



Lecture 4 :

Lymphoid Tissue



King saud university
Histology team med438



- **Colour index :**
Red : important
Grey : doctors notes

Objectives :

Describe the microscopic structure of the following organs in correlation with their functions:

1- Lymph nodes.

2- Spleen.

3- Tonsils.

4- Thymus.

LYMPHOID TISSUE

*lymphoid tissue = leucocytes + lymphocytes

Diffuse: * (mucosa associated lymphoid tissue)

Encapsulated

*has capsule

Lymph nodes

Spleen

Tonsils (Are incompletely encapsulated)

Thymus

EXTRA

Primary lymphoid organs: organs where lymphocytes are formed and matured

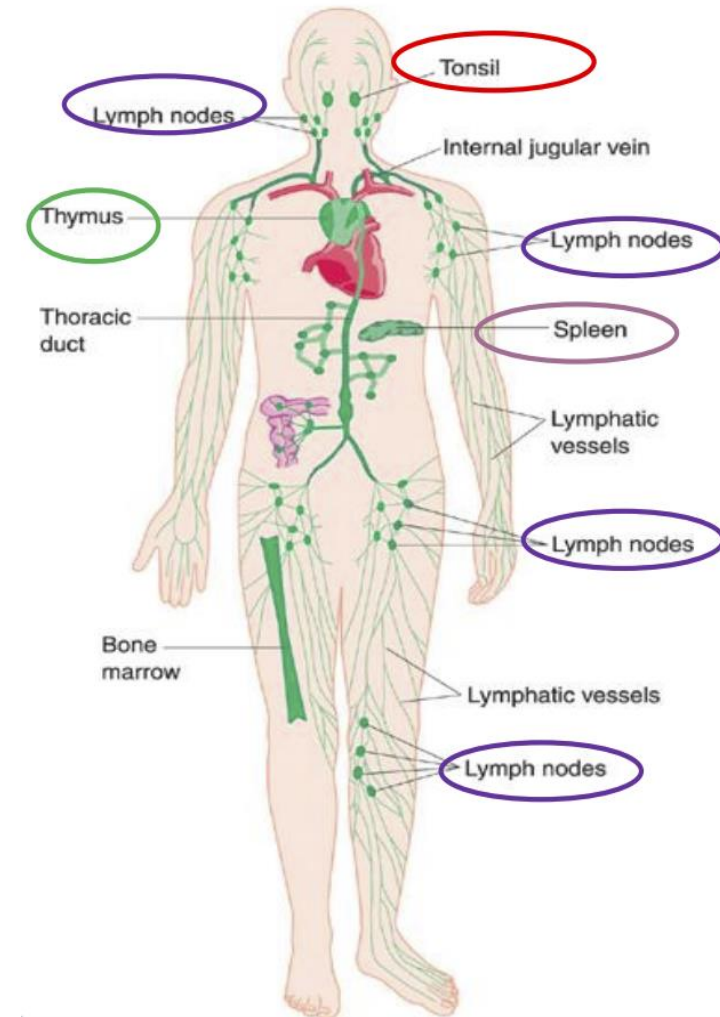
Example: red bone marrow and thymus

Secondary lymphoid organs: other lymphoid organs:

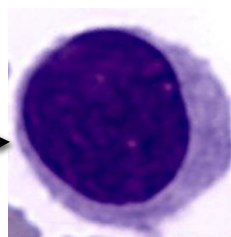
Example: lymph node, spleen, tonsils, MALTs, Peyer's patches

*mucous membrane: It consists of epithelial + connective tissue, It is located in wet area for example: inside the mouth or nose

*the lymphatic system consists of lymphatic organs and lymphatic vessels

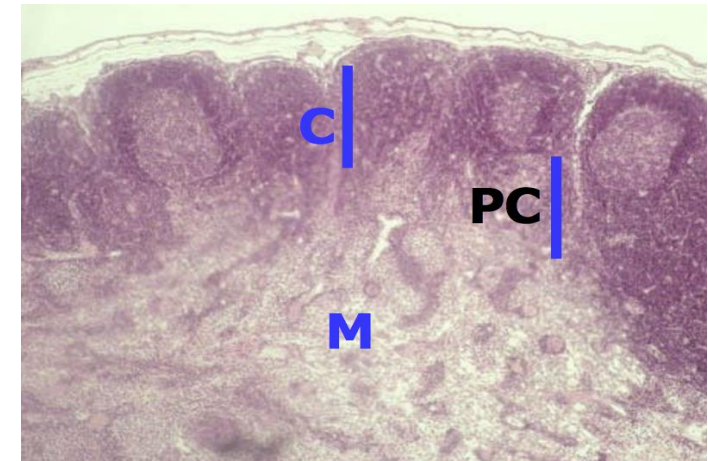


Lymphocyte

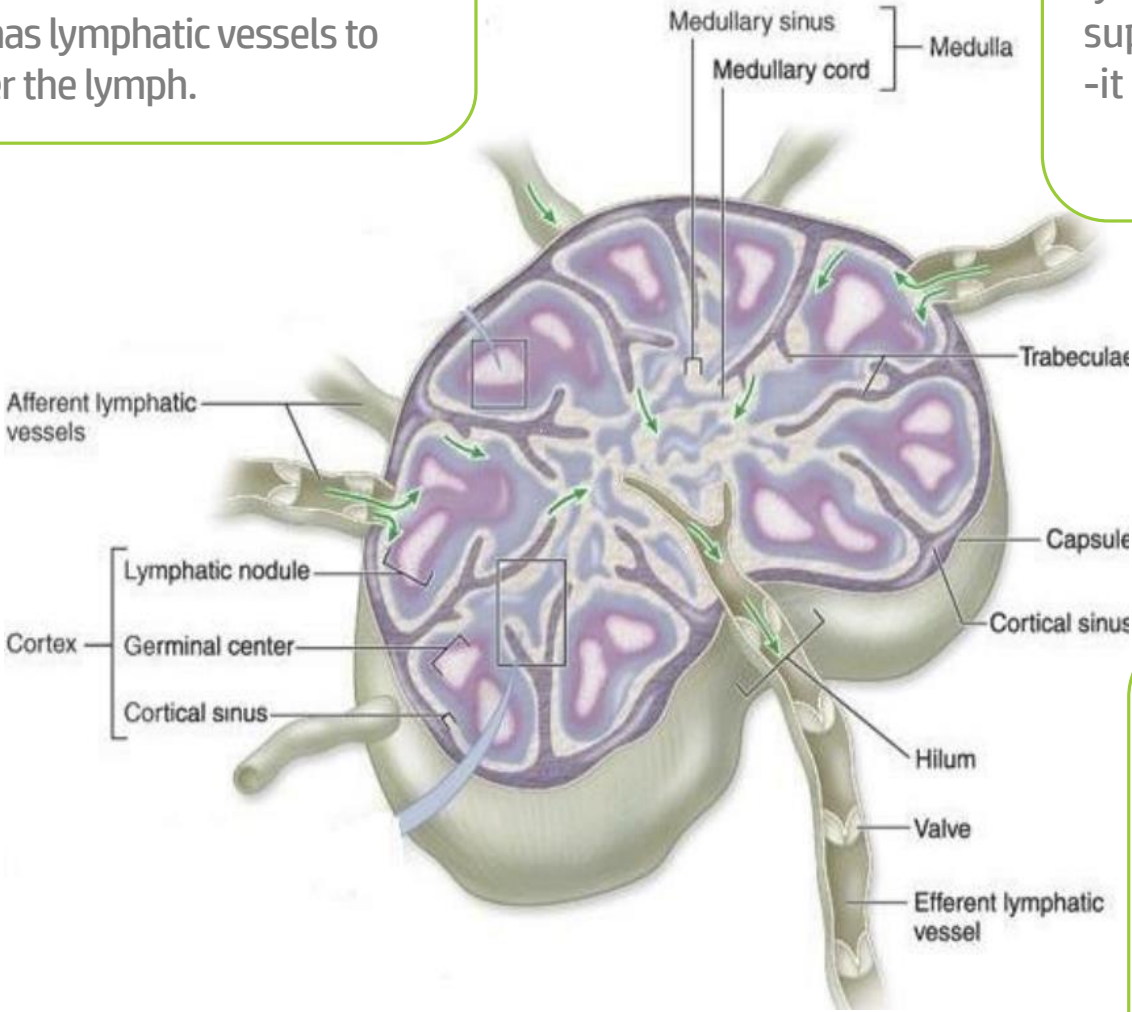


Lymph Nodes :

- ❖ Ovoid , kidney shaped organs.
- ❖ Each node has:
 - 1- A **convex surface** which receives **afferent lymph vessels**. *a = Arrive
 - 2- A **hilum** where **efferent lymph vessels** leave and drain lymph from the node. *e = Exit
- ❖ 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**.
- ❖ Each lymph node is divided into three regions:
 - 1- Cortex
 - 2- Paracortex
 - 3- Medulla

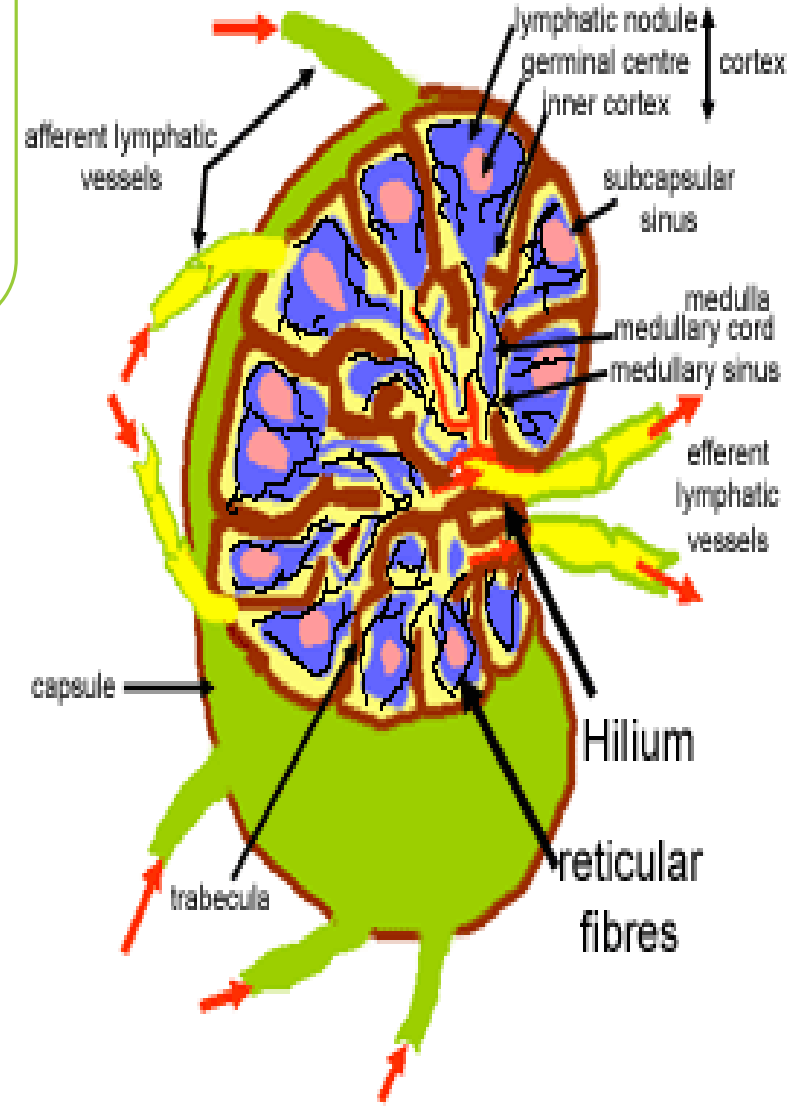


*-The capsule is dense ,
irregular collagenous
connective tissue
-it has lymphatic vessels to
filter the lymph.



*Afferent lymphatic vessels:
-carry the lymph towards the
lymph nodes to be poured in
supcapsular sinus.
-it has more than one vessel.

*Efferent lymphatic
vessel:
-carry cleaned ,
filtered lymph.
-it has one vessel
to give enough
time for filtration
the lymph.



LYMPH NODES

*The type of collagen is very important

(A) Stroma

*supportive tissue

Capsule

*type 1 collagen

Trabeculae (septa)

Reticular C.T

*extension of trabeculae
type 3 collagen

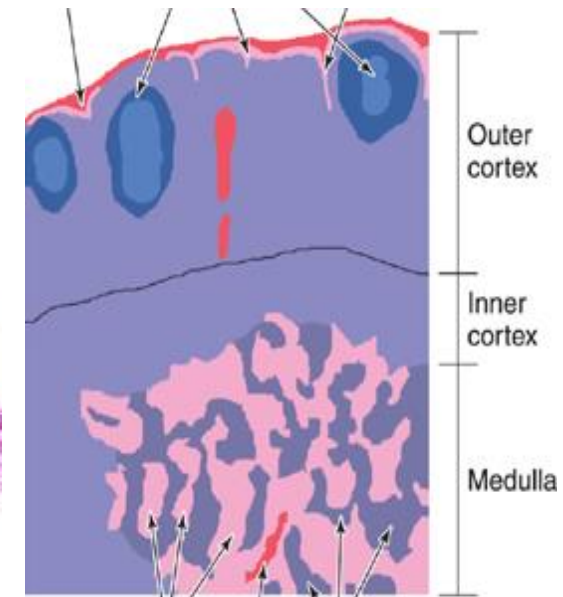
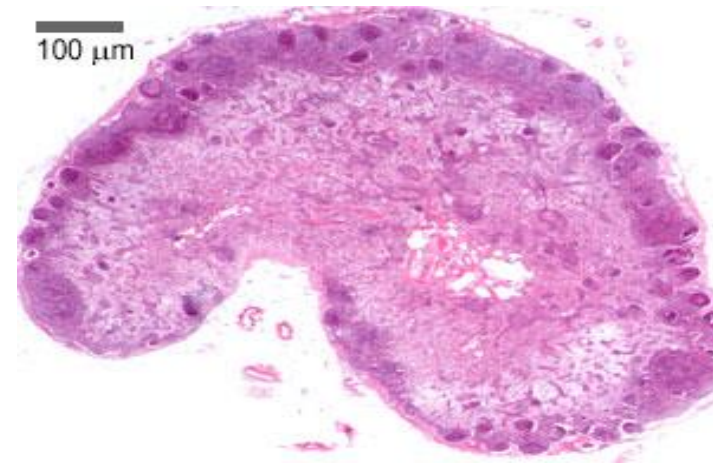
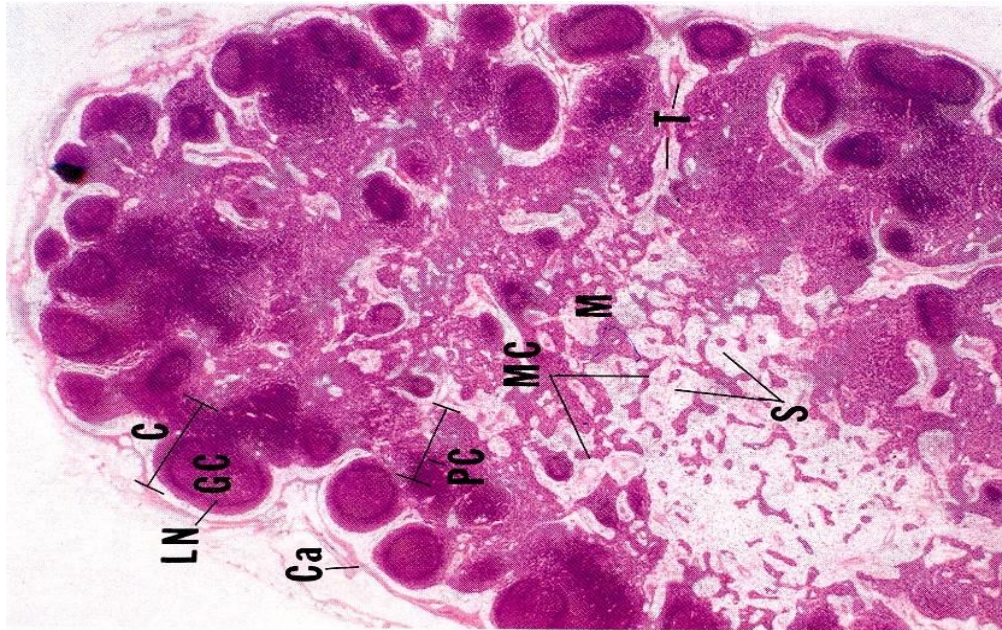
(B) Parenchyma

*(lymphoid tissue + lymph sinuses)

Cortex

Paracortex

Medulla



Lymph nodes :

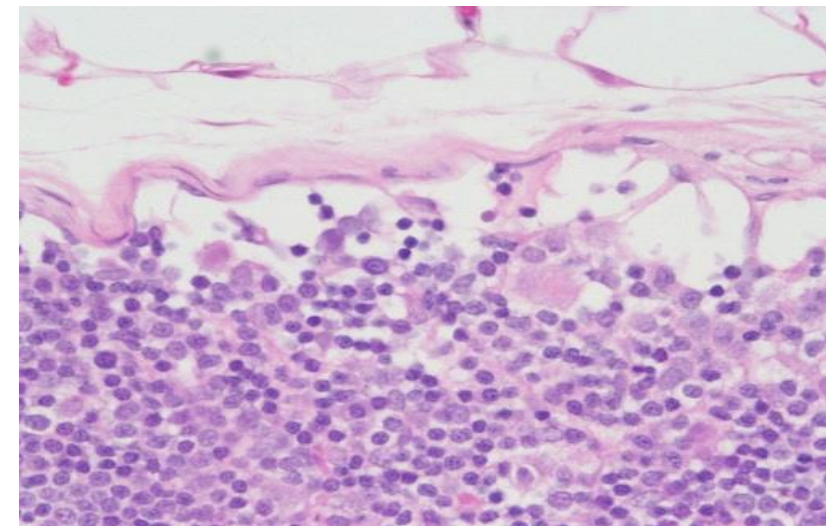
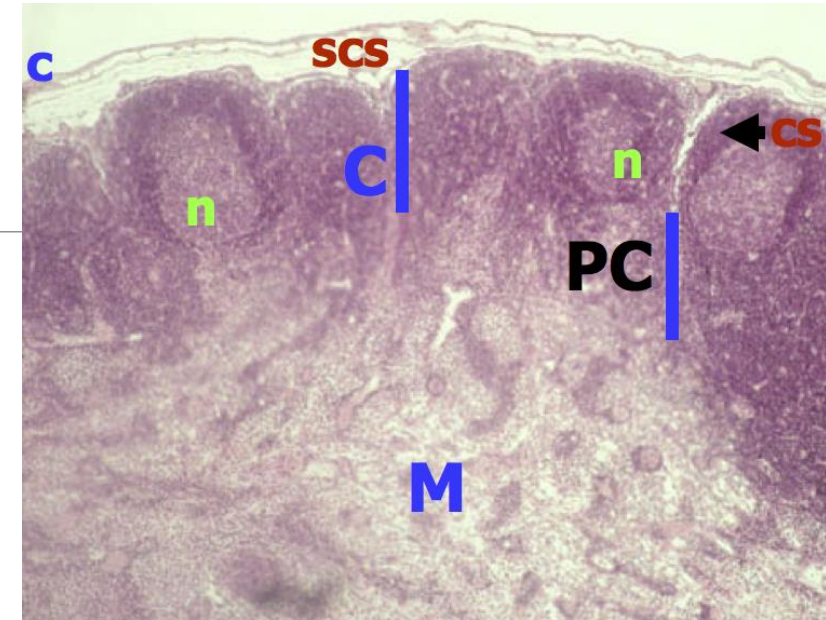
□ Cortex

Contains the :

- 1- Subcapsular lymphatic sinus.
- 2- Cortical sinuses.
- 3- Lymphoid nodules (primary & secondary):
Composed mainly of **B lymphocytes** , **macrophages** and **reticular cells**.

*All the lymphatic organs are rich in macrophage because it is immune organ.

*The macrophage move along the lymphatic to clean it.



□ Cortex

Lymph Nodules (Follicles): * B cells is the main type of cells

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

Lymph nodules may be:

(A) **Primary nodules**: formed of virgin B lymphocytes.* with out germinal center

(B) **Secondary nodules**: with paler germinal centers and it Contain:

- **Germinal centers** , central light areas filled with activated B lymphocytes

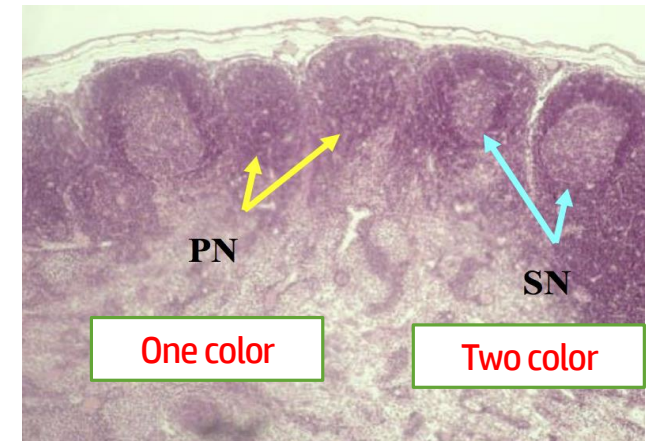
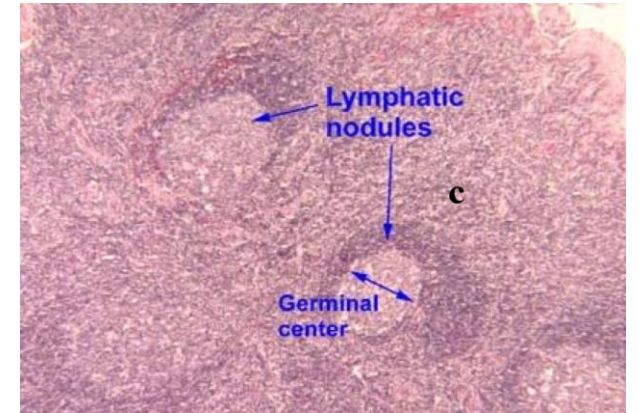
(B lymphoblast) , plasma cells and macrophages.

- The germinal center is surrounded by a darker-staining region called the **corona**.

*lymph nodule exist only on the cortex part of lymph node

*primary nodules before infection

*Secondary nodules after infection

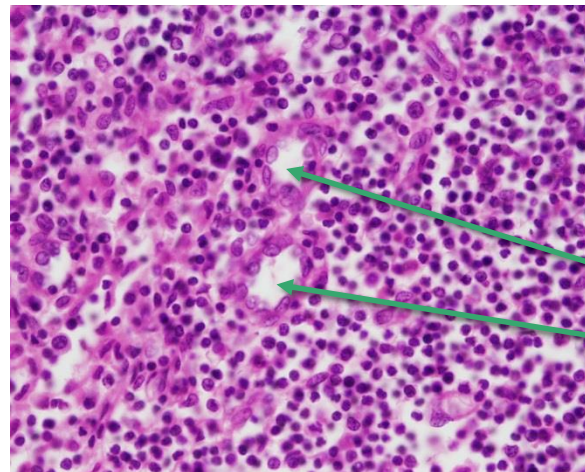


□ Paracortex

- 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**.

* T lymphocytes came from bone marrow and then activate in the thymus

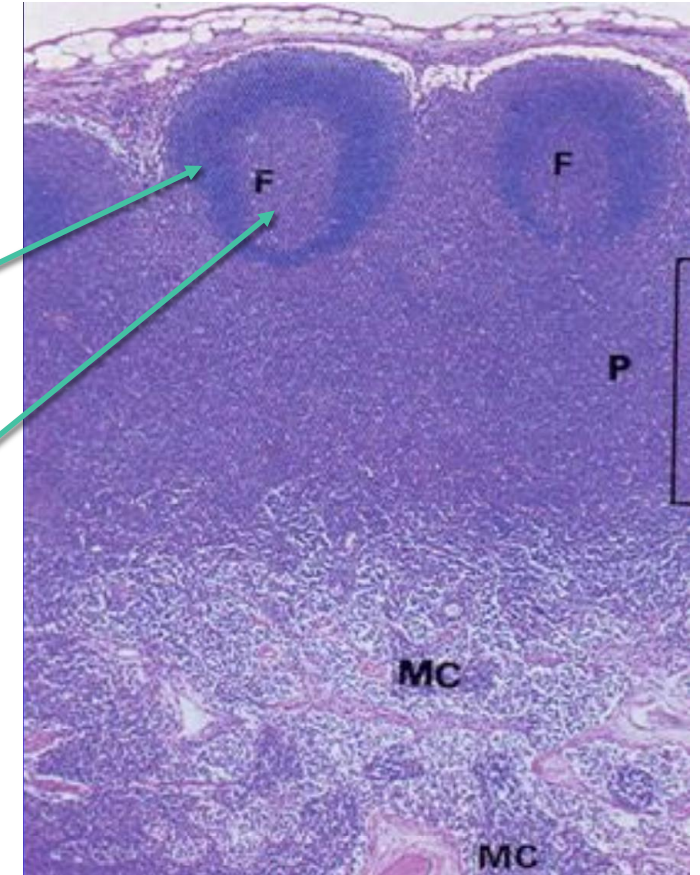
* B lymphocytes came and activate in bone marrow



Many small
condense cell
"inactive"

Few large lighter cell
"active form of the
immune cells"

Blood vessels



□ Medulla

Consists of:

1- Medullary cords.

Which composed of:

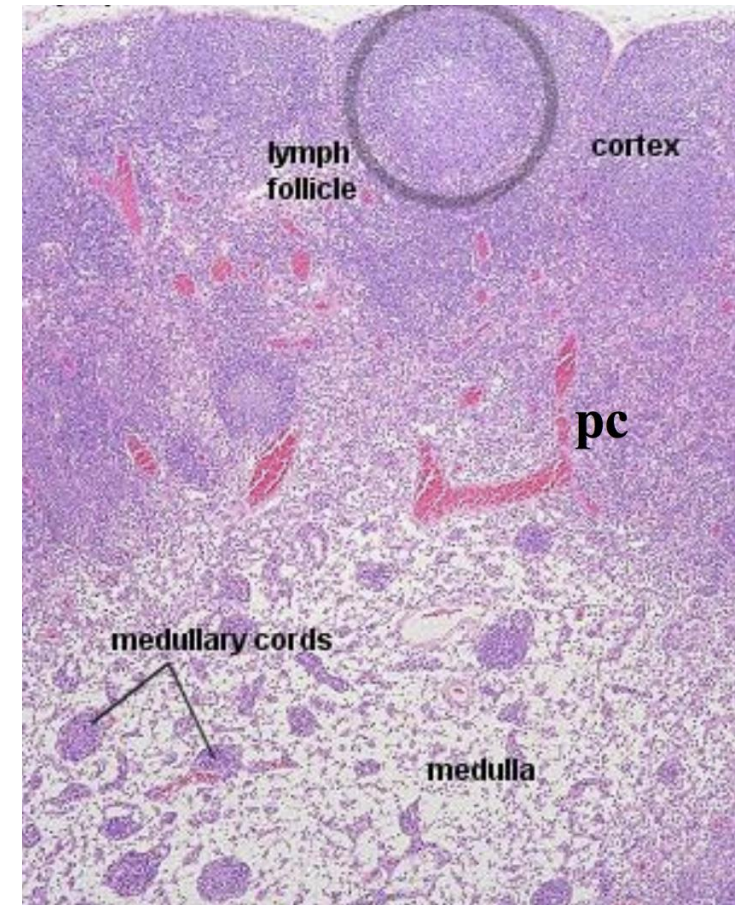
B & T lymphocytes , plasma cells and macrophages.

2- Medullary lymph sinuses.

Which continuous with:

the subcapsular and cortical lymph sinuses.

*The main type of cells is T cells



Lymph Flow Through The Lymph Node

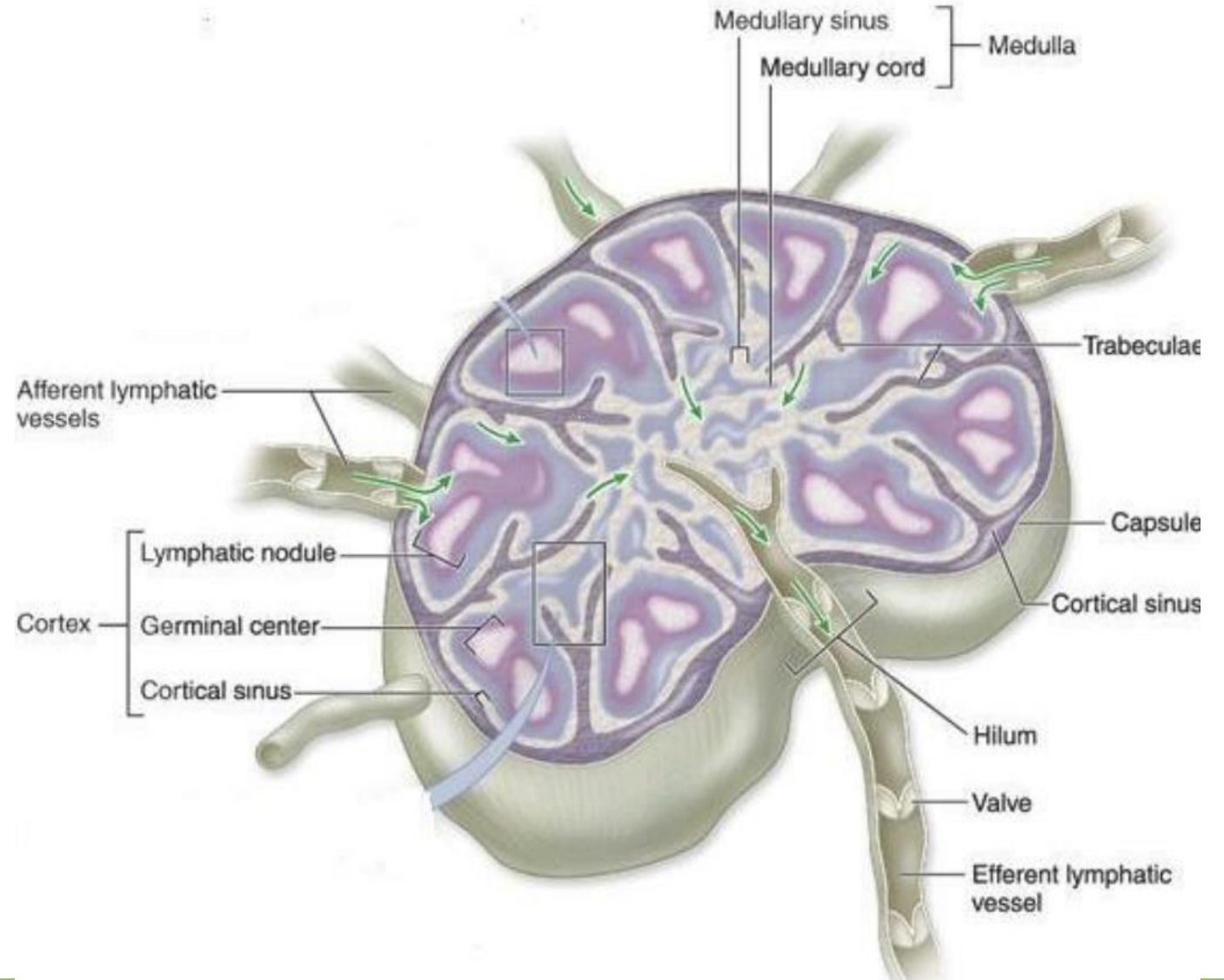
Afferent lymph vessels

Subcapsular sinuses

Cortical sinuses

Medullary sinuses

Efferent lymphatic vessels



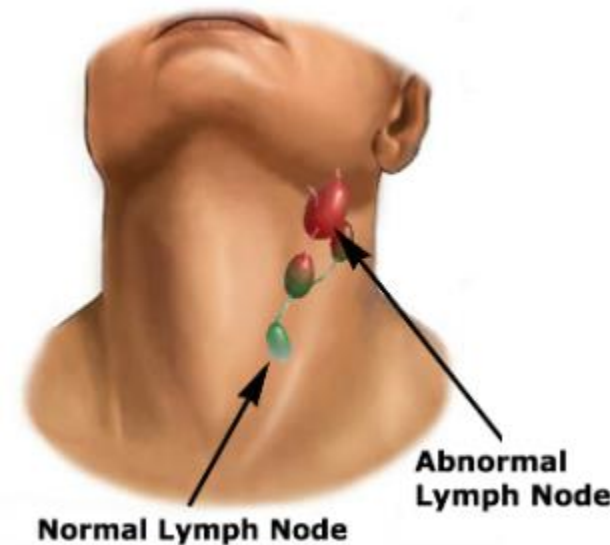
Function of lymph node:

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

○ Clinical applications: (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.

*in normal condition , not palpable



Thymus

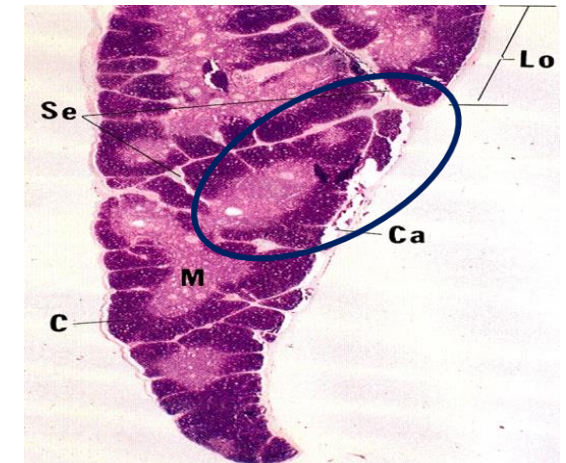
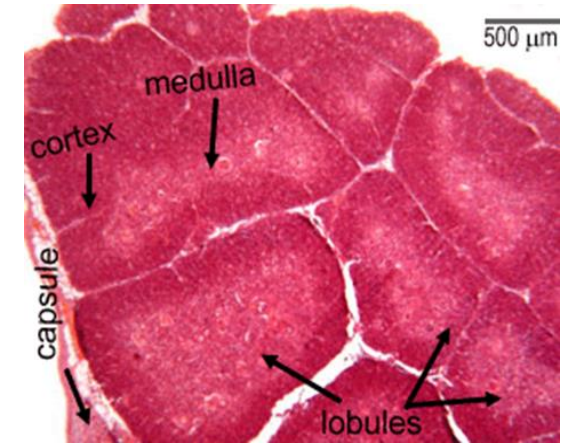
A) Stroma :

- 1- Capsule
- 2- Interlobular trabeculae: **incomplete**

B) Thymic Lobule :

- 1- Cortex
- 2- Medulla

- *Thymus is composed of 2 lobes divided into incomplete lobules
- *It is located between sternum and heart , it's a capsulated organ
- *White areas in the pic represent connective tissues
- *Each lobule consists of medulla and cortex surrounded by an outer capsule



Thymus

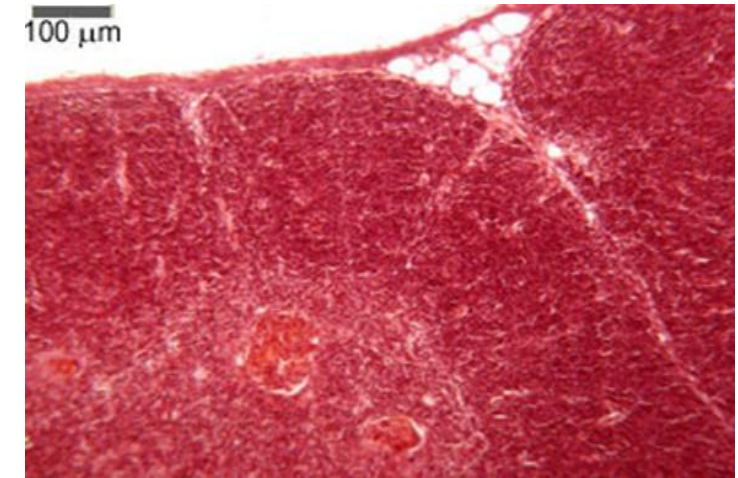
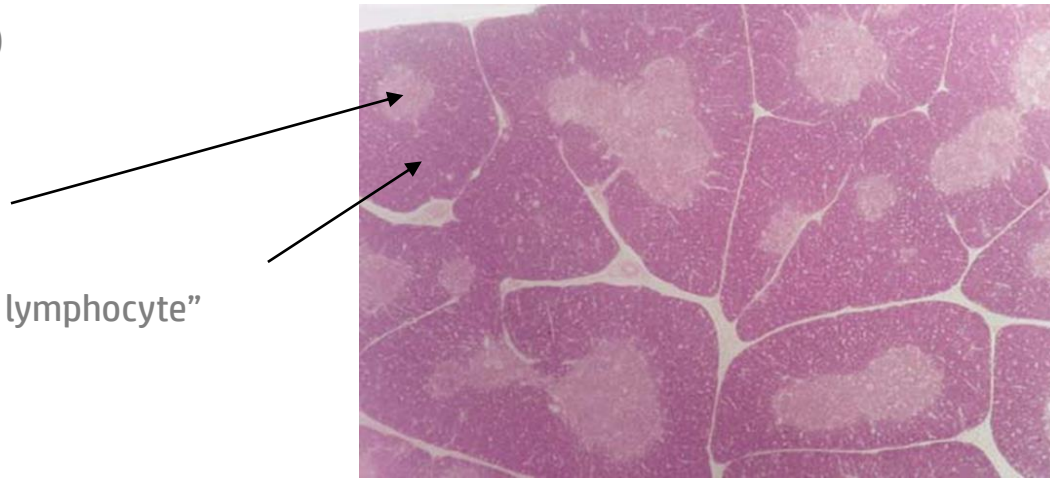
- ❖ Bilobed lymphoid organ located in thorax.
- ❖ Enclosed in a thin connective tissue **capsule**.
- ❖ **Septa (trabeculae)** from the capsule into the organ , subdividing it into incomplete lobules.
- ❖ Possesses **no lymph nodules , no lymph sinuses , no reticular fibers**.

*No B cells

*No plasma cells (antibodies)

*Medulla is the pale area

*Cortex is the dark area “rich in T lymphocyte”



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

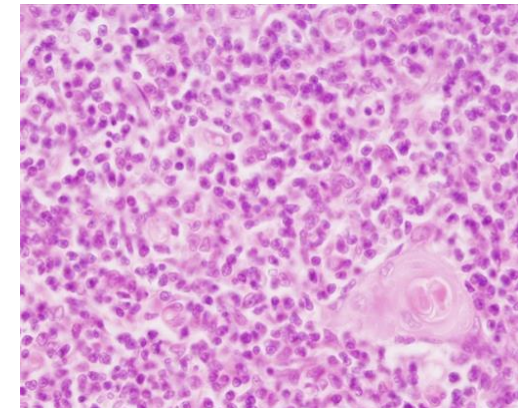
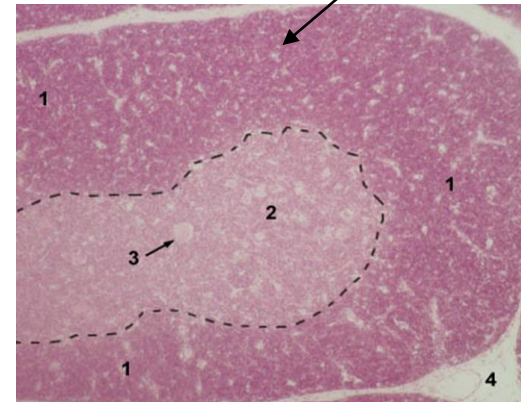
*All lymphatic tissues have macrophages

*epithelial reticular cells only found in thymus

From 437:

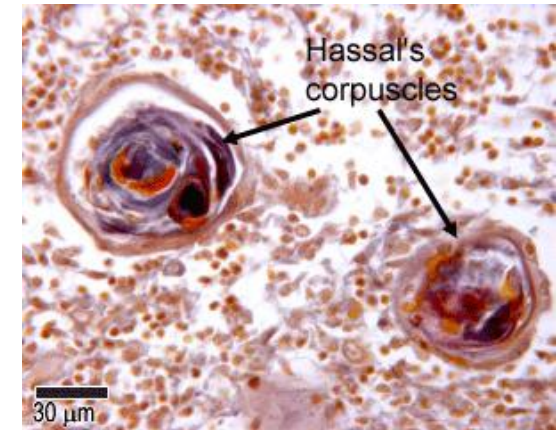
- *Inactive T cell will be in cortex of thymus than it will be engulf by macrophages.
- *Active T cell will be in medulla of the thymus.
- *Epithelial reticular cells are special component only for thymus.
- *Epithelial reticular cells responsible for maturation of T cell.

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



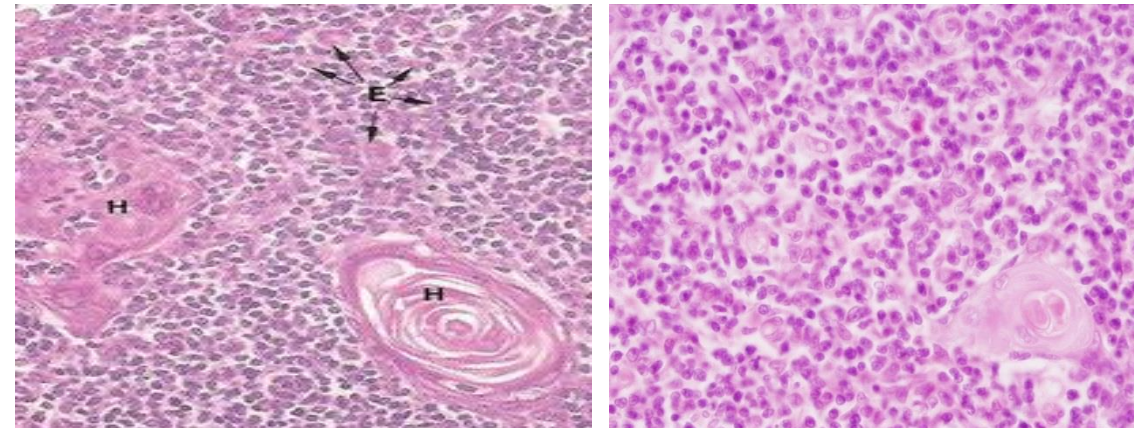
Hassall's Corpuscles

- 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.



*Hassall's corpuscles are degenerated group of epithelial reticular cell.

*Their function differ when located in cortex.



Function Of Thymus:

1- Maturation of T lymphocytes (produce immunocompetant T lymphocytes).

2- It involutes after puberty and becomes infiltrated by adipose tissue.

3- Remnants of thymus remain in adult to form T lymphocytes.

4- No B lymphocytes , no plasma cells in the thymus.

*Maturation of T lymphocyte happens in the cortex because the epithelial reticular cells of the cortex have the ability to secrete factors essential for the maturation of immature T lymphocyte.

*Mature = immunocompetent

*Immature= immunoincompetant

Tonsils

The tonsils contains:(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 **non keratinized epithelium** that dips into 10-12 **crypts**.
- The **parenchyma** is composed of lymphoid nodules with germinal centers.

*Pharyngeal and lingual tonsils have the same structure , but different sizes

*Palatine and lingual are stratified squamous

*Pharyngeal is pseudostratified squamous



Spleen

- Stroma of Spleen:

1-Capsule:

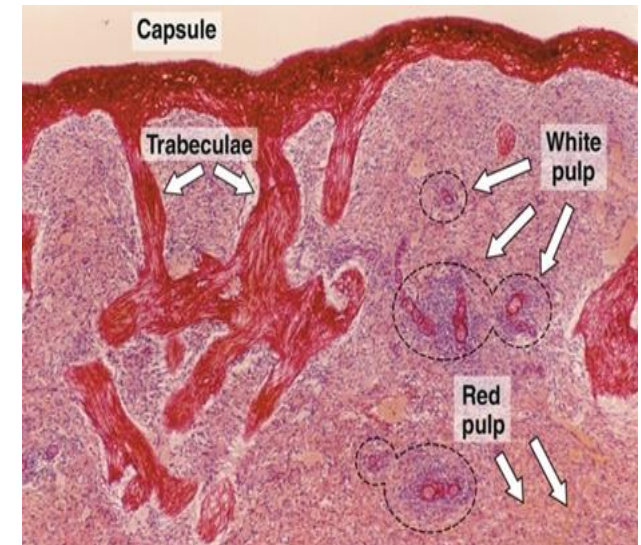
- is covered by visceral layer of peritoneum; mesothelium.
- Is formed of fibromuscular C.T:
- Dense fibrous C.T + smooth muscle cells.

*The capsule takes the dark red coloration because of the presence of the muscles.

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

3-Reticular C.T

From 437: Reticular connective tissue located in lymph nodes , bone marrow , spleen and liver.



Spleen

- Parenchyma Of Spleen :

A) White pulp.

B) Red pulp.

N.B: 1- No cortex 2- No medulla 3- No afferent lymphatic vessel.

*Afferent lymphatic vessel is only found in the lymphatic nodes.

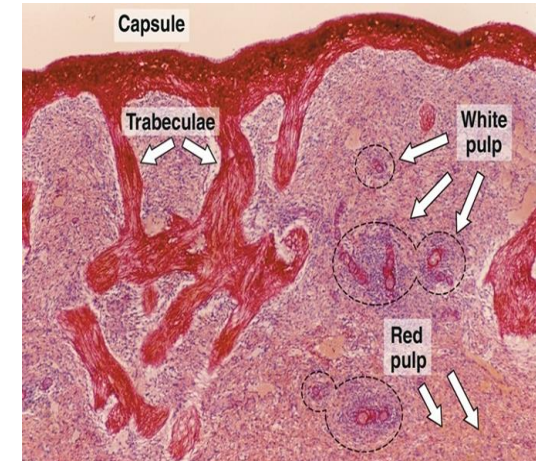
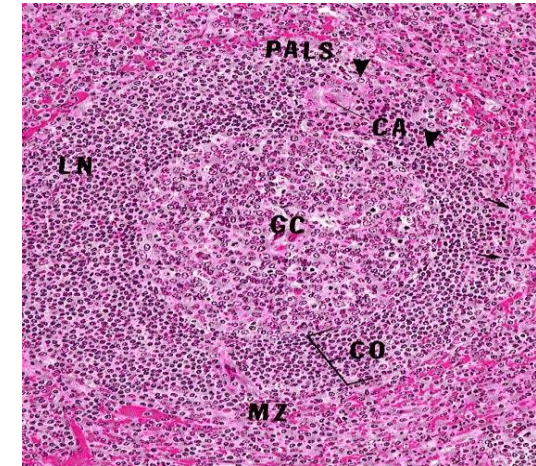
*The rest of organs have efferent lymphatic vessel.

A) White Pulp:

1-**Periarterial lymphatic sheaths (PALS):** housing T lymphocytes. *First layer of the arteriole

2-**Lymphoid follicles** (with germinal centers): housing B lymphocytes.

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



Spleen

- Parenchyma Of Spleen :

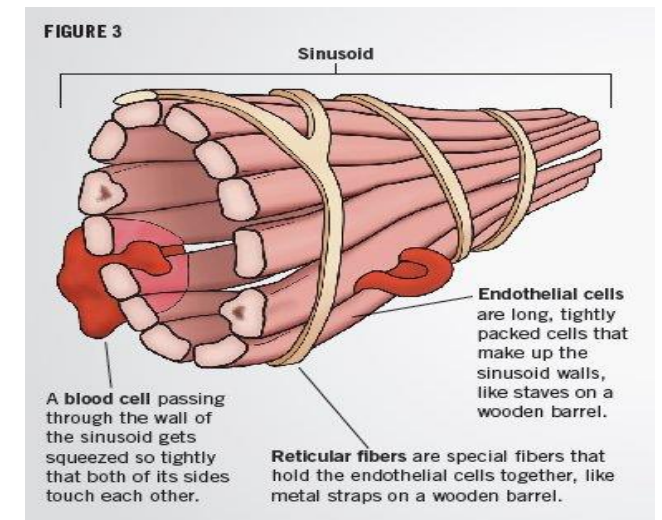
B) Red pulp:

1-Splenic (pulp) cords:

Extravasated blood cells , 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.

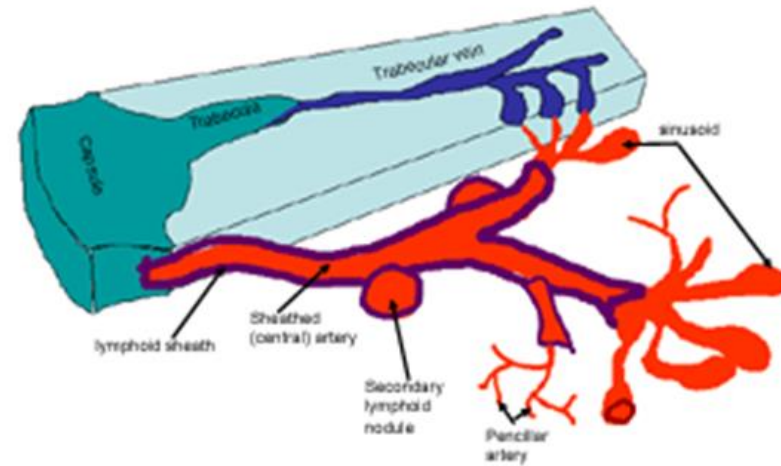
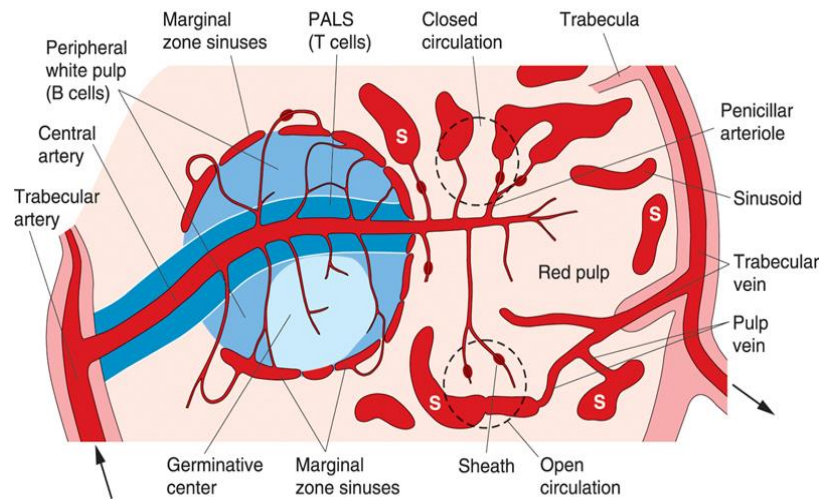


Cells Of Parenchyma Of Spleen:

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

Splenic *Microcirculation

*Means : Circulation of the blood in the smallest blood vessels



Function Of Spleen :

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

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.

*In case of spleen damage , liver takes over in blood filtration

*spleen can easily damaged

To understand the Lymphatic System more , see these videos :

<https://www.youtube.com/watch?v=kjLwVqxwalM&feature=share>

<https://www.youtube.com/watch?v=QD9AdNXSQe4&feature=share>

MCQs :

1-Part of the stroma?

- A) Capsule
- B) Cortex
- C) Medulla
- D) Paracortex

2-One of spleen's functions is?

- A) Maturation of T lymphocytes
- B) Filtration of the lymph fluid
- C) Filtration of blood
- D) Production of antigens

3-Which one of these is not found in the spleen?

- A) White pulp
- B) Capsule
- C) Afferent lymphatic vessel
- D) Trabeculae

4-The presence of _____ leads to enlarged lymph node?

- A) Red Blood Cells
- B) Antigens or Microorganisms
- C) Neutrophils
- D) Antibodies

5-Surgical removal of the spleen is essential if?

- A) It is inflamed
- B) It is attacked by microorganisms
- C) It is Ruptured
- D) All the above

6-There is No B lymphocytes , no plasma cells in?

- A) Thymus
- B) Spleen
- C) Tonsils
- D) Lymph nodes

7-red bone marrow and thymus are considered as?

- A) Primary lymphoid organs
- B) Secondary lymphoid organs
- C) Tertiary lymphoid organs
- D) Non of these

8-One of the following is NOT a secondary lymphoid organ?

- A) Spleen
- B) Lymph node
- C) Thymus
- D) Tonsils

C	A	A	C	B	C	C	A
8	7	6	5	4	3	2	1

Team members :

- **Abdullah alassaf**
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- **Faisal alqifari**

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- **Rawan alzayed**
- **Renad alkanaan**
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Noura alnasser
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