



بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

# LYMPHOID TISSUE

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## Objectives:

By the end of the lecture, the student should describe the microscopic structure of the following organs in correlation with their functions:

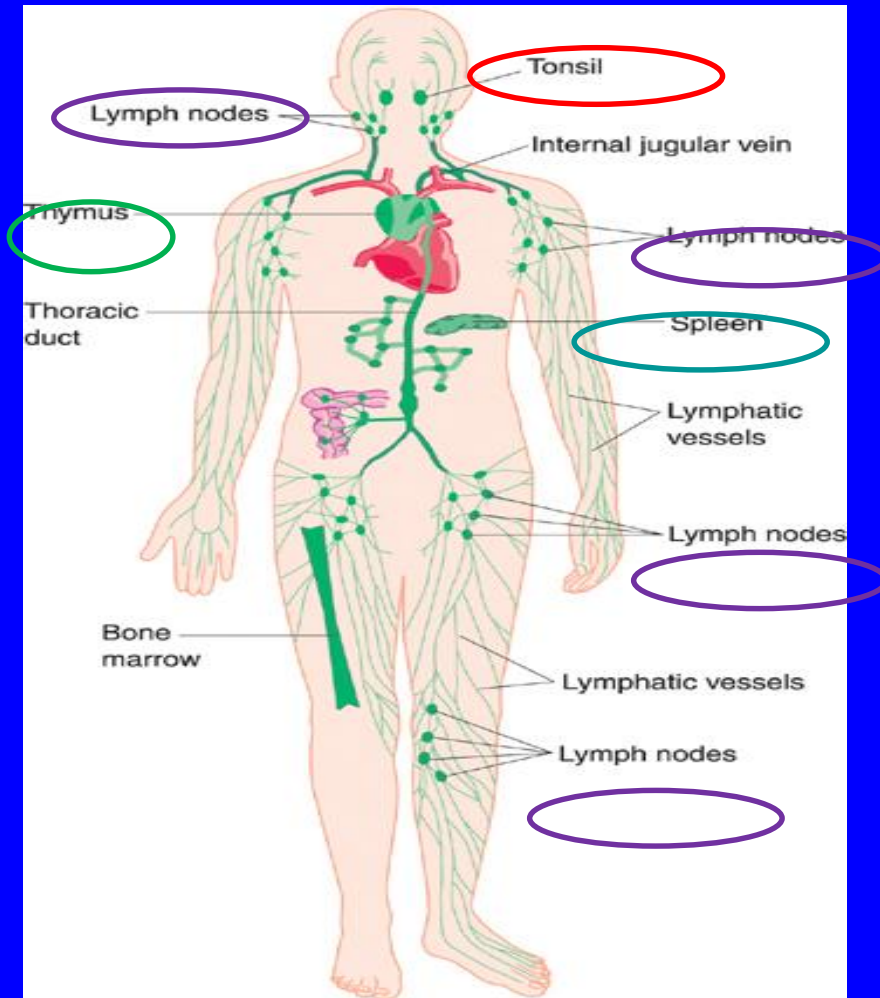
- 1- Lymph nodes.
- 2- Spleen.
- 3- Tonsils.
- 4- Thymus.

# LYMPHOID TISSUE

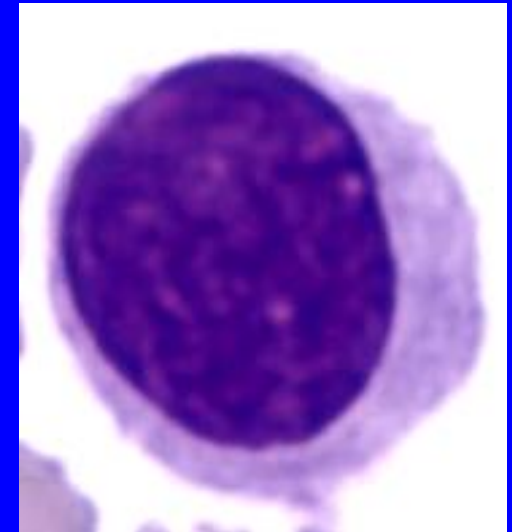
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- **Diffuse:** mucosa associated lymphoid tissue.
- **Encapsulated:**
  - Lymph nodes
  - Spleen
  - Tonsils (are incompletely encapsulated)
  - Thymus

# LYMPHOID TISSUE

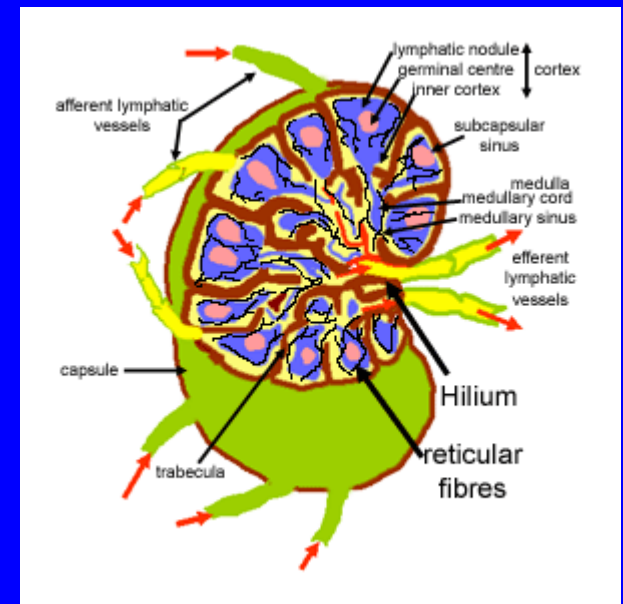
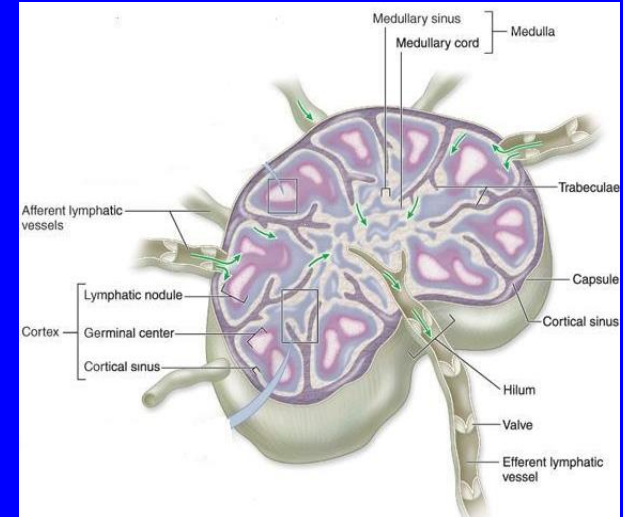


## Lymphocyte



# LYMPH NODES (L.N.)

- Ovoid, kidney shaped organs.
- Each node has:
  - ◆ A **convex surface** which receives **afferent lymph vessels**
  - ◆ A **hilum** where **efferent lymph vessels** leave and drain lymph from the node.



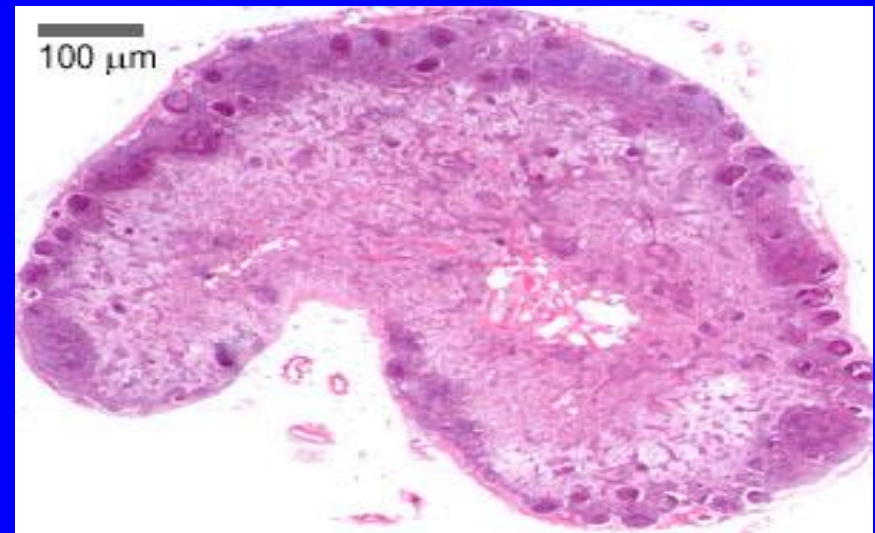
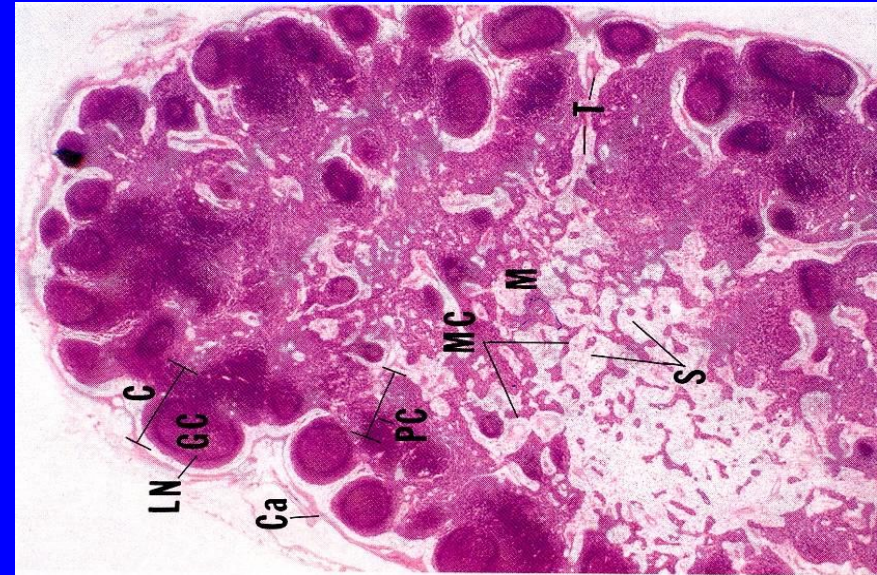
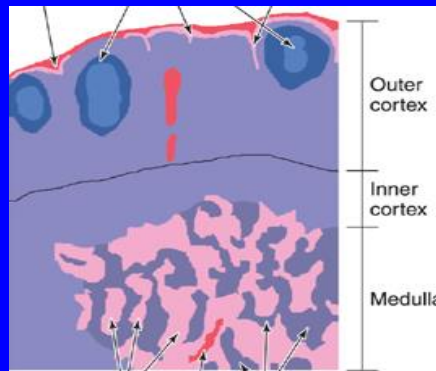
# Lymph Nodes

## (A) Stroma:

- 1- Capsule
- 2- Trabeculae (septa)
- 3- Reticular C.T.

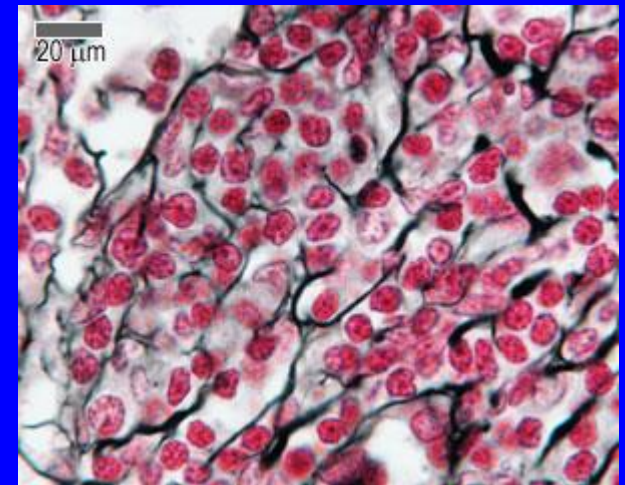
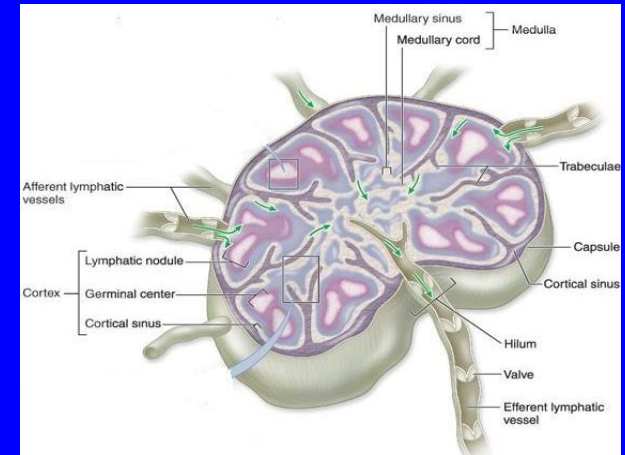
## (B) Parenchyma: (lymphoid tissue + lymph sinuses)

- 1- Cortex
- 2- Paracortex
- 3- Medulla



# Lymph Nodes

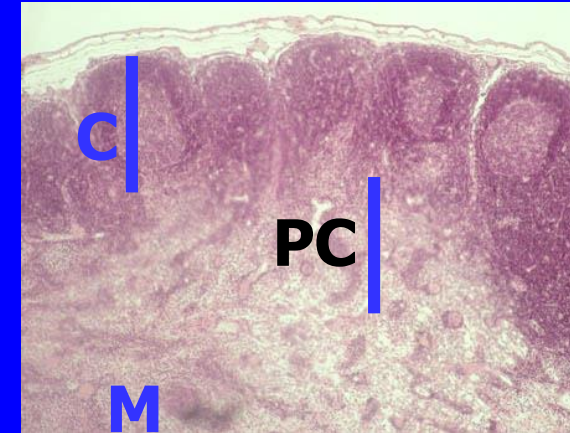
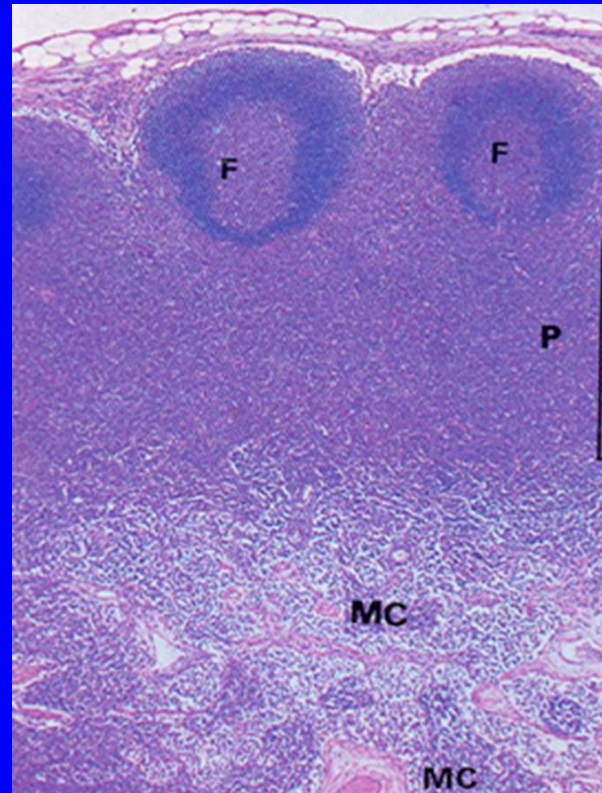
- Each lymph node has a dense connective tissue **capsule**.
- From the capsule, connective tissue **septa** (**trabeculae**) extend into the outer part (cortex) of the node and divide it into incomplete compartments.
- The framework of the node is formed by **reticular connective tissue**.



# Lymph Nodes

■ Each lymph node is divided into three regions:

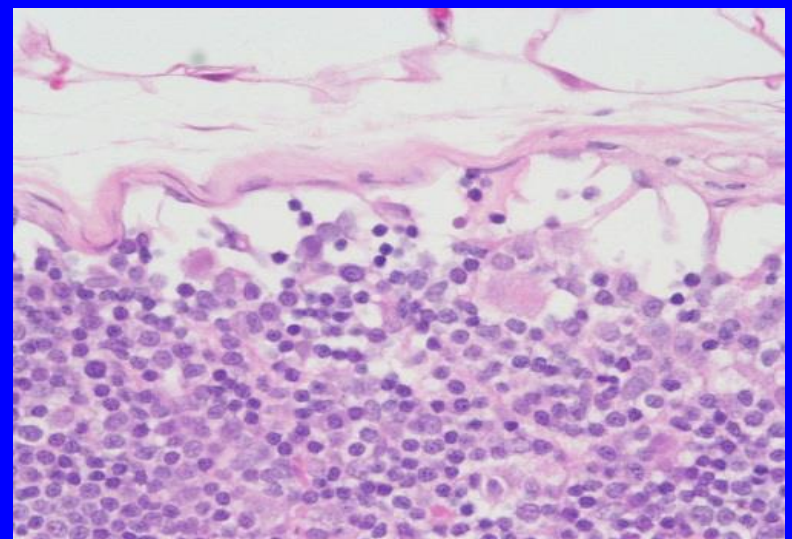
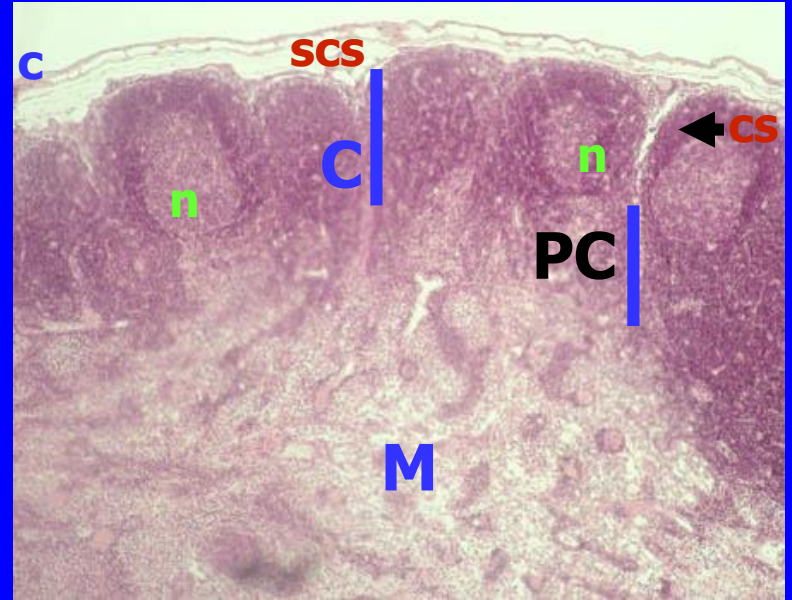
- ◆ Cortex
- ◆ Paracortex
- ◆ Medulla





# Lymph Nodes: CORTEX

- contains the:
  - ◆ Subcapsular lymphatic sinus.
  - ◆ Cortical sinuses.
  - ◆ Lymphoid nodules (primary & secondary) composed mainly of B lymphocytes, macrophages and reticular cells.

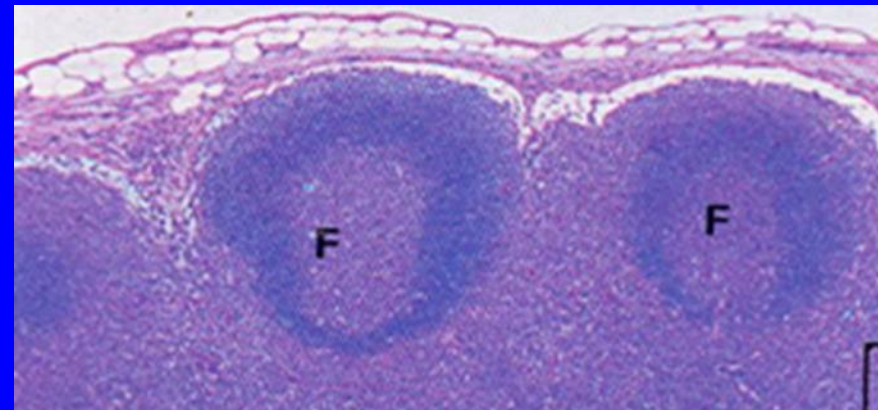
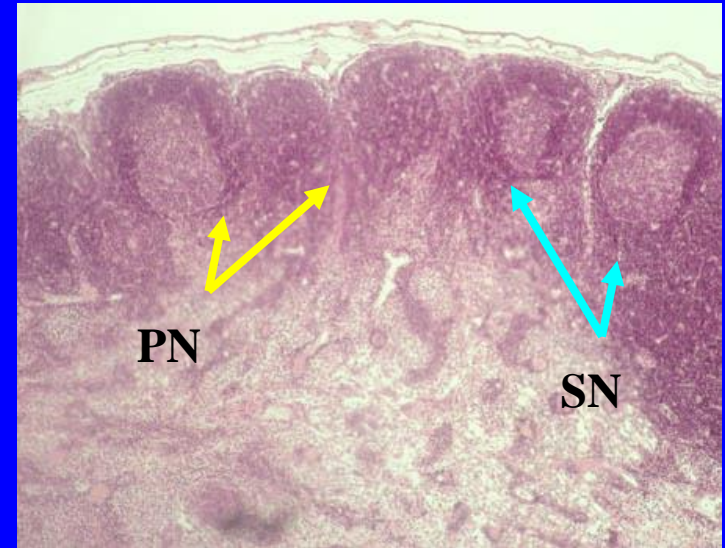


# Lymph Nodules (Follicles)

- Lymph nodules are small masses of lymph tissue (lymphocytes).

Lymph nodules may be:

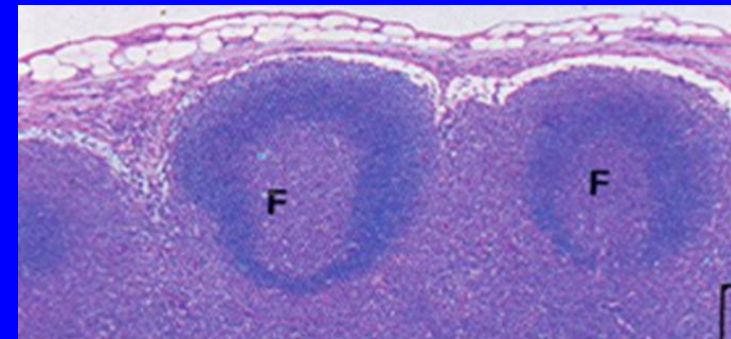
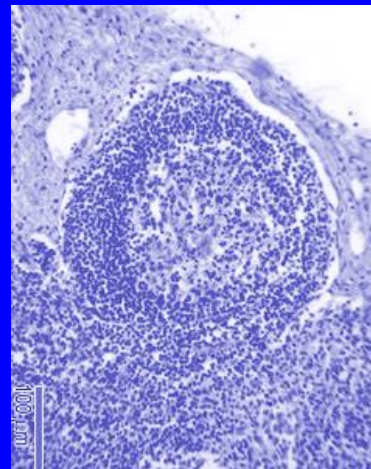
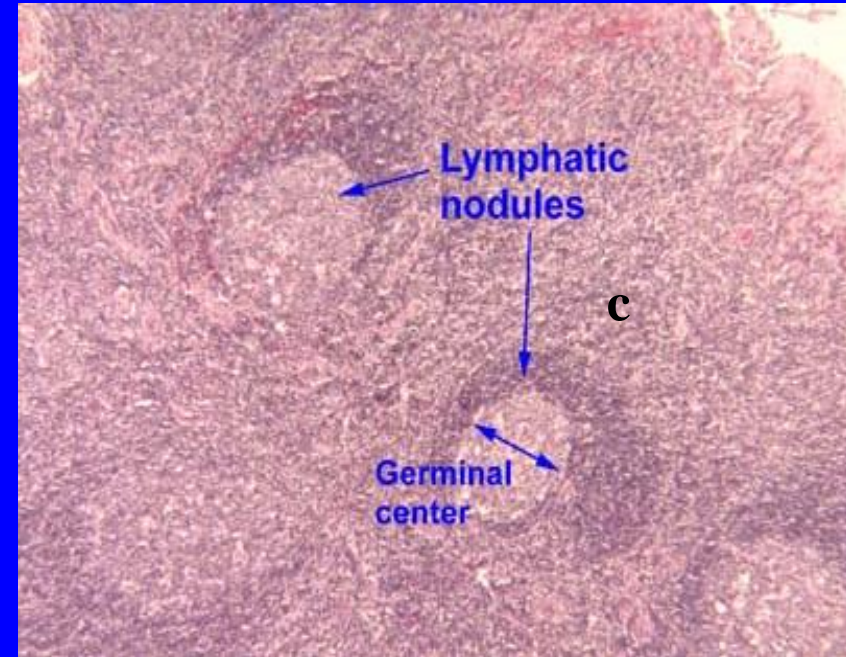
- **Primary nodules:** formed of virgin B lymphocytes.
- **Secondary nodules:** with paler germinal centers.



# Secondary Nodules

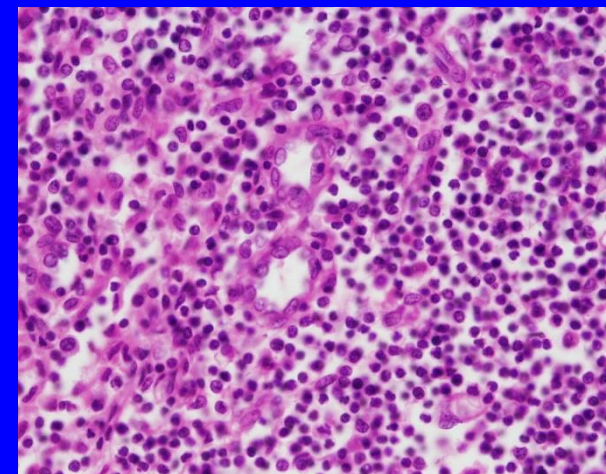
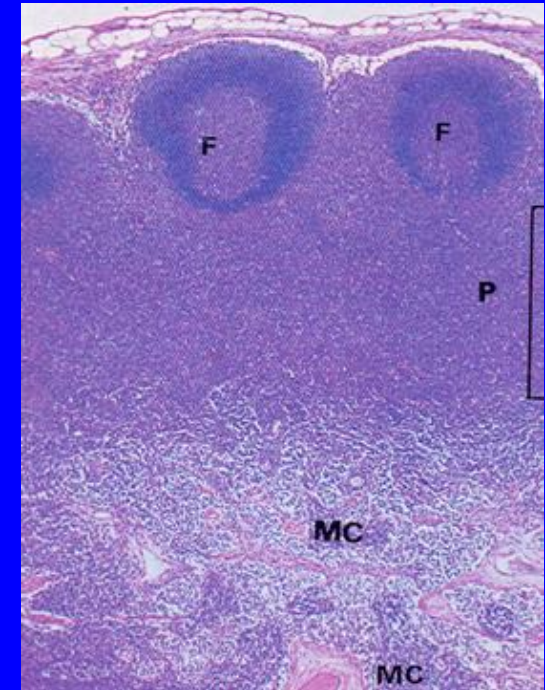
Contain:

- **Germinal centers**, central light areas filled with activated B lymphocytes (B lymphoblasts), plasma cells and macrophages.
- The germinal centre is surrounded by a darker-staining region called the **corona**.



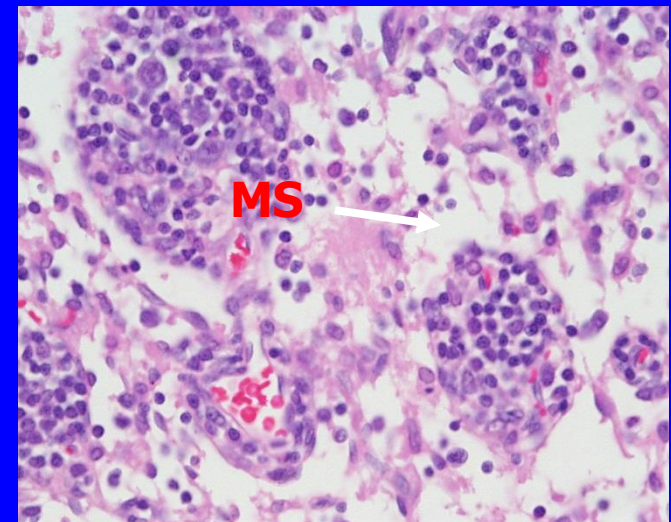
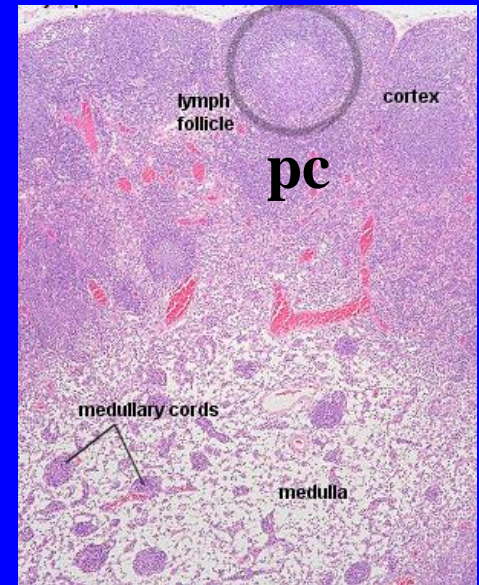
# Lymph Nodes: PARACORTEX

- It is the region between cortex and medulla.
- It is the **thymus dependent zone** and contains **T lymphocytes**.
- It contains **high endothelial venules** through which lymphocytes enter the lymph node; B cells enter the cortex and T cells settle in the paracortex.
- Has NO nodules.



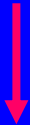
# Lymph Nodes: MEDULLA

- Consists of:
  - ◆ Medullary cords.
  - ◆ Medullary lymph sinuses.
- The medullary cords are composed of B & T lymphocytes, plasma cells and macrophages.
- The medullary lymph sinuses are continuous with the subcapsular and cortical lymph sinuses



# Lymph Flow Through The Lymph Node

Afferent lymph vessels



Subcapsular sinuses



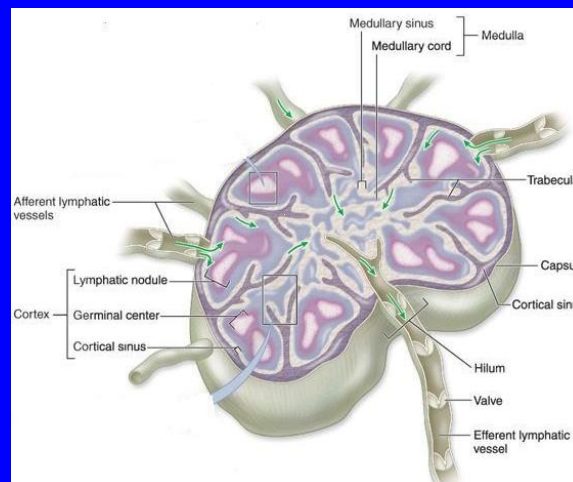
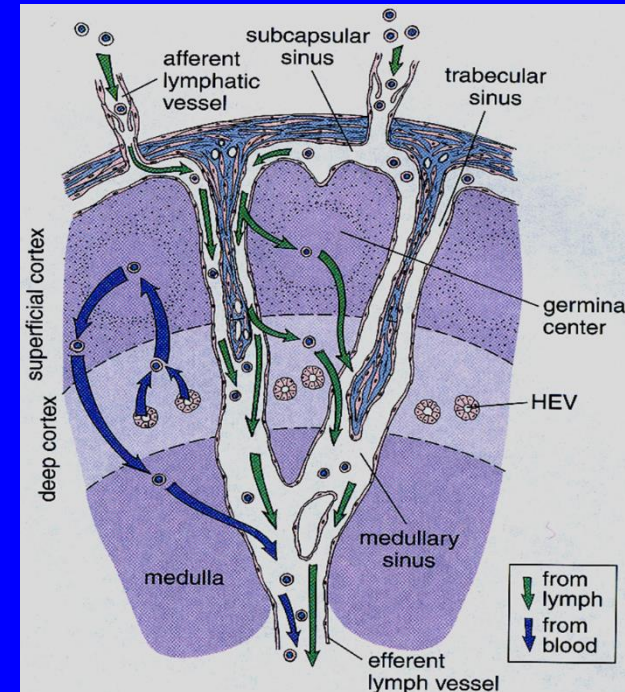
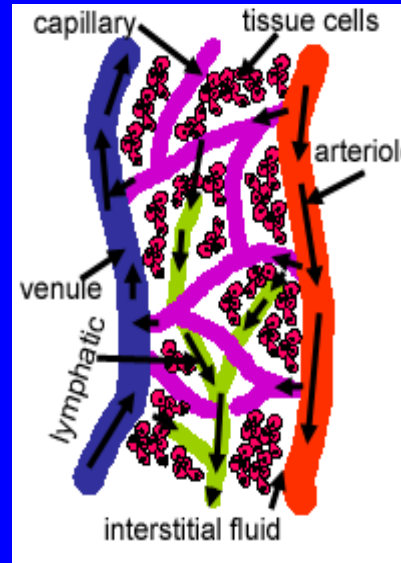
Cortical sinuses



Medullary sinuses



Efferent lymphatic vessels



# Lymph Node: Function

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- Proliferation of B and T lymphocytes.
- Filtration of lymph from bacteria and other foreign substances.

# Clinical Applications

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## Palpable lymph node

- The presence of antigen or bacteria leads to rapid proliferation of lymphocytes of the lymph node (L.N), leading to increase of L.N. to several times of its normal size, so the L.N. becomes enlarged and palpable to the touch.



# THYMUS

## A) Stroma:

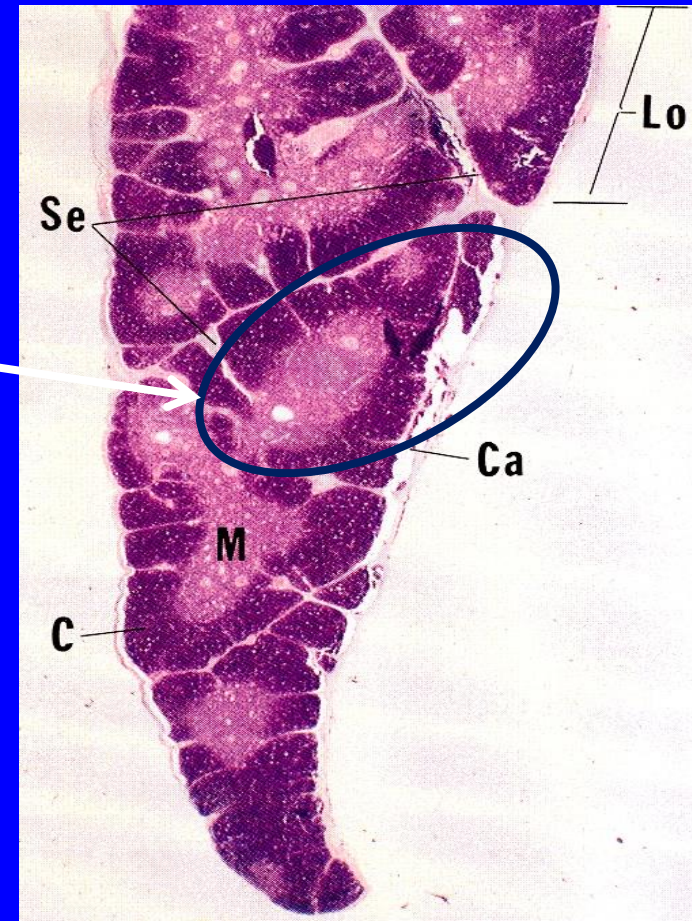
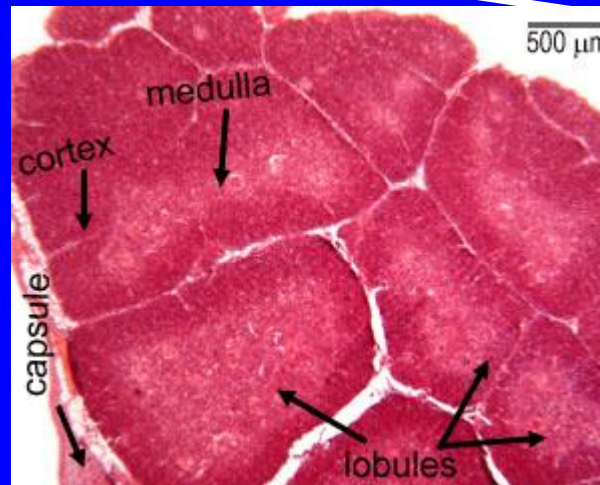
1- Capsule

2- Interlobular trabeculae: incomplete

## B) Thymic lobule:

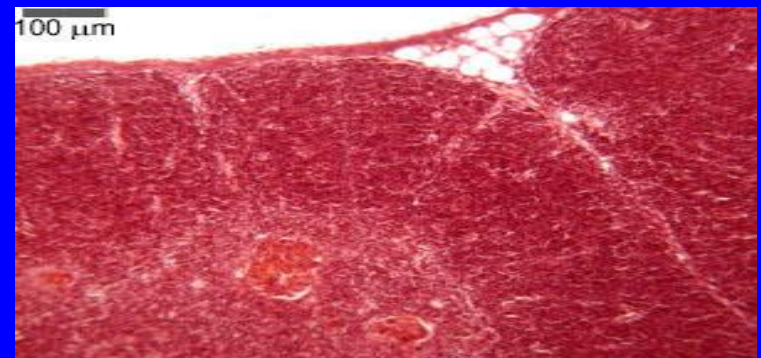
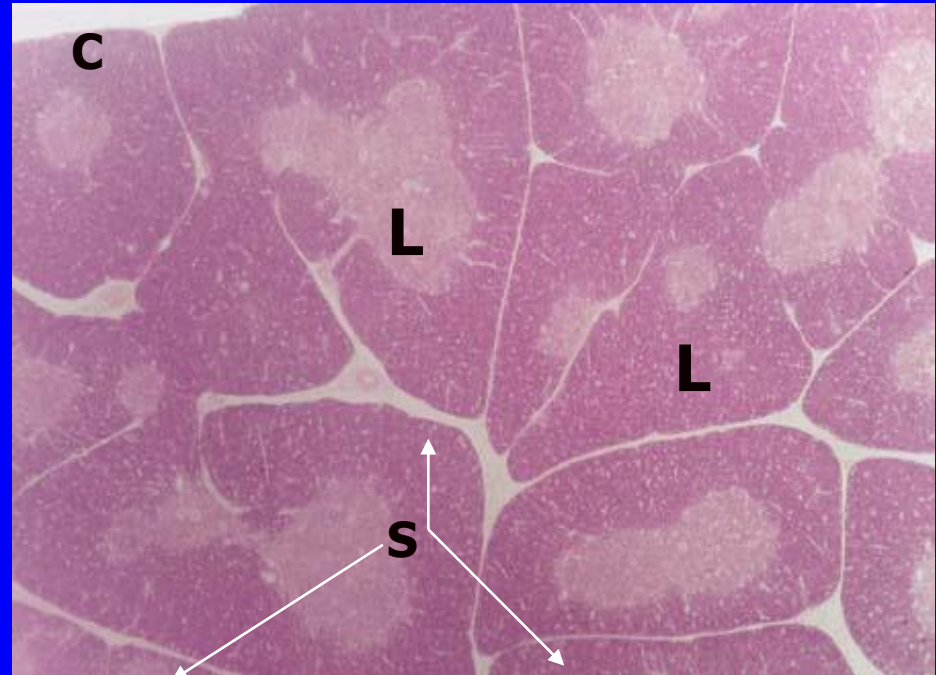
1- Cortex

2- Medulla



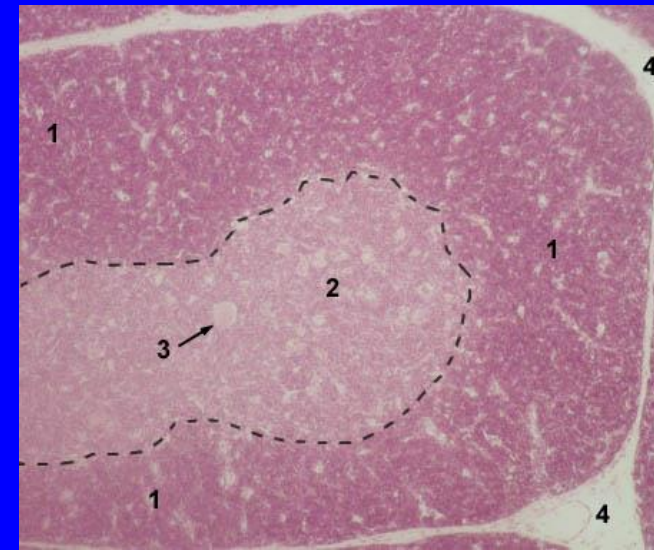
# Thymus

- Bilobed lymphoid organ located in thorax.
- Enclosed in a thin connective tissue **capsule**.
- **Septa (trabeculae)** from the capsule into the organ, subdividing it into incomplete **lobules**.
- Possesses **no lymph nodules, no lymph sinuses, no reticular fibers.**

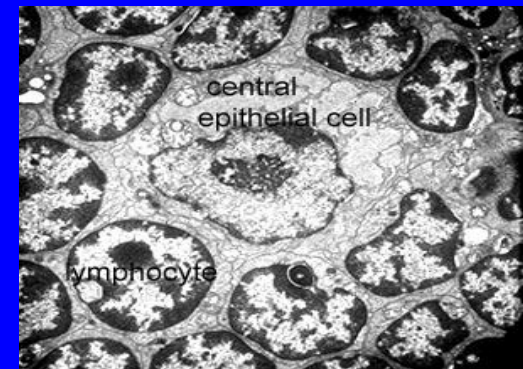


# Thymus

- Each lobule is divided into an outer cortex and inner medulla.
- **CORTEX:** is darker than the medulla because it is populated with immunologically immature T-lymphocytes (more than 90% will die), epithelial reticular cells, and macrophages. Here the immature T cells undergo proliferation, and transform into mature cells and then migrate to medulla.

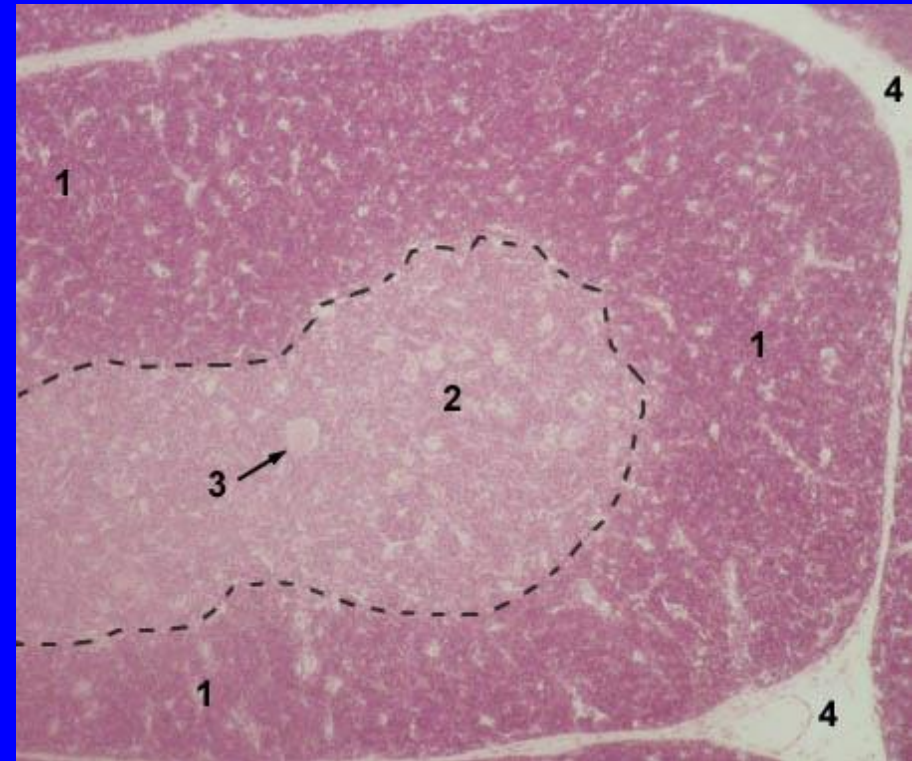
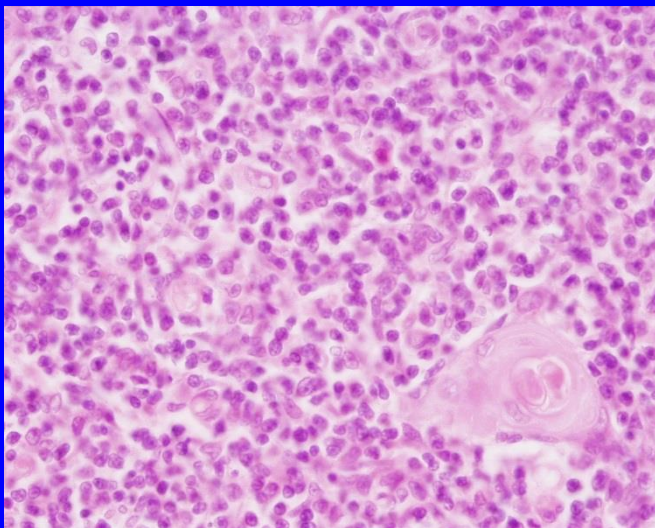


- 1 - cortex
- 2 - medulla
- 3 - Hassall's corpuscle
- 4 - interlobular connective tissue (septa)



# Thymus

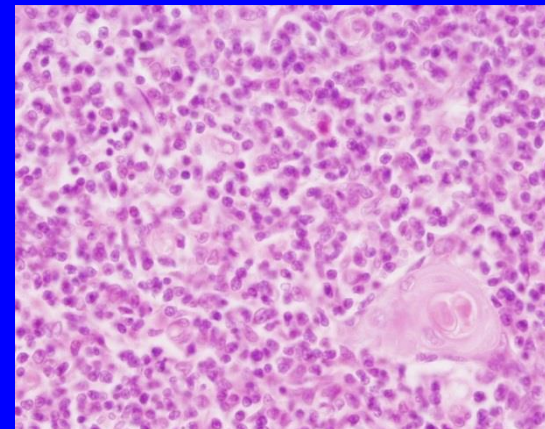
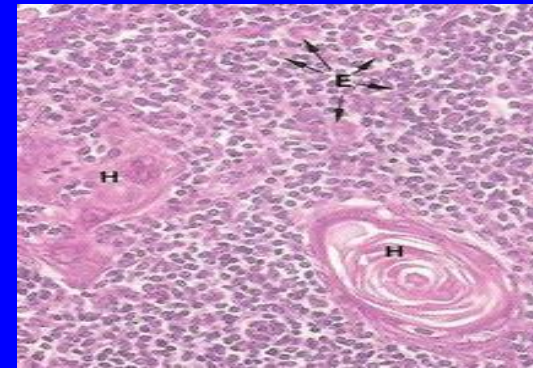
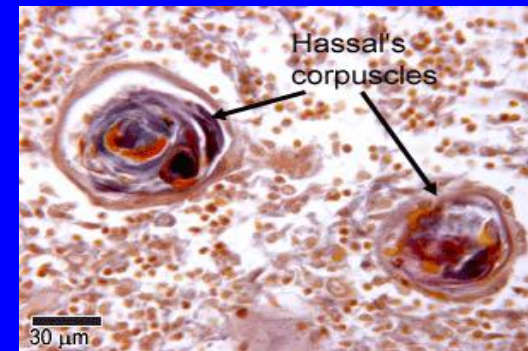
- **MEDULLA:** consists of mature T-lymphocytes, epithelial reticular cells, thymic (Hassall's) corpuscles and macrophages.



- 1 - cortex
- 2 - medulla
- 3 - Hassall's corpuscle
- 4 - interlobular connective tissue (septa)

# Hassall's Corpuscles

- Are composed of groups of concentrically arranged keratinized epithelial reticular cells.
- Are found in medulla of thymic lobules.
- Increase in number with age.
- Probably represent a degenerative process.



# Function of thymus

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- Maturation of T lymphocytes (produce immunocompetent T lymphocytes).
- It involutes after puberty and becomes infiltrated by adipose tissue.
- Remnants of thymus remain in adult to form T lymphocytes.
- No B lymphocytes, no plasma cells in the thymus

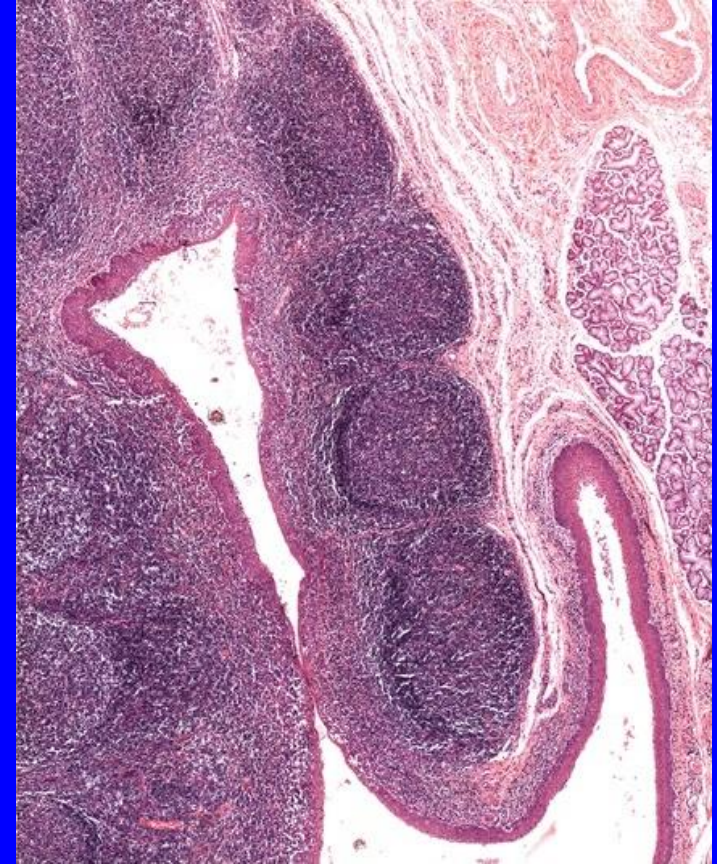
# TONSILS

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- The tonsils (palatine, pharyngeal, and lingual) are incompletely encapsulated aggregates of lymphoid nodules that guard the entrance to the pharynx.
- Function: production of antibodies.

# Palatine Tonsils

- **Bilateral**, located at the entrance of the oral pharynx.
- Incomplete **capsule** separates its deep aspect from the wall of the pharynx.
- The superficial aspect is covered by stratified squamous nonkeratinized **epithelium** that dips into 10-12 **crypts**.
- The **parenchyma** is composed of lymphoid nodules with germinal centers.



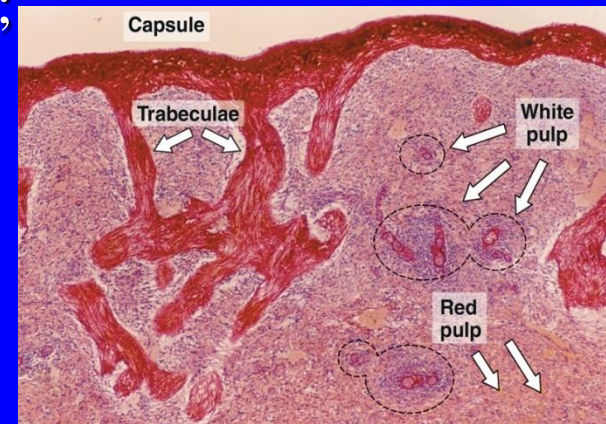


# SPLEEN

## Stroma of Spleen

### 1- Capsule:

- ◆ is covered by visceral layer of peritoneum; mesothelium
- ◆ Is formed of fibromuscular C.T. :
- ◆ Dense fibrous C.T. + smooth muscle cells.



**2- Trabeculae:** Are irregular, incomplete, divide the spleen into intercommunicating compartments (lobules).

**3- Reticular C.T.**

# Parenchyma of Spleen

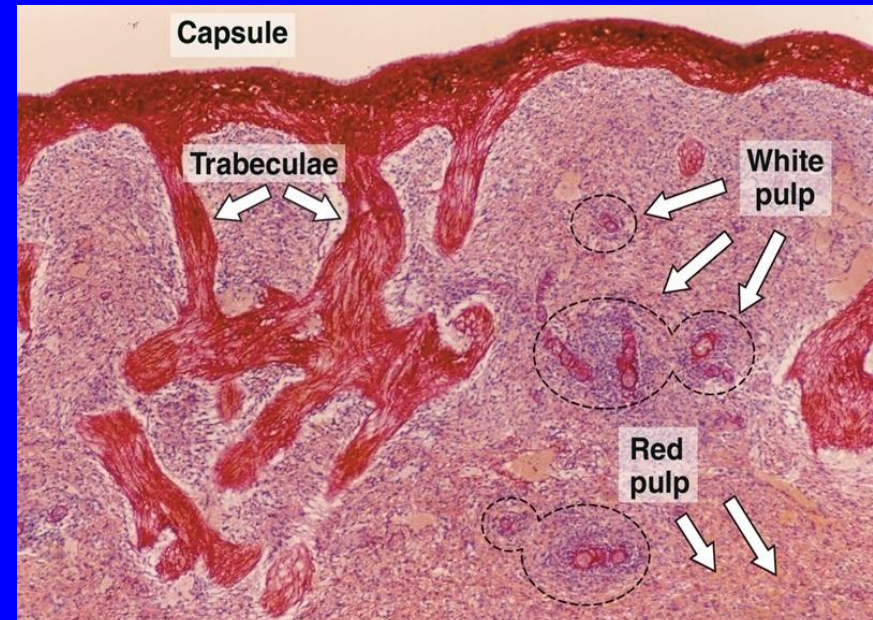
**(A) White pulp.**

**(B) Red pulp.**

N.B. No cortex,

No medulla,

No afferent lymphatic vessel.

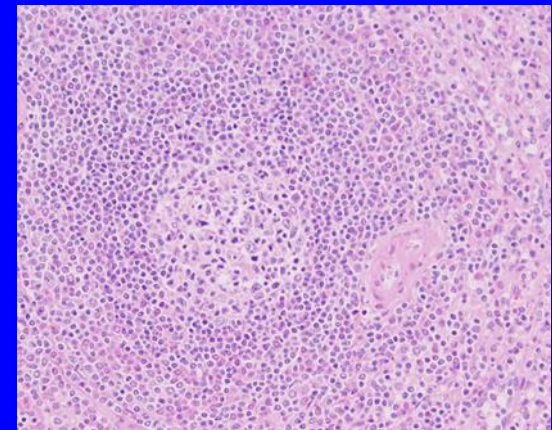
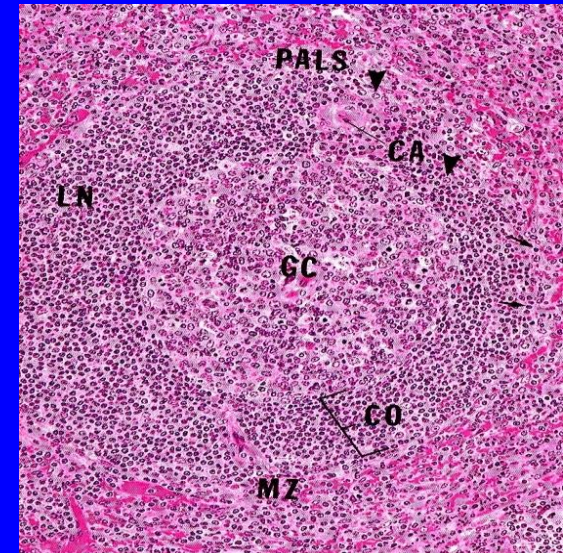


# Parenchyma of Spleen

## White Pulp:

- 1- Periarterial lymphatic sheaths (PALS): housing T lymphocytes.
- 2- Lymphoid follicles (with germinal centers): housing B lymphocytes.

N.B. Both 1&2 have the acentrically located central artery (central arteriole) (follicular arteriole).



# Parenchyma of Spleen

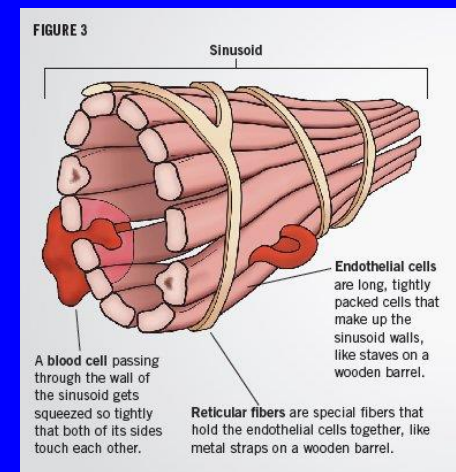
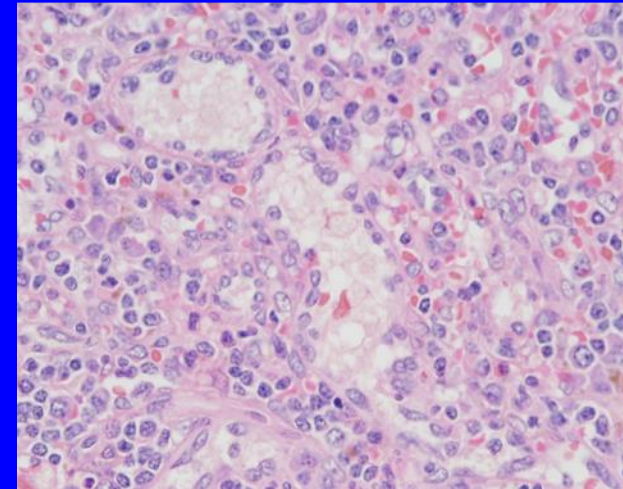
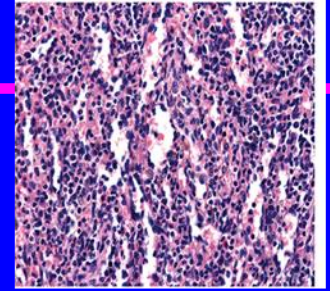
## (B) Red pulp:

### 1- Splenic (pulp) cords:

Extravasated blood cells, lymphocytes, plasma cells, macrophages & reticular cells and fibers.

### 2- Splenic blood sinusoids:

Are lined with elongated fusiform endothelial cells with large intercellular spaces & supported by discontinuous, circular basement membrane.

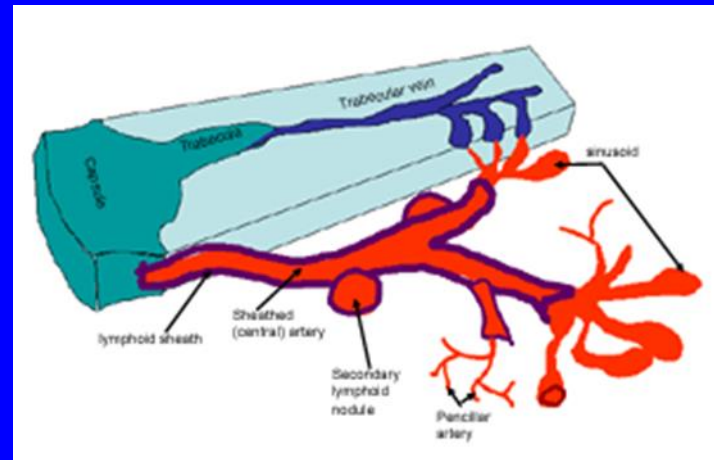
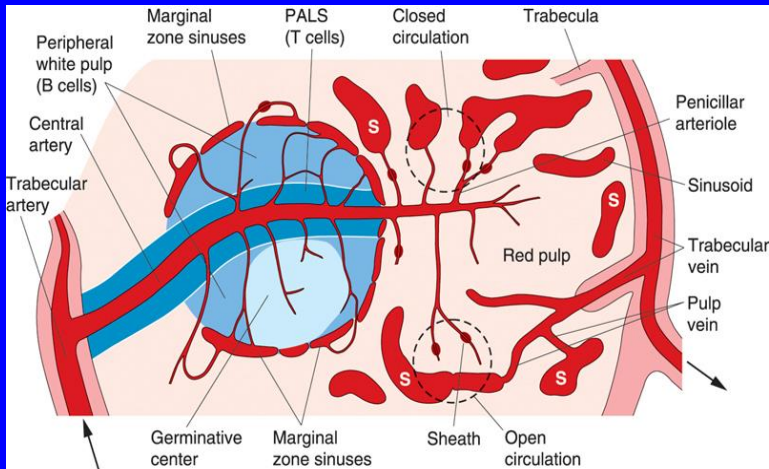


# Cells of parenchyma of spleen

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1. Lymphocytes.
2. Plasma cells.
3. Macrophages.
4. Blood elements (RBCs, leucocytes and blood platelets).

# Splenic Microcirculation



# Functions of Spleen

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- 1- Filtration of blood.
- 2- Phagocytosis of old RBCs & old blood platelets & invading microorganisms.
- 3- Production & proliferation of immunocompetent B & T lymphocytes.
- 4- Production of antibodies.

# Clinical Applications

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## Rupture of the Spleen

- Spleen is a fragile or friable organ, so major trauma to the upper left abdominal quadrant usually leads to rupture of the spleen.

Surgical removal of that ruptured spleen is essential.



**GOOD LUCK**