymphoid organ: where functional lymphocytes go including lymph nodes, spleen, MALT (mucosa associated lymphoid tissue) - lymphoid nodules of Gastro intestinal (Peyer's patches), Respiratory & Urogenital systems

- Lymphocytes contact antigens and divide and differentiate into effector B cells and T cells
- Memory cells form & circulate for years to provide extended immunity



T cells

- Thymus-processed lymphocyte
- 2 subdivisions based on expression of specific surface markers.

  CD4 - helper T cells

  CD8 - cytotoxic T cells

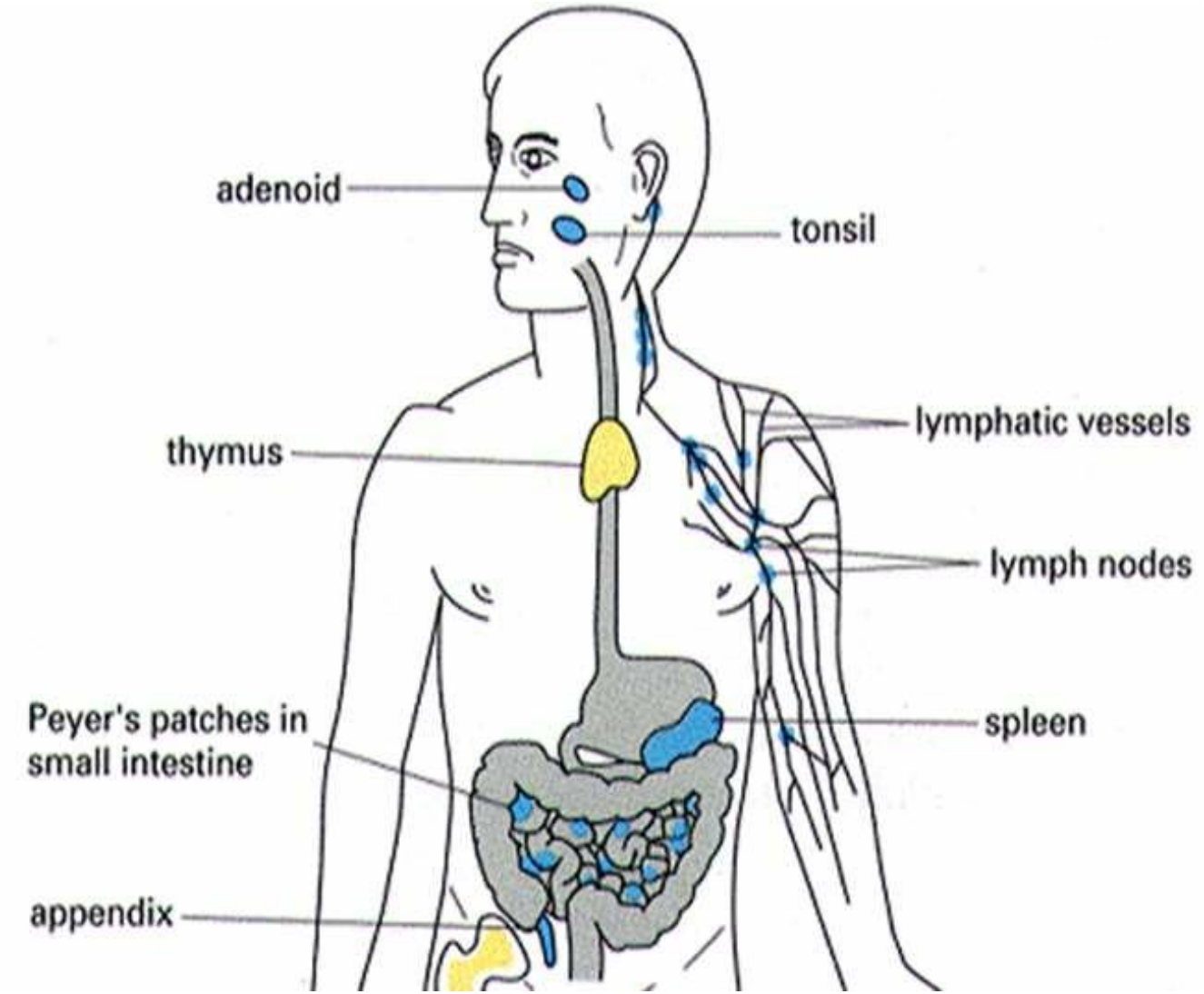
B cells

- Function of B cells is production of antigen-specific antibody (immunoglobulin).
- Once activated B cells terminally differentiate into ***plasma cells***.

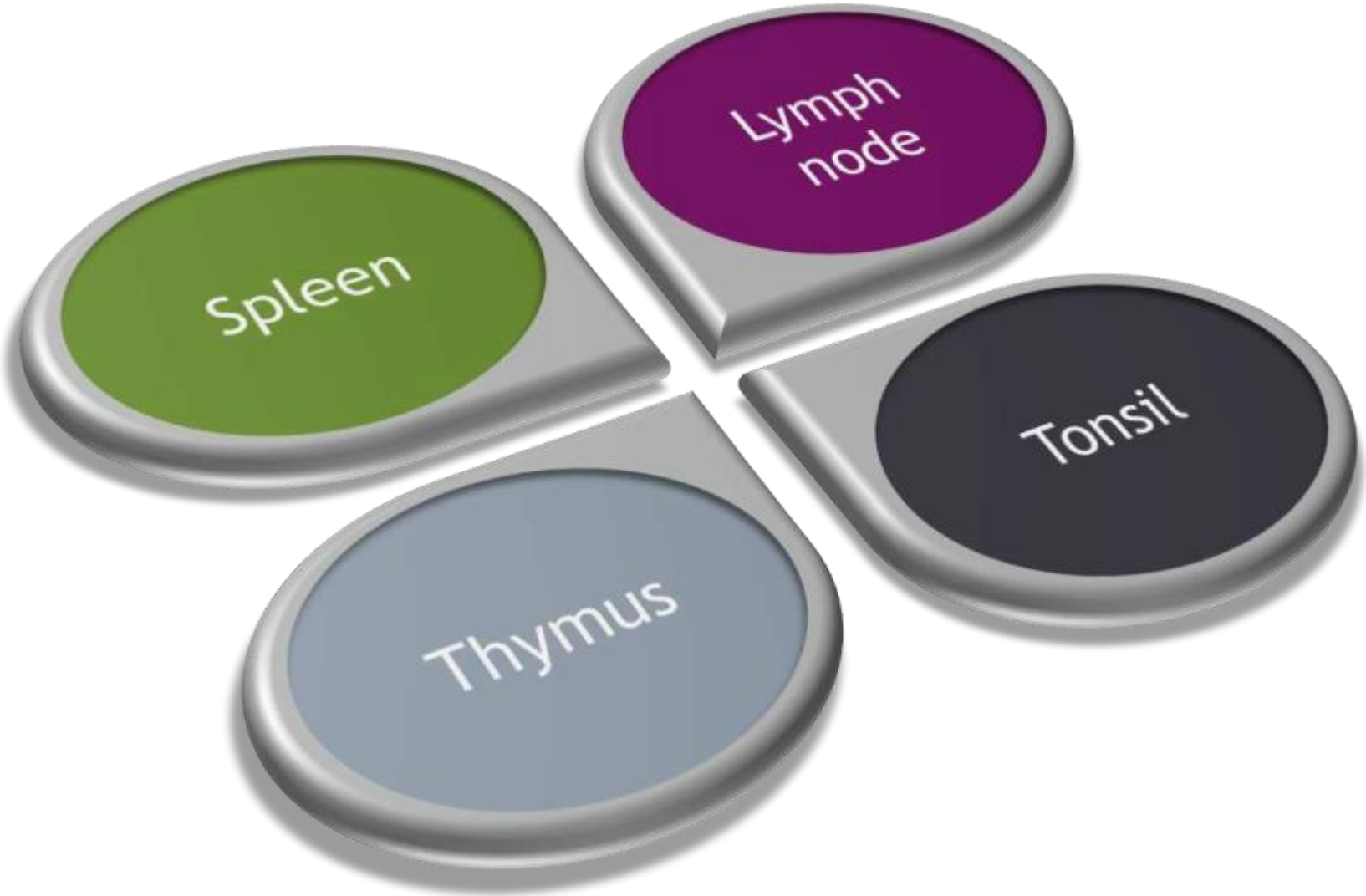
LYMPHATIC SYSTEM

- Includes lymphoid organs, lymphatic vessels, lymphocytes & lymph.
- **Lymph capillaries** – Thin walled, collect lymph. Absent in cornea, hair, nail & bone marrow.
- **Lymph Fluid:** – Transudate from blood, contains same proteins as in plasma, in smaller amounts.
- **Lymphocytes** are suspended in lymph.
- Lymph capillaries unite to form larger lymph vessels which drain into veins.

Distribution of Lympatic system



LYMPHATIC ORGANS

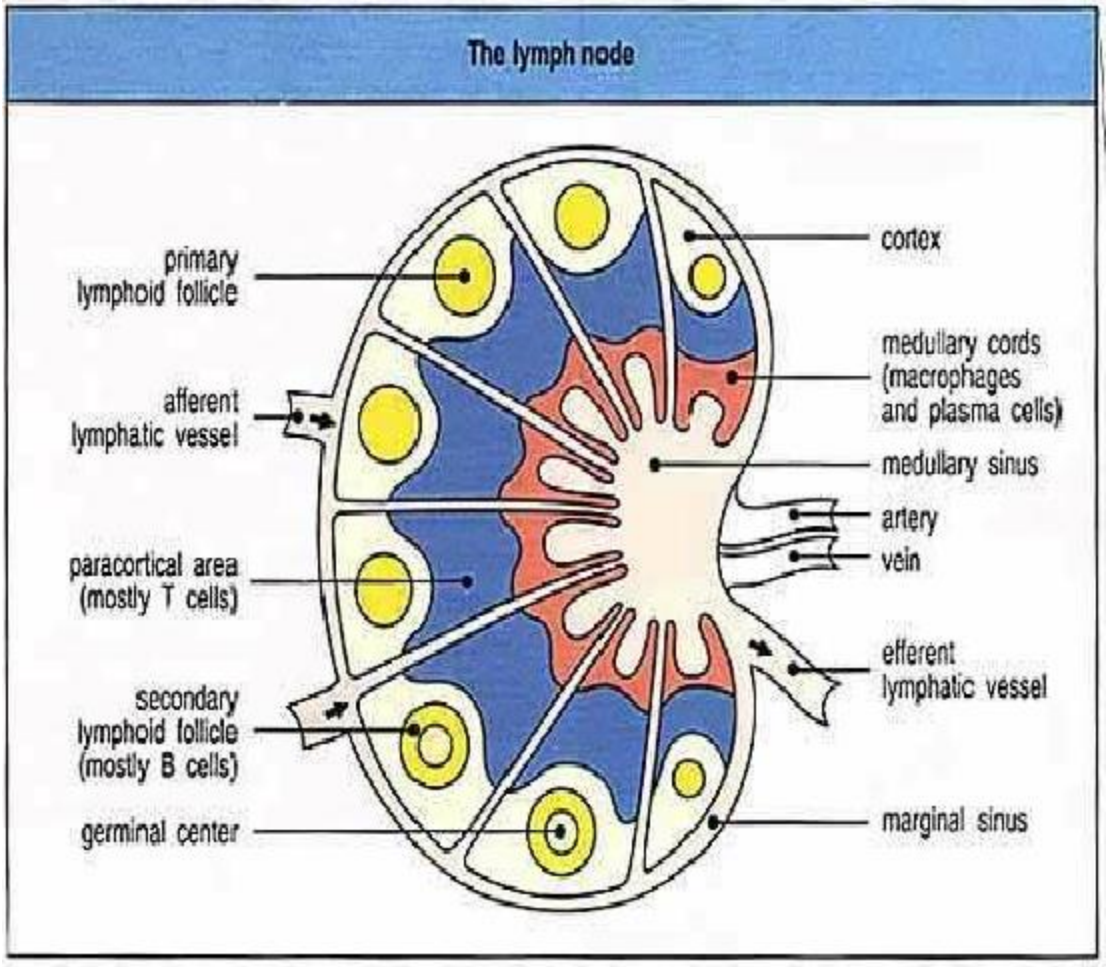


1. LYMPH NODE

- Small oval kidney shaped bodies lying along the course of lymph vessels.
- Encapsulated ,centres of antigen presentation and lymphocyte activation, differentiation and proliferation.
- 450 lymph nodes
  - 60-70 – head & neck
  - 100 – thorax
  - 250 – abdomen & pelvis

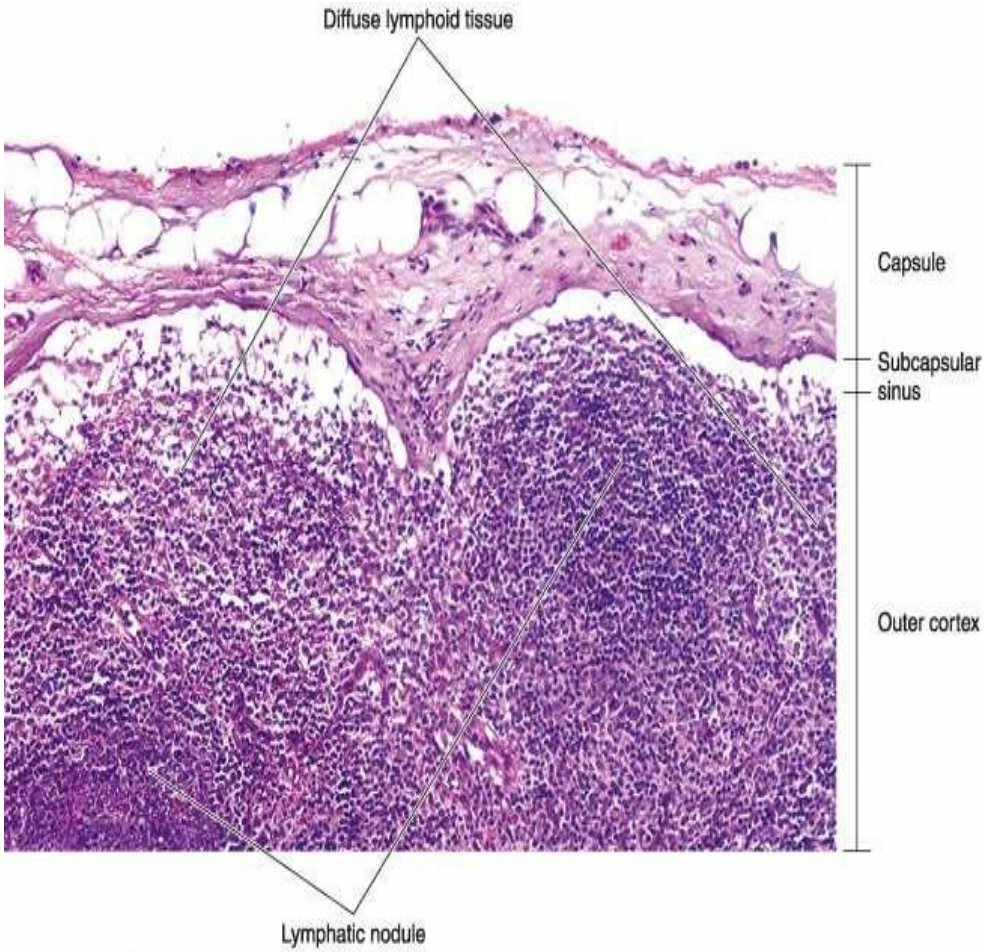
LYMPH NODE

- Bean-shaped
- Hilum
- Afferent & Efferent lymphatic vessels



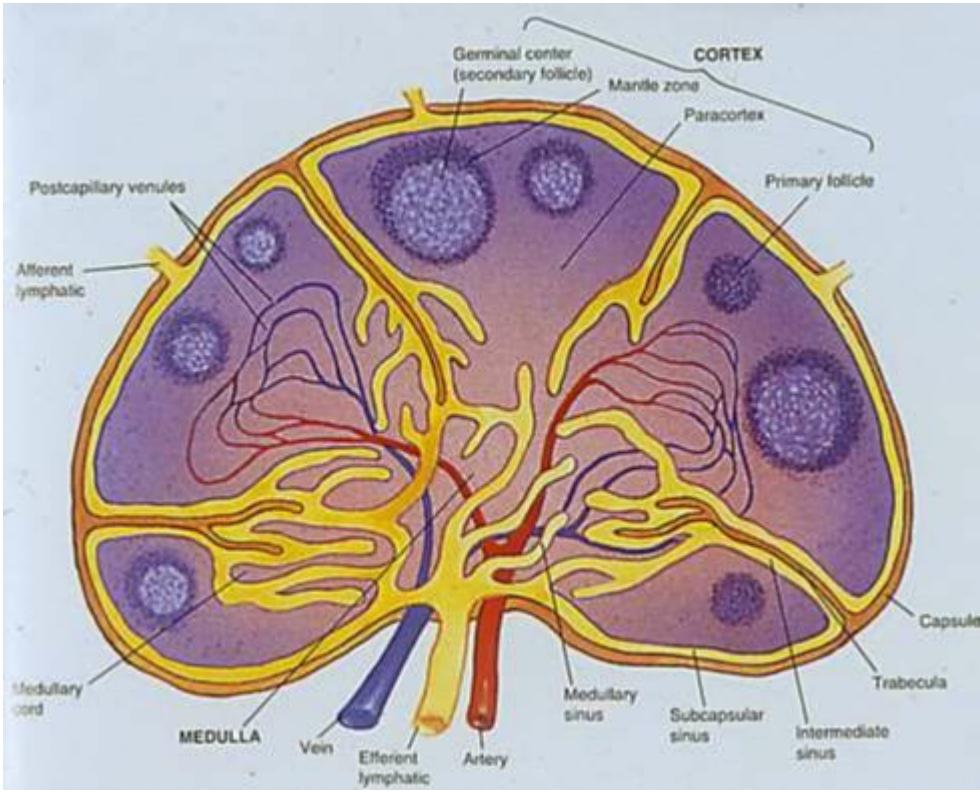
Lymph node

- Capsule – Collagen fibres, Elastic fibres & Fibroblasts
- Septa – **trabeculae**
- **Subcapsular sinus**



LYMPH NODE

- Cortex – follicles
- Medulla
- Lymphoid/Lymphatic follicles
- Germinal centre

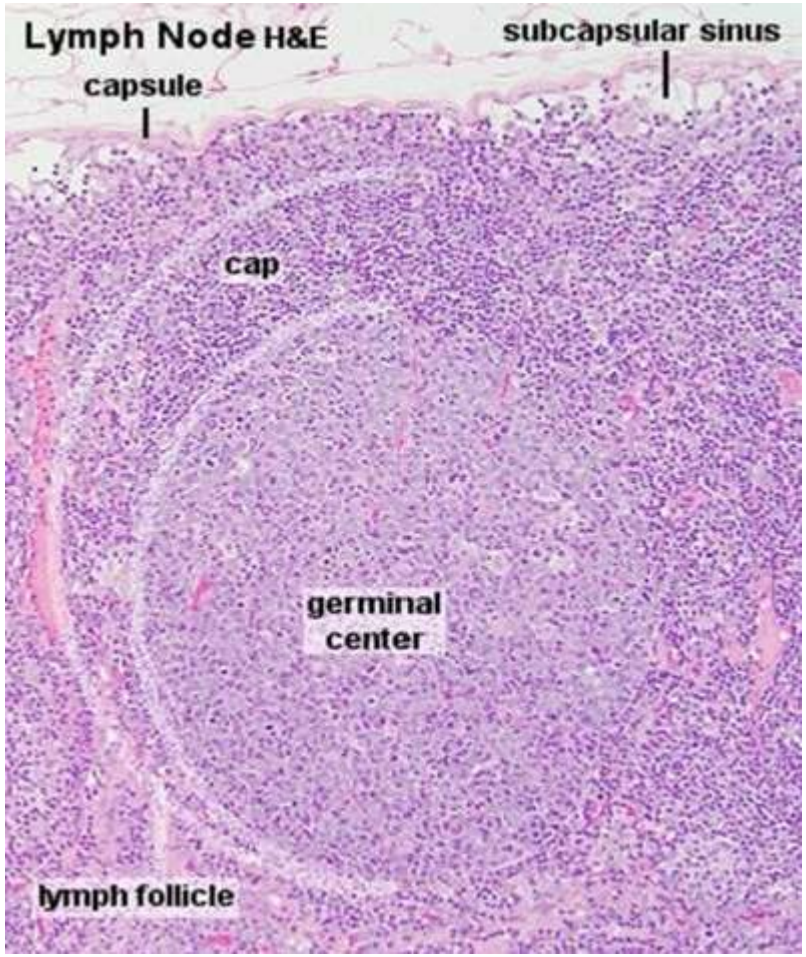


LYMPH NODE - CORTEX

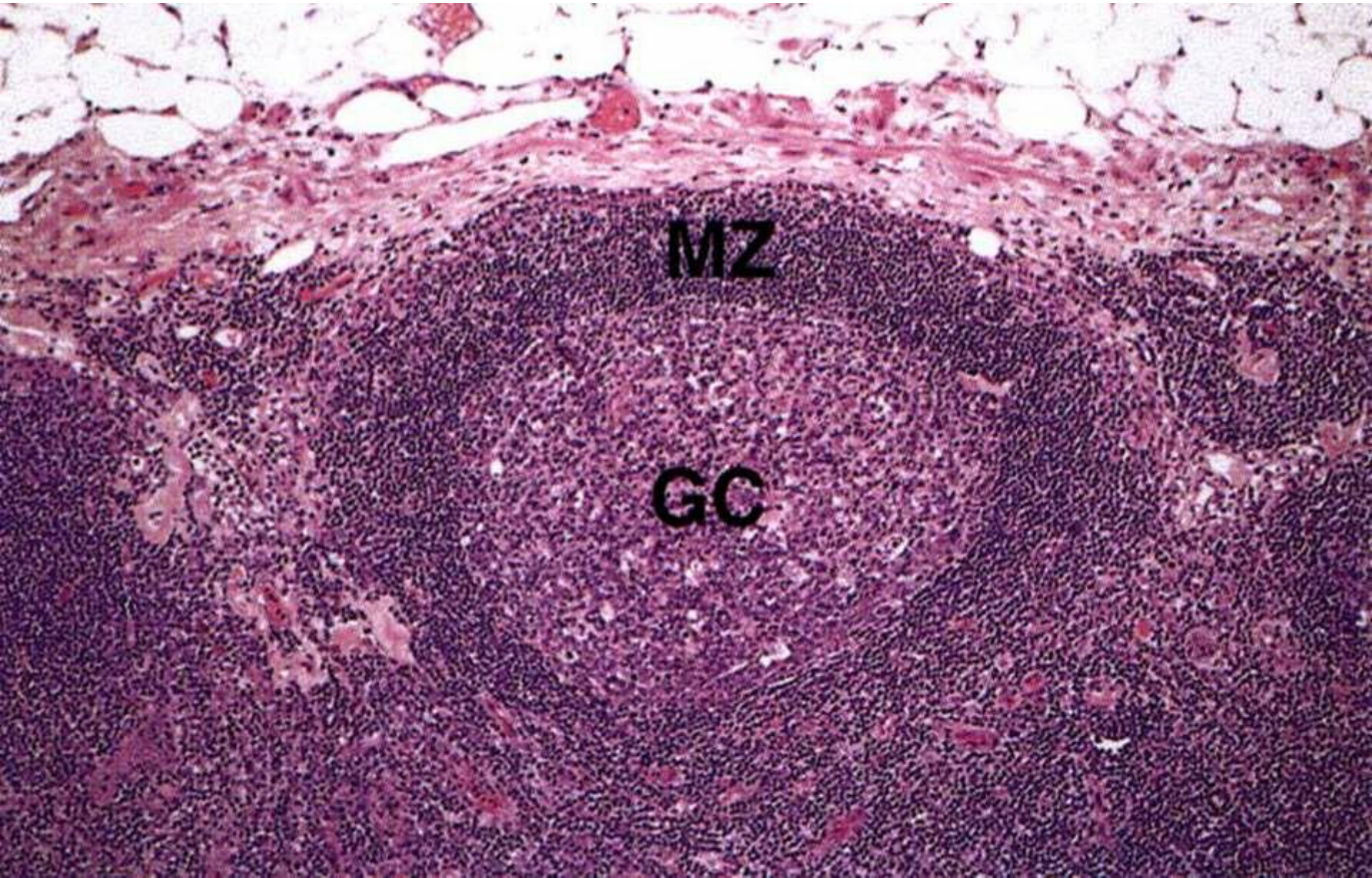
- Beneath capsule, subcapsular sinus- wide reticular fiber meshes. Lymph having antigens, lymphocytes & APC(Antigen presenting cells).
- Reticular cells (littoral cells), macrophages, lymphocytes
- Lymphoid nodules with (secondary nodule) or without (primary nodule) germinal centres, mainly B Lymphocytes
- Cortical sinus, between lymphoid nodules.

Lymphoid Follicles/Nodules

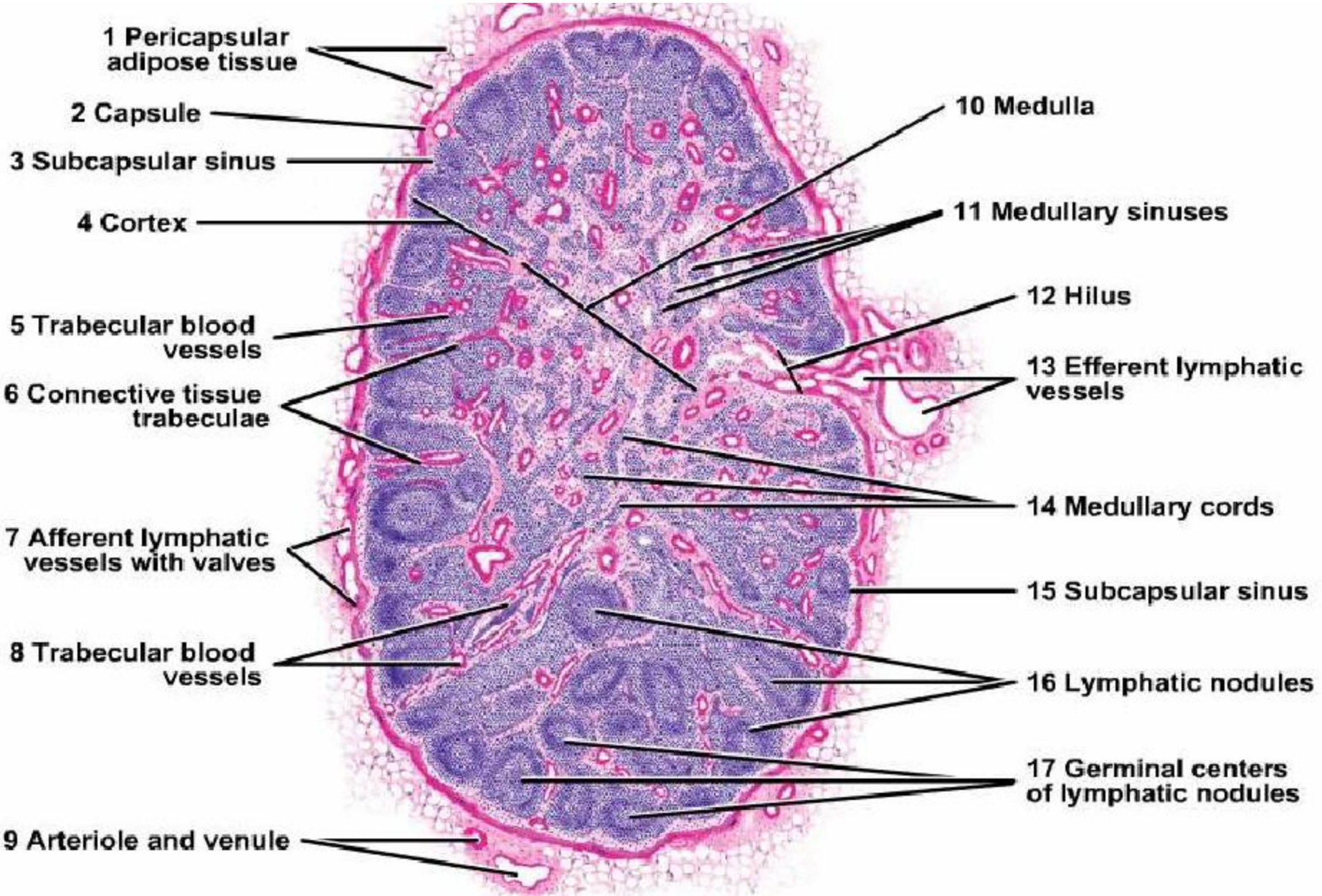
- **Ovoid collection of densely packed lymphocytes** in a meshwork of reticular cells
- Most lymphocytes are B cells.
- Two distinct areas
  - Mantle – darker stained, mainly small, resting lymphocytes
  - **Germinal center** (defines "secondary" or "reactive" lymphoid follicles): lighter stained, larger, activated B cells – centroblasts and centrocytes (with cleaved nuclei)



Lymphatic nodule with germinal center

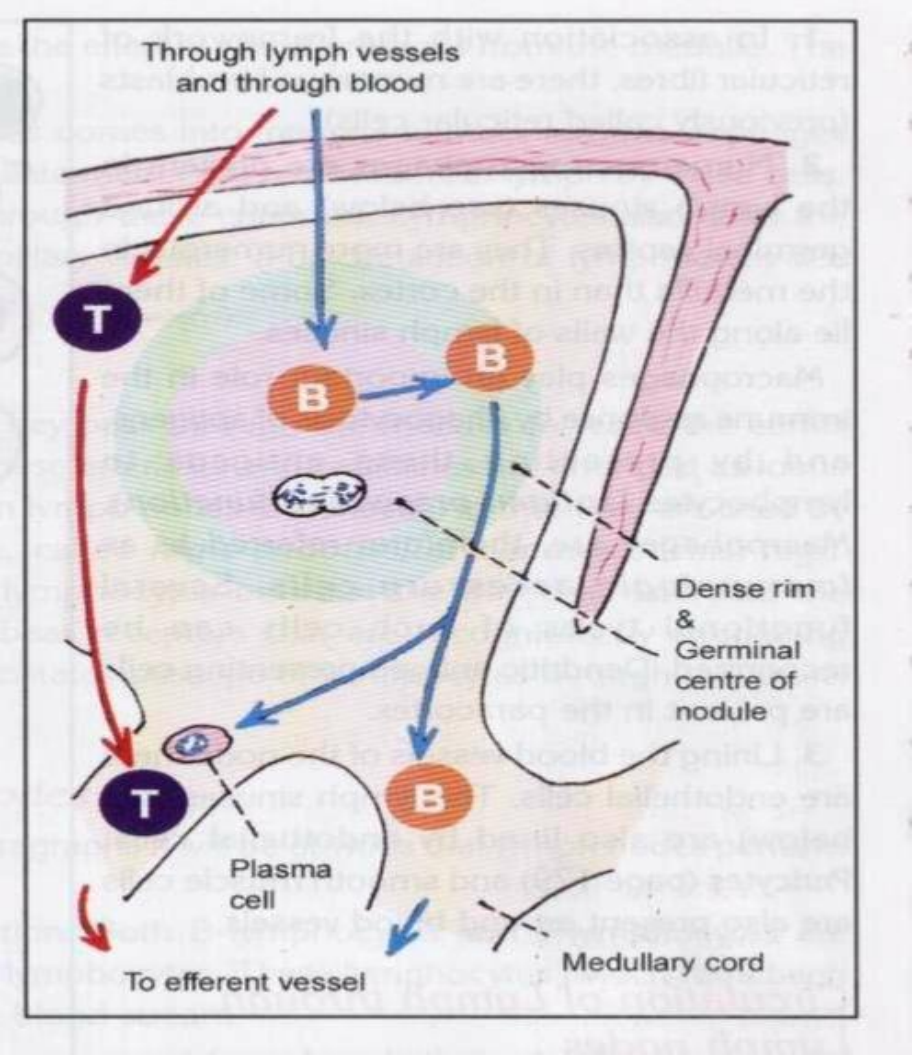


Lymph node


1 Pericapsular adipose tissue
2 Capsule
3 Subcapsular sinus
4 Cortex
5 Trabecular blood vessels
6 Connective tissue trabeculae
7 Afferent lymphatic vessels with valves
8 Trabecular blood vessels
9 Arteriole and venule
10 Medulla
11 Medullary sinuses
12 Hilus
13 Efferent lymphatic vessels
14 Medullary cords
15 Subcapsular sinus
16 Lymphatic nodules
17 Germinal centers of lymphatic nodules

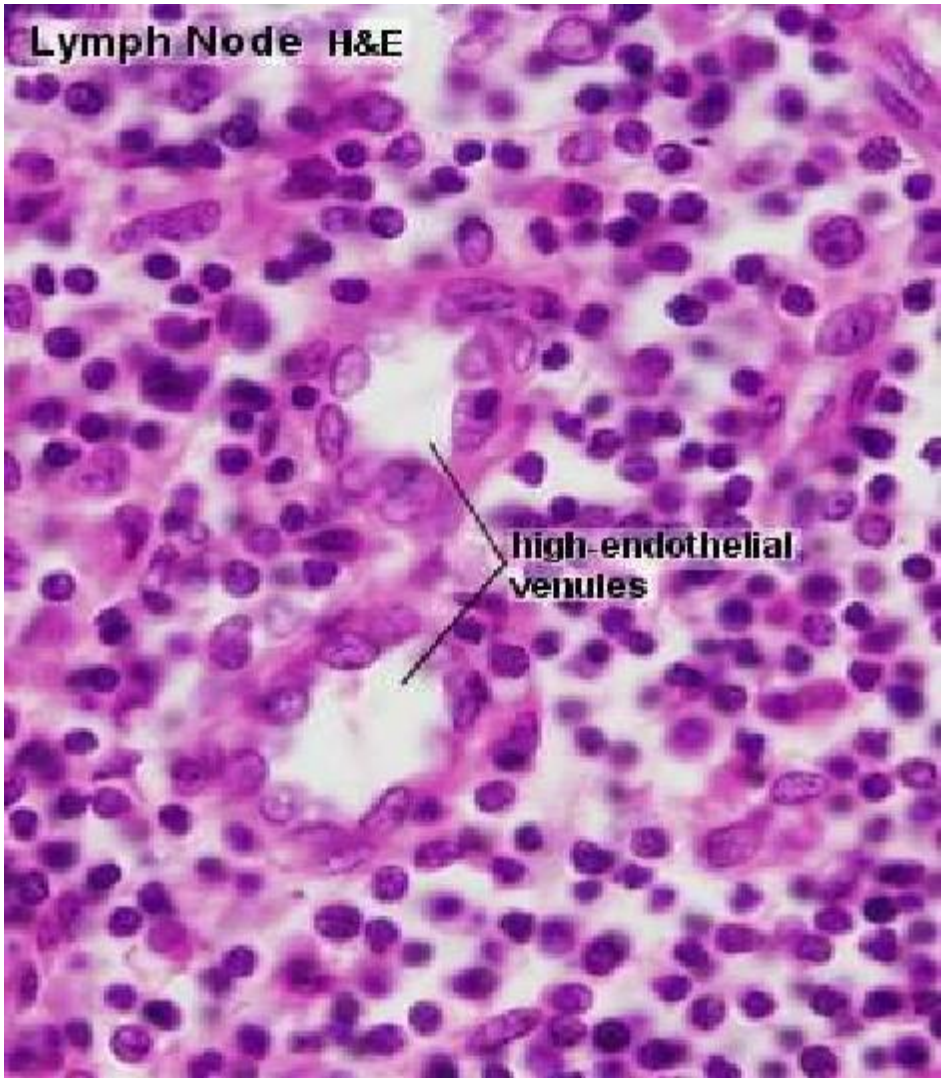
Cells of lymph node

- ‘T’ & ‘B’ lymphocytes
- Lymph follicles – ‘B’ cells
- Germinal centre-lymphoblasts
- Dark rim-Aggregations of ‘B’ cells---mature into plasma cells, seen in medullary cords
- Fate of ‘B’cells in lymph node



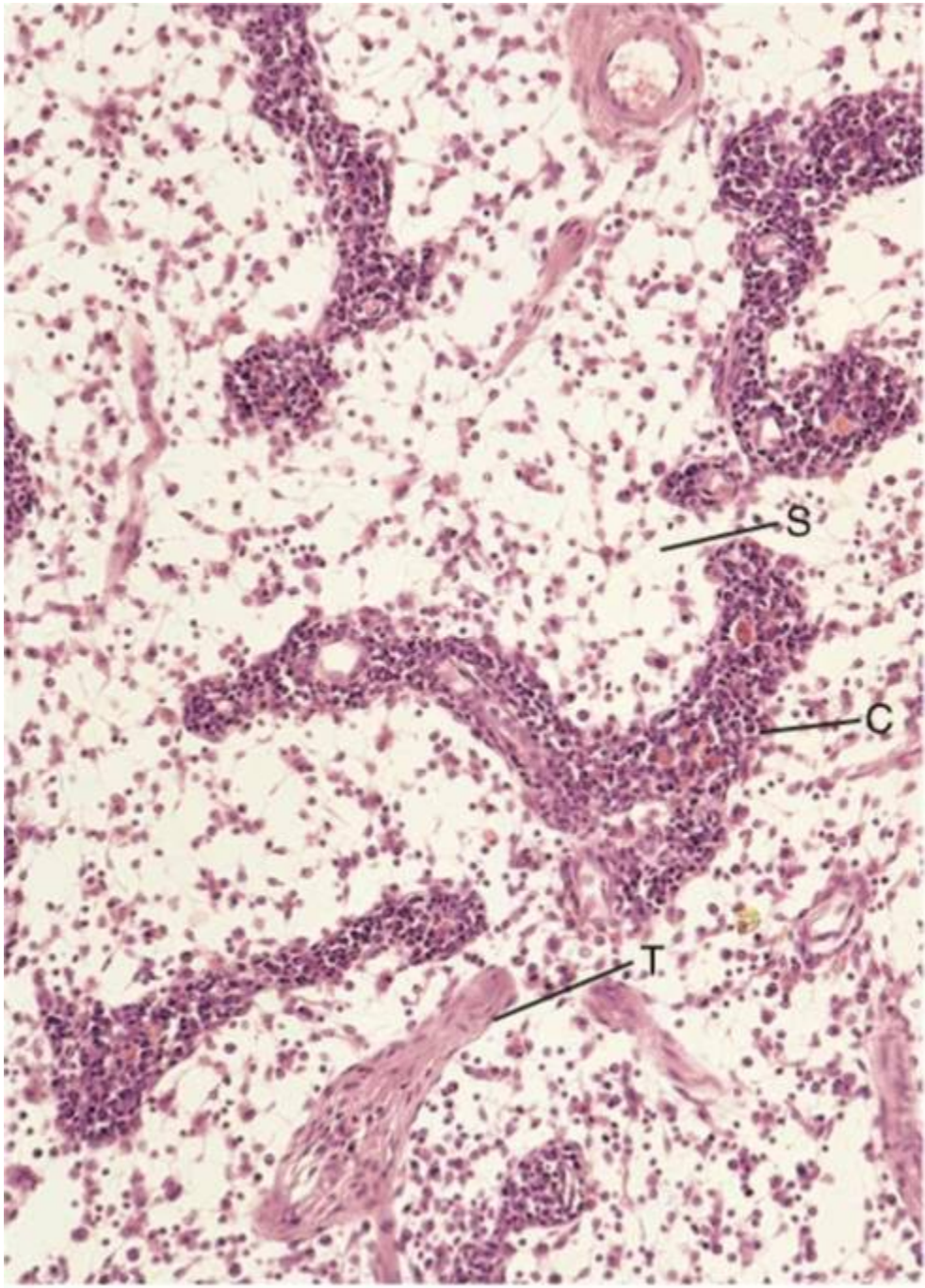
Para cortical area-

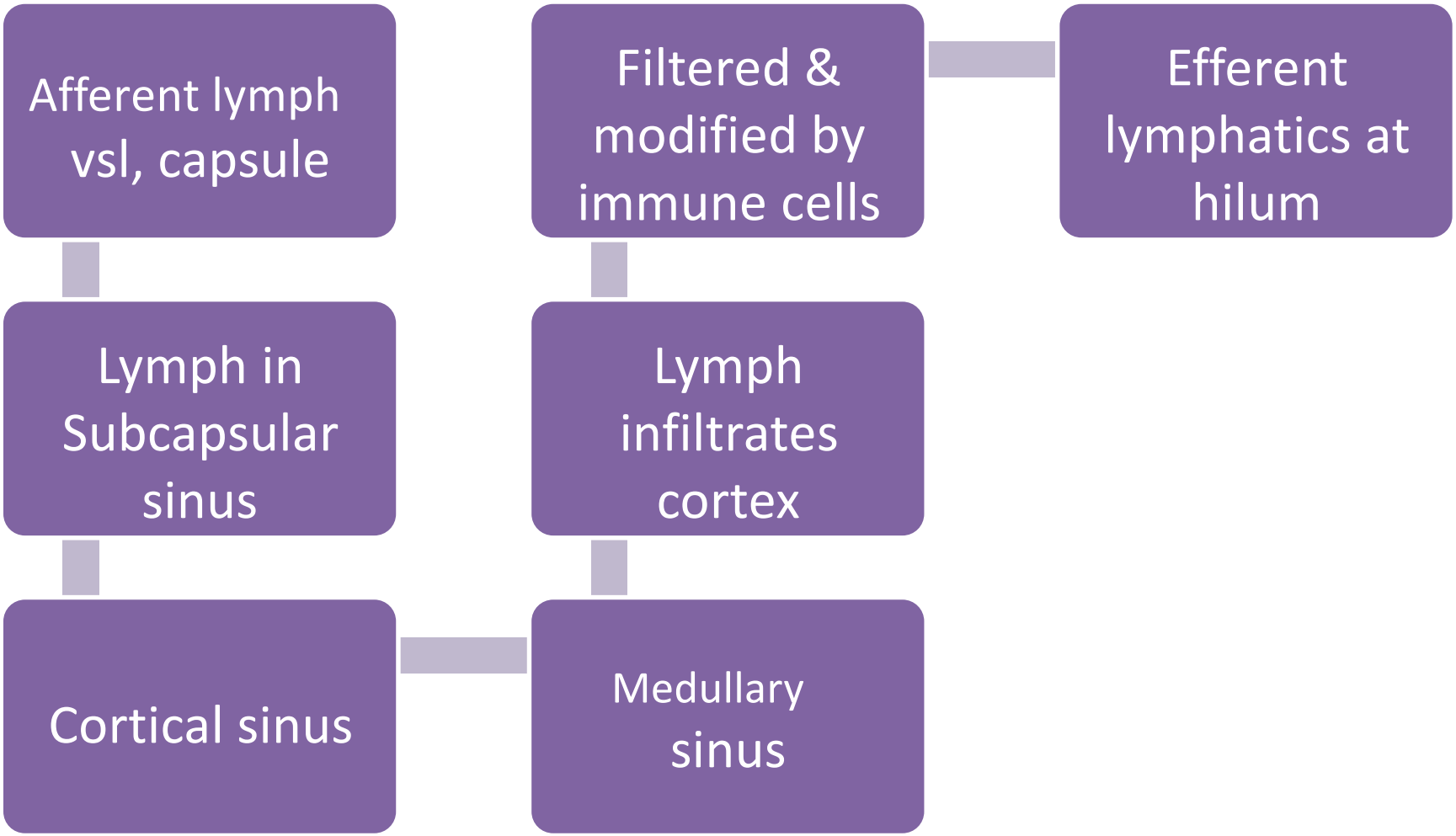
- Between cortical follicles and medulla
- Accumulation of T cells. (Lack of B cell nodules)
- Both CD4 & CD8
- Interdigitating dendritic cells
- Expands in T cell mediated immune response states



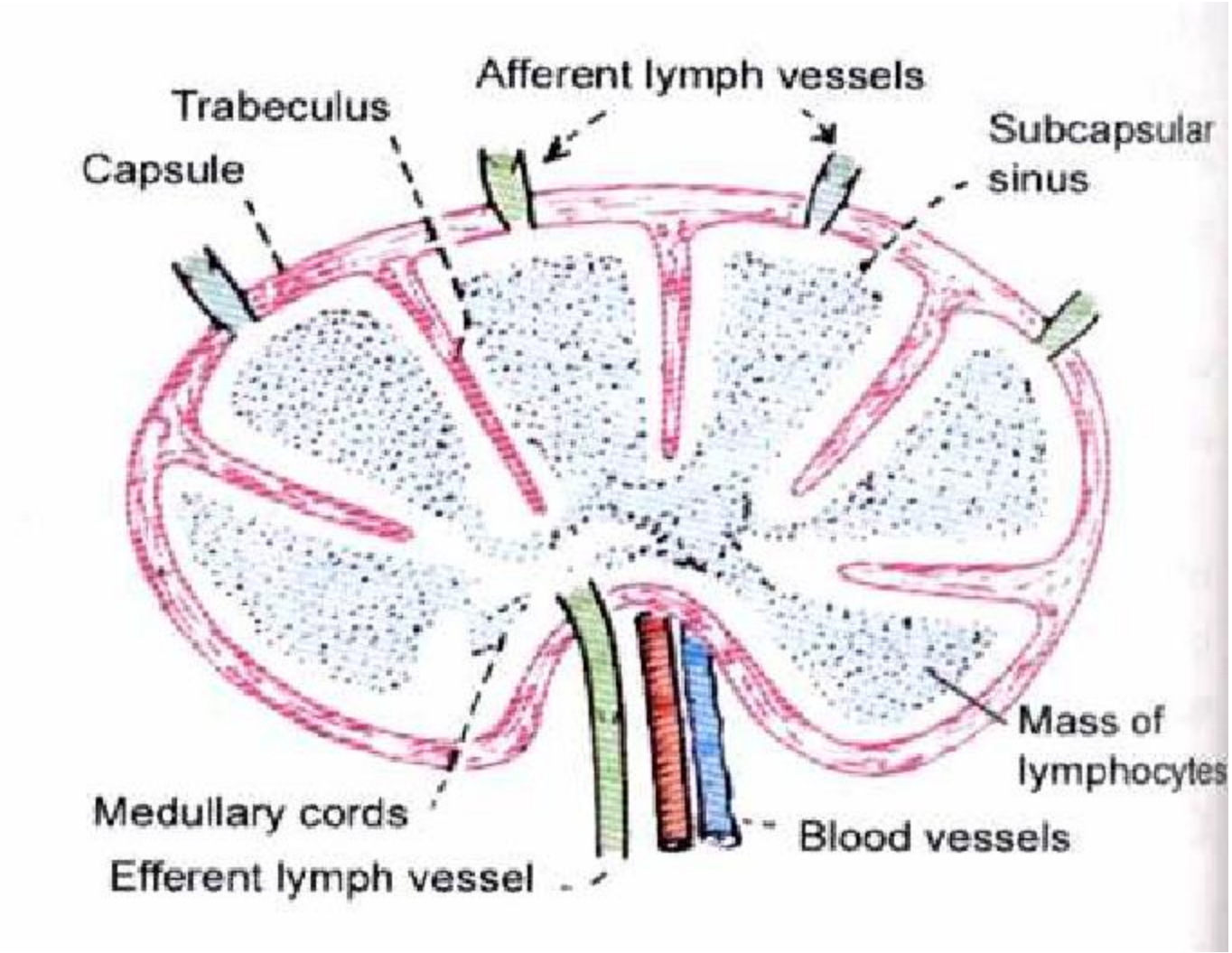
Medulla

- **Medullary cords-** branched extensions of lymphoid tissue. B lymphocytes, plasma cells & macrophages.
- **Medullary sinuses -** cords separated by spaces, bridged by reticular cells & fibers. Contain lymph, lymphocytes, macrophages.
- Medullary sinus is continuous with cortical sinus, join at hilum, delivers lymph to efferent lymph vessel




Afferent lymph vsl, capsule
Lymph in Subcapsular sinus
Cortical sinus
Medullary sinus
Lymph infiltrates cortex
Filtered & modified by immune cells
Efferent lymphatics at hilum

Circulation of lymph through a lymph node



Applied histology

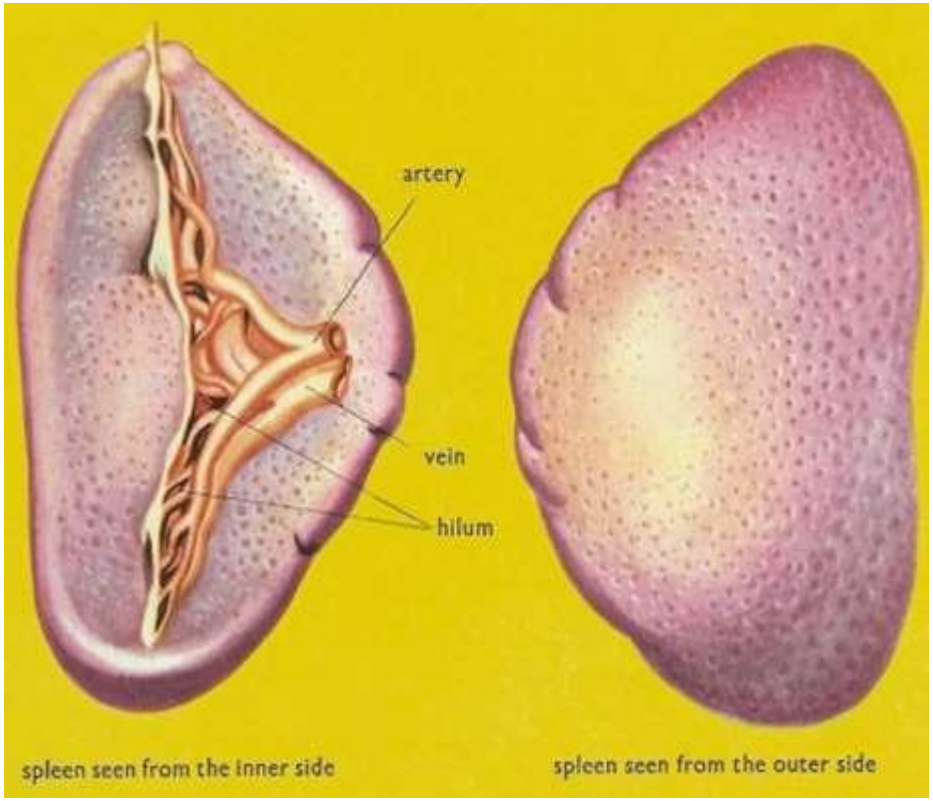
- Lymphadenitis
- Lymphatic spread of cancers

SPLEEN

SPLEEN

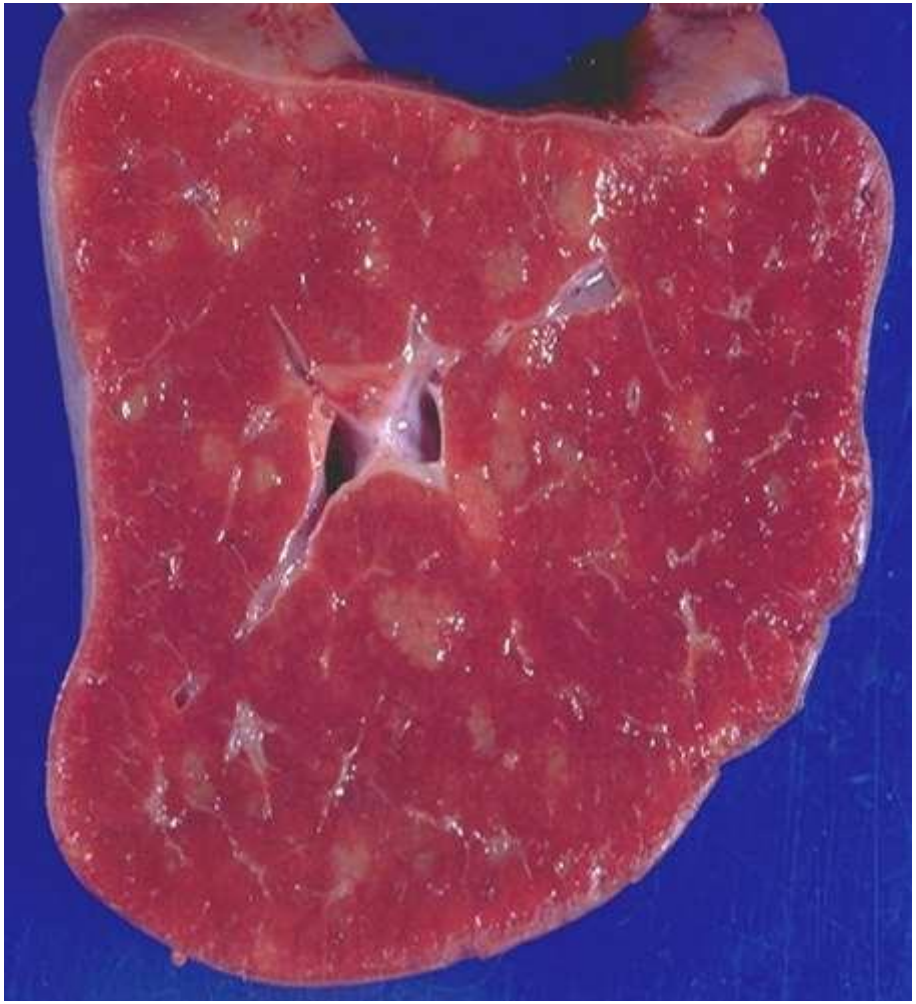
- Largest lymphatic organ
- Location – Upper left quadrant of abdomen
- Rich blood supply
- Filters blood
- Reacts to blood borne antigen

Contains Lymphocytes, special vascular spaces, meshwork of reticular cells and fibres and macrophages



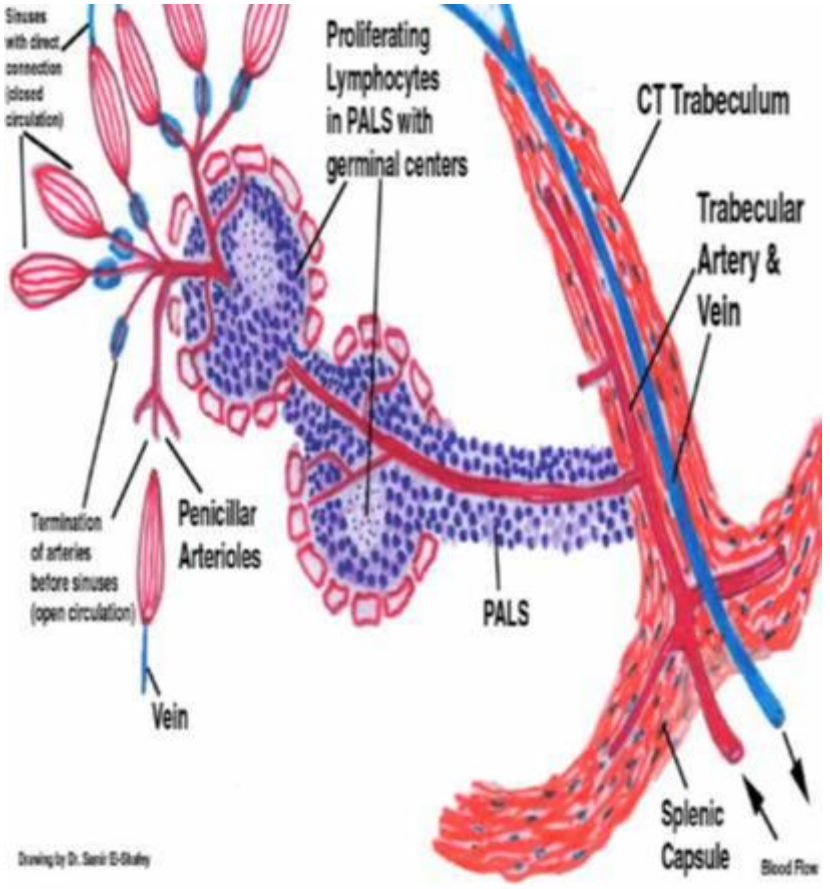
Capsule & Trabeculae
contains myofibroblast

Splenic pulp - White pulp & Red pulp



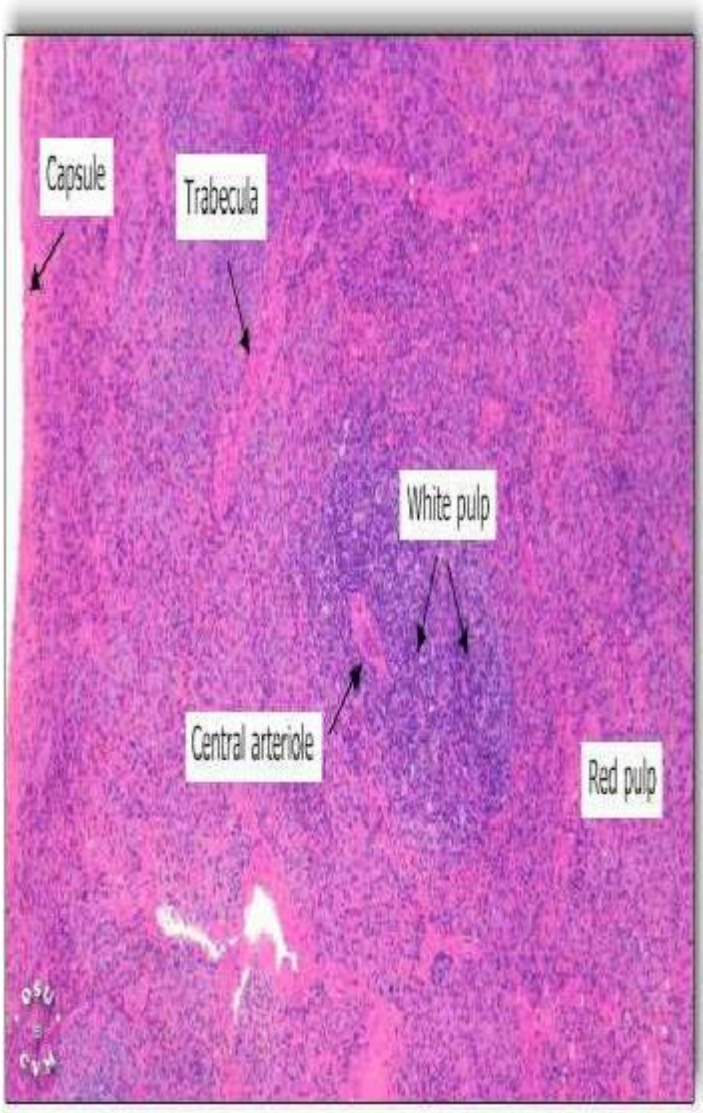
Circulation through Spleen

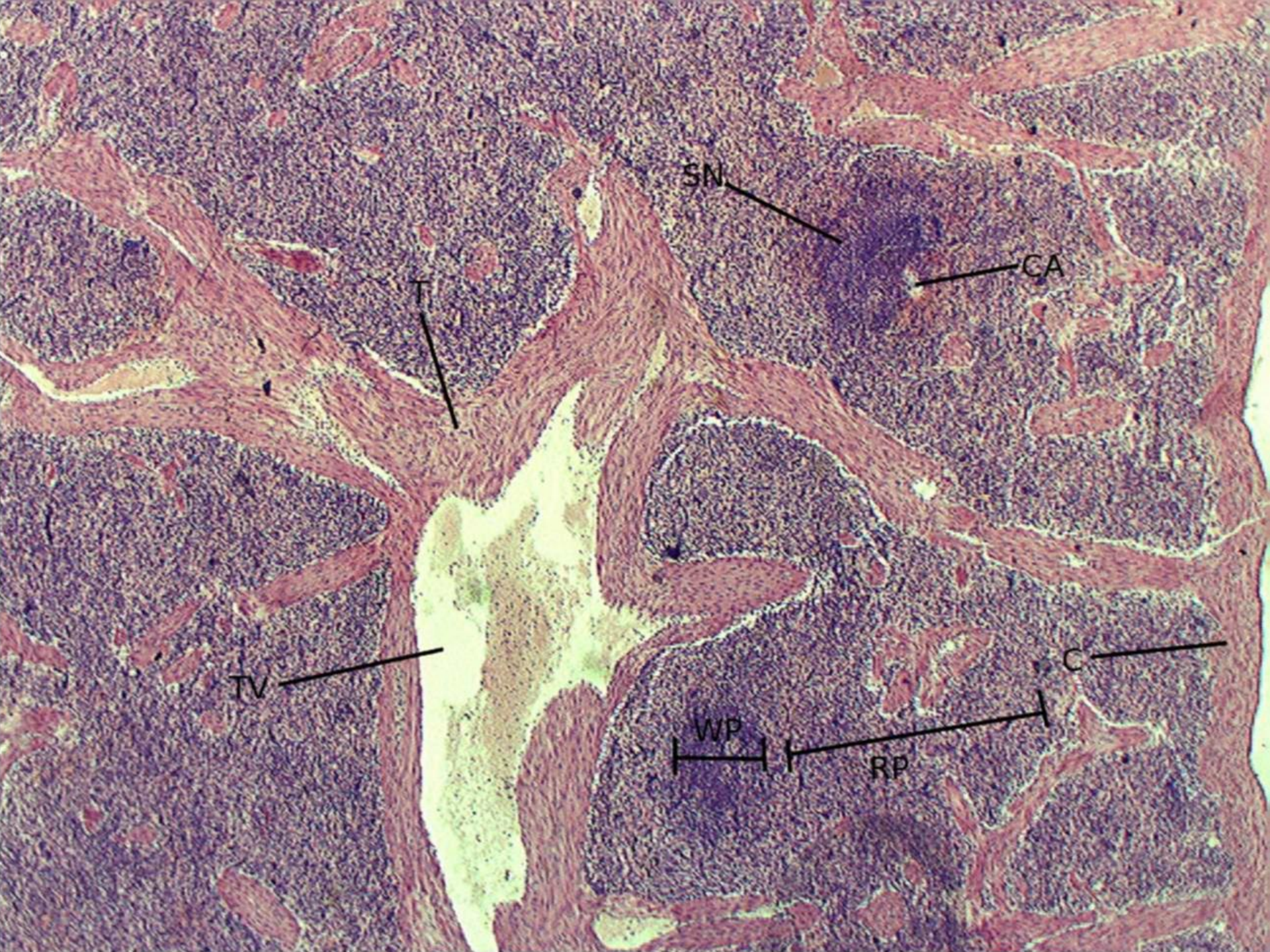
- Splenic artery branches
- Arterioles in Trabeculae
- White pulp
- Penicilli
- Red pulp (Open)
- Peri Arterial lymphatic sheath (PALS)

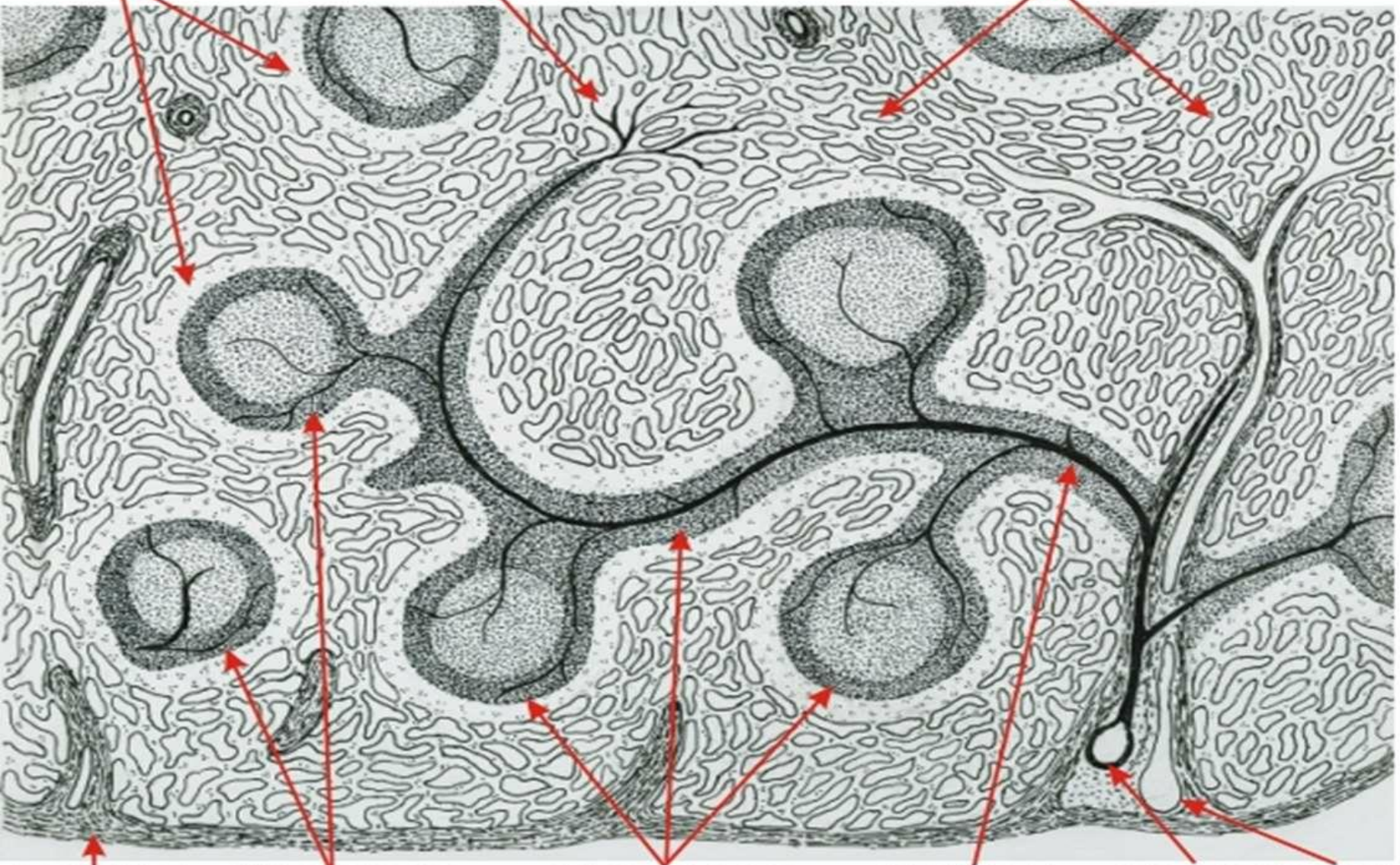


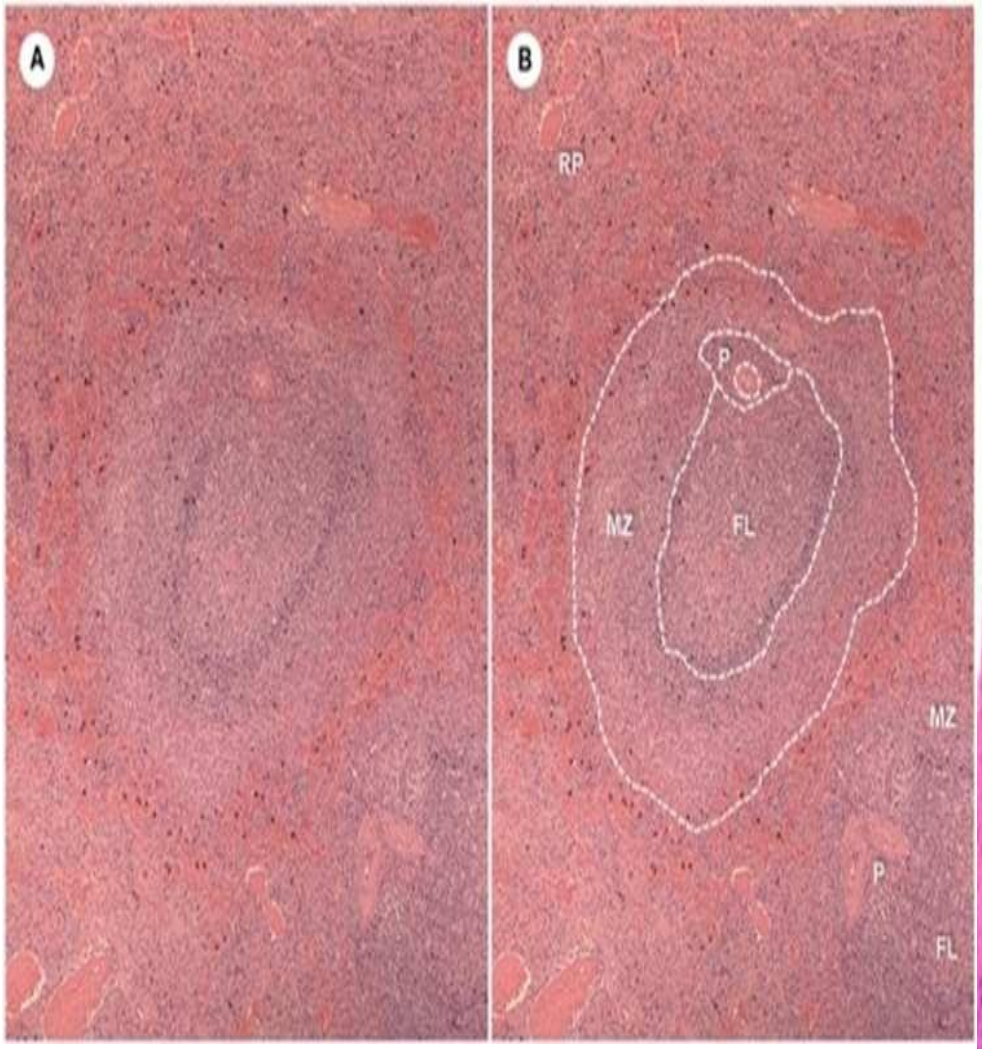
SPLEEN-WHITE PULP

- Rich in Lymphocytes
- Basophilic in H&E
- Lymphocytes cover the artery - Peri Arterial Lymphatic Sheath (PALS)
- Cylindrical in shape, Contains T – lymphocytes
- In cross section, appears like lymphatic follicle
- But has central artery
- If lymphatic follicle present in PALS, the artery is present eccentrically
- Large lymphatic follicle are called ***Malphigian bodies*** – contains B-lymphocytes




SN
CA
T
TV
C
WP
RP


MARGINAL ZONES
TERMINAL CAPILLARIES
RED PULP: SPLENIC CORDS SEPARATED BY BLOOD SINUSES (pale)
CAPSULE
LYMPHATIC NODULES
WHITE PULP
LYMPHATIC NODULES plus PERIARTERIAL SHEATH
CENTRAL ARTERY
ARTERY VEIN
IN A TRABECULE


A
B
RP
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MZ
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MZ
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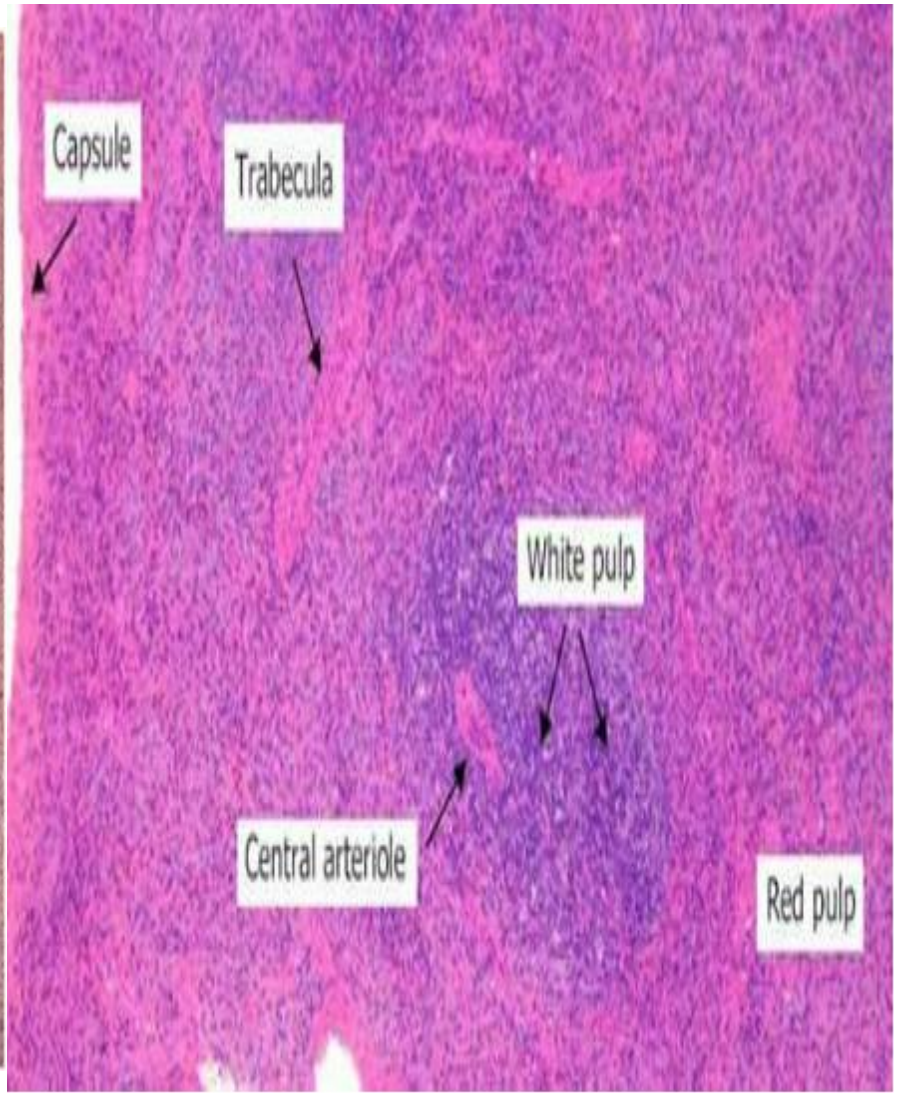

Capsule
Trabecula
White pulp
Central arteriole
Red pulp

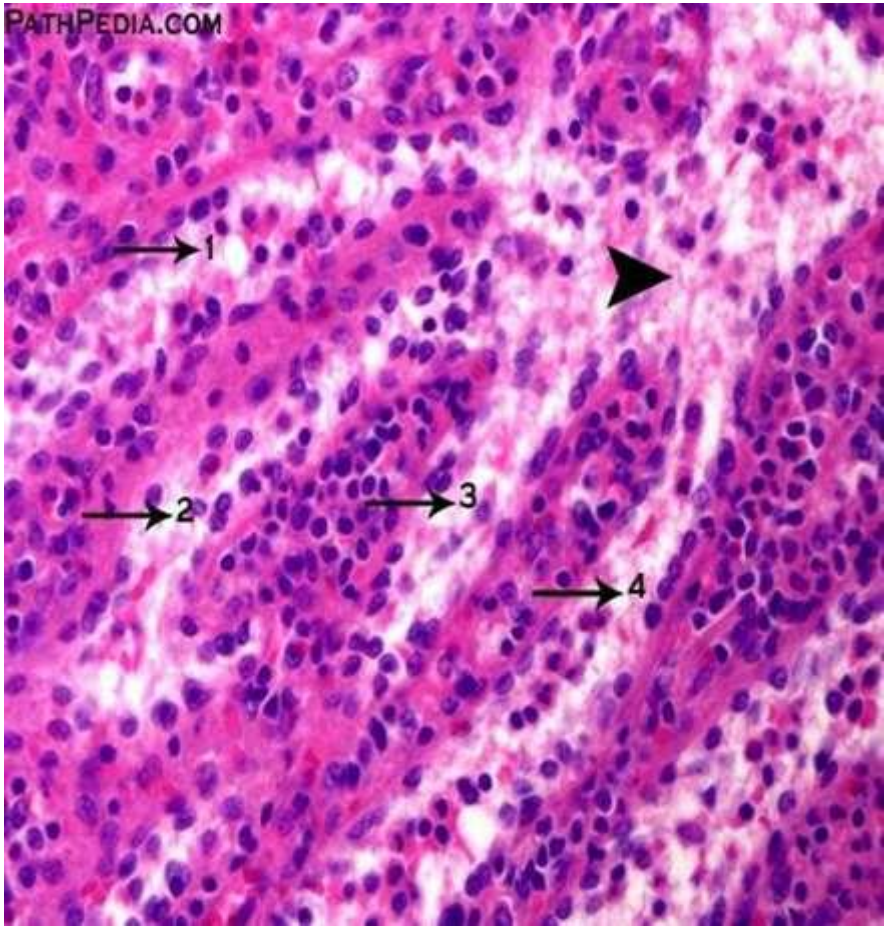
RED PULP

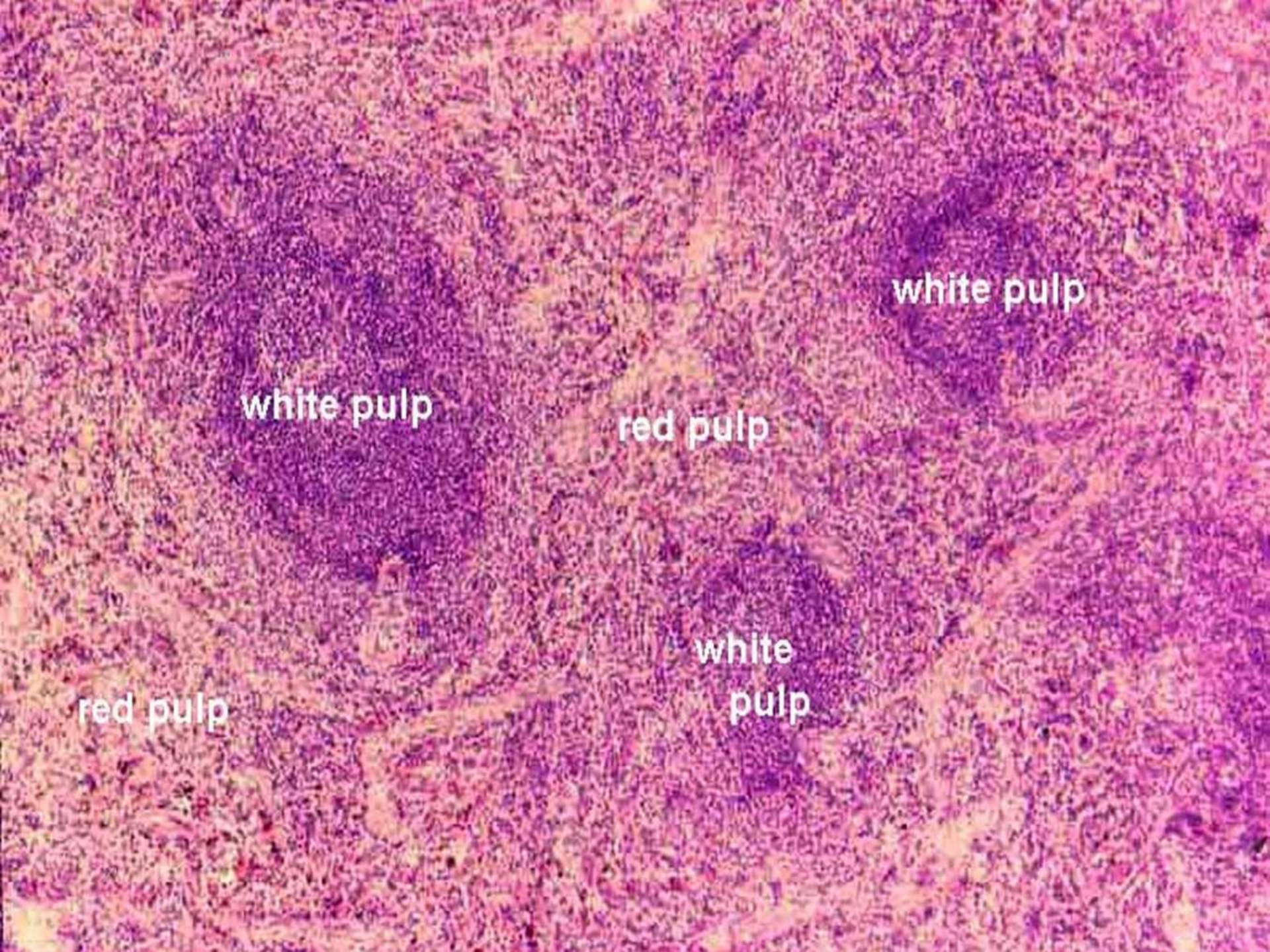
Sponge-like
Contains Splenic sinuses seperated by Splenic cords of Billroth

Sinuses are venous sinuses with discontinuous basement membrane

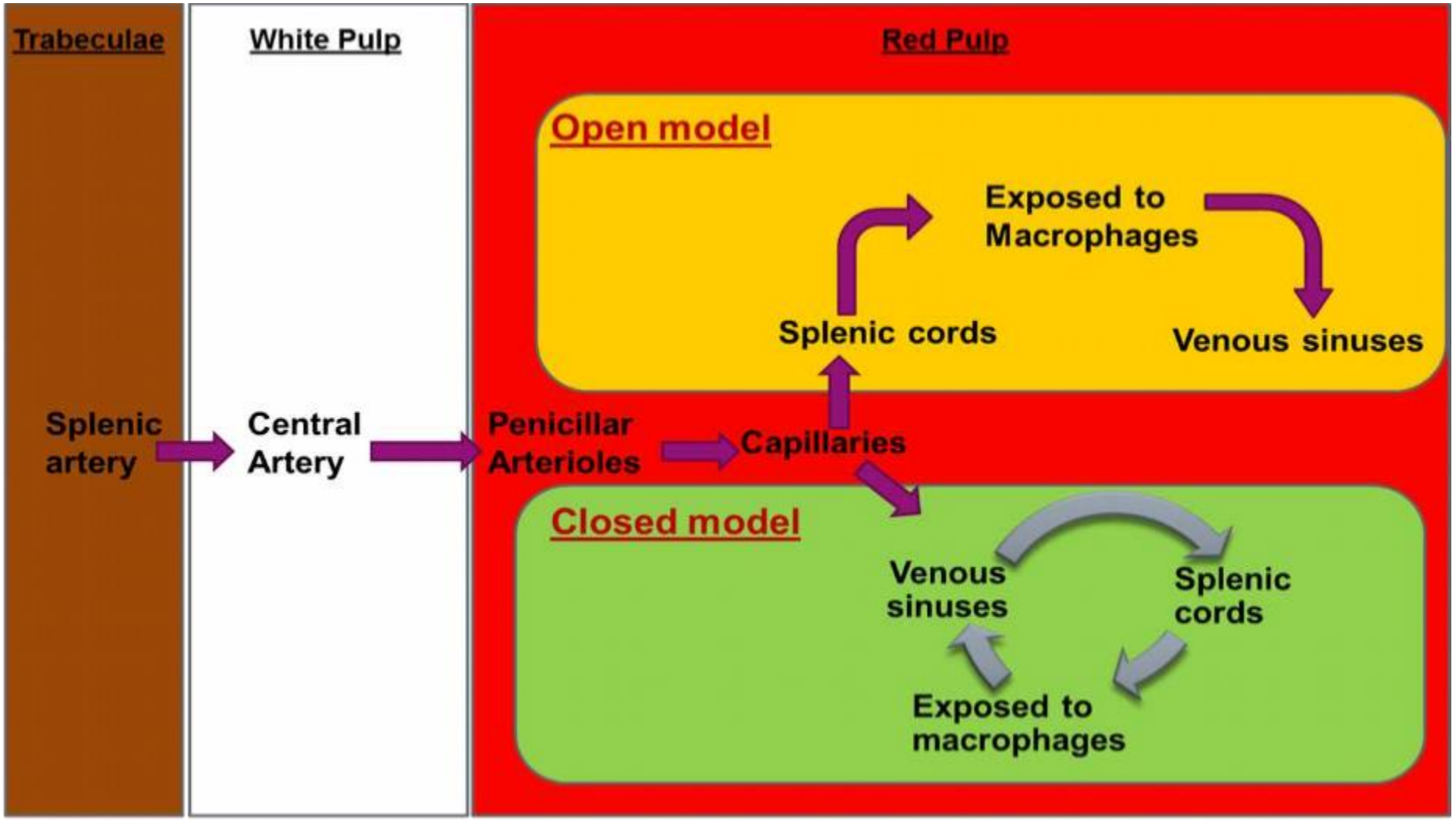
Splenic cords – Meshwork of reticular fibres with RBC, macrophages, Lymphocytes and plasma cells

Macrophages - Phagocytosis of damaged RBC




white pulp
white pulp
red pulp
white
pulp
red pulp

Splenic Circulation



Functions of Spleen

Immunological

- Proliferation of lymphocytes
- Production of Antibodies
- Removal of antigen from blood

White pulp

Haemopoietic

Formation of blood cells in foetal life

- Destruction of RBC
- Storage of Blood

Red pulp

Differentiating features

Lymph node

- Trabeculae-not thick
- Cortex & medulla
- Lymphoid follicles in cortex
- No arteriole in follicles

Spleen

- Trabeculae-thick
- White & Red pulp
- Malpighian bodies in white pulp
- Eccentric arteriole in Malpighian bodies.

Thank you for your attention

Thank You!!!