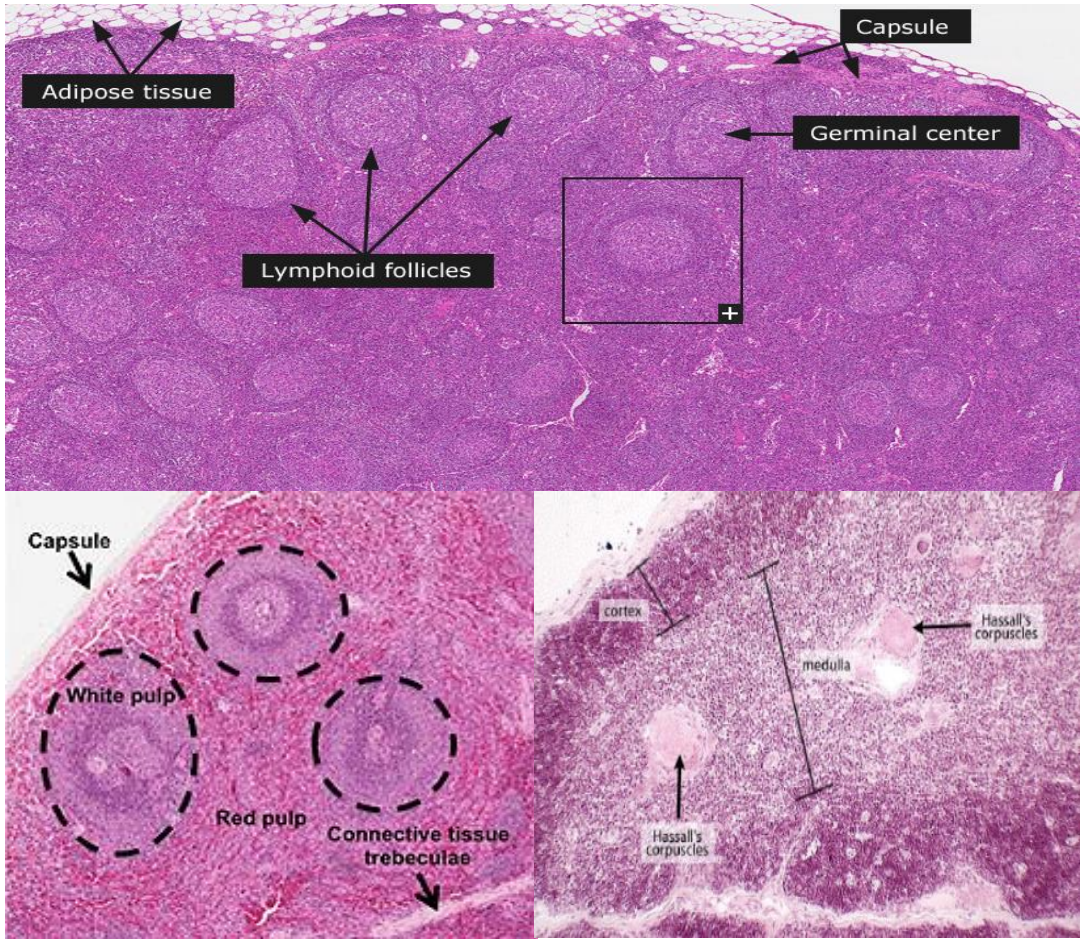
General Histology / Year 2



Lymphatic System
Lymphatic organs
Lecture 5

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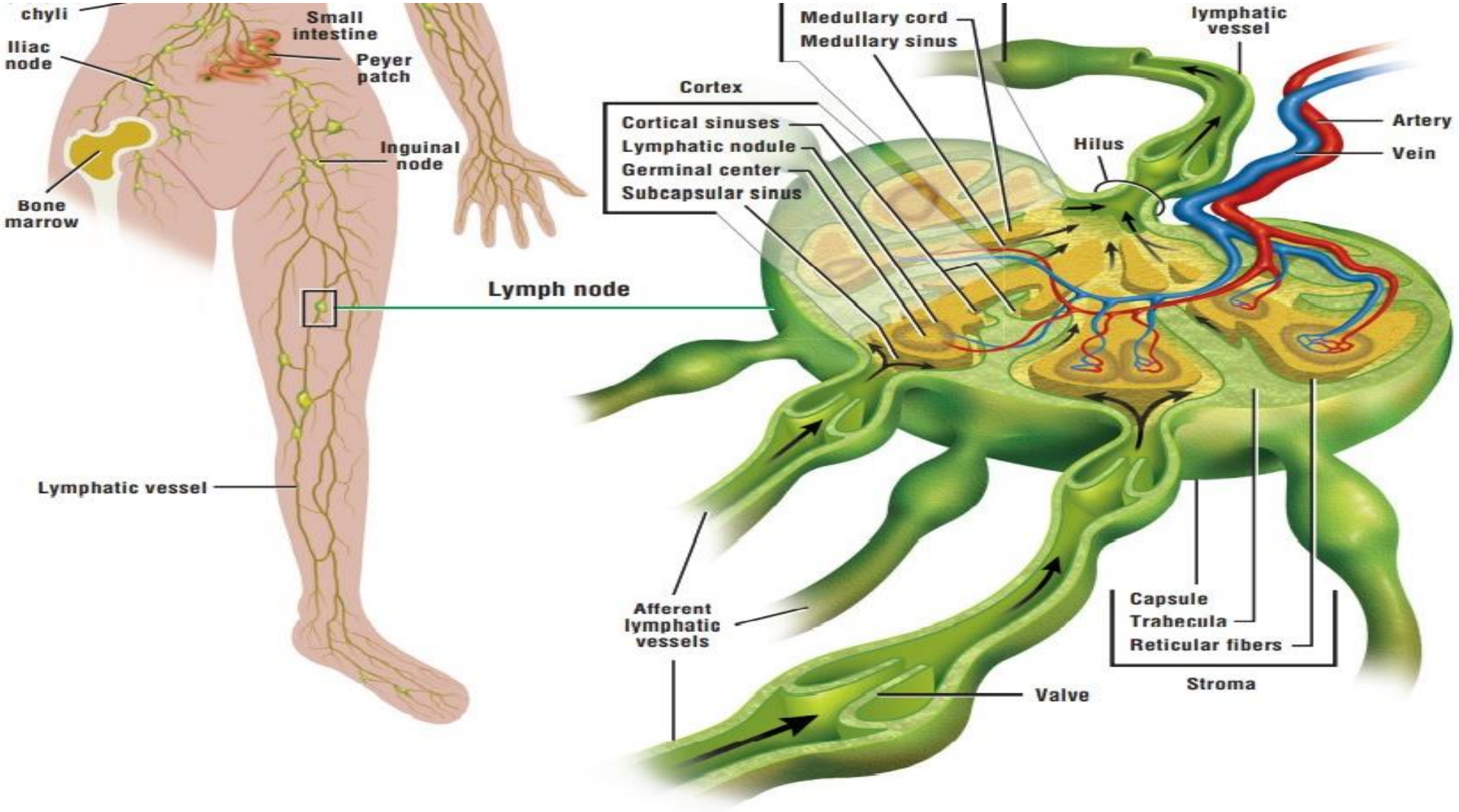
Lymph nodes

- **The lymph nodes are the oval or bean or kidney shaped bodies.**
- **They are located in the passage of lymphatic vessels.**
- **They usually occurs in groups.**
- **Afferent lymphatic vessels enters lymph into the gland.**
- **After entering the lymph gets filtered in lymph node by trapping of foreign particles & micro-organism. Lymph reaches to blood only after passing through Lymph node.**
- **Efferent lymphatic vessels carries lymph from the lymph node.**
- **The concave border of the gland is called as hilum through which arteries and nerves enter and veins and lymphatics leave the organ.**
- **The nodes are found in the axillae, groin, along the great vessels of the neck, & in large number in the thorax, abdomen, & mesenteries.**


chyli
Small intestine
Iliac node
Peyer patch
Inguinal node
Bone marrow
Lymph node
Lymphatic vessel
Medullary cord
Medullary sinus
lymphatic vessel
Cortex
Cortical sinuses
Lymphatic nodule
Germinal center
Subcapsular sinus
Hilus
Artery
Vein
Afferent lymphatic vessels
Capsule
Trabecula
Reticular fibers
Stroma
Valve

FUNCTIONS

- **1. Filtration, macrophages in the nodes remove / destroy microorganisms and debris preventing its delivery to the blood.**
- **2. Immune system activation, lymphocytes in the nodes monitor lymph for antigens and mount an attack against them.**
- **3. Production of new lymphocyte through germinal center.**

Histological Structure of Lymph Node

- **The lymph node is surrounded by a pericapsular adipose tissue, that contains numerous blood vessels, an arteriole and venule.**
- **A dense connective tissue capsule surrounds the lymph node.**
- **Fibrous strands of connective tissue called trabeculae extend inward to divide the node into compartments**
- **The trabecular connective tissue also contains the major blood vessels of the lymph node.**
- **A lymph node has two histologically distinct regions: Cortex and Medulla.**

Histological Structure of Lymph Node

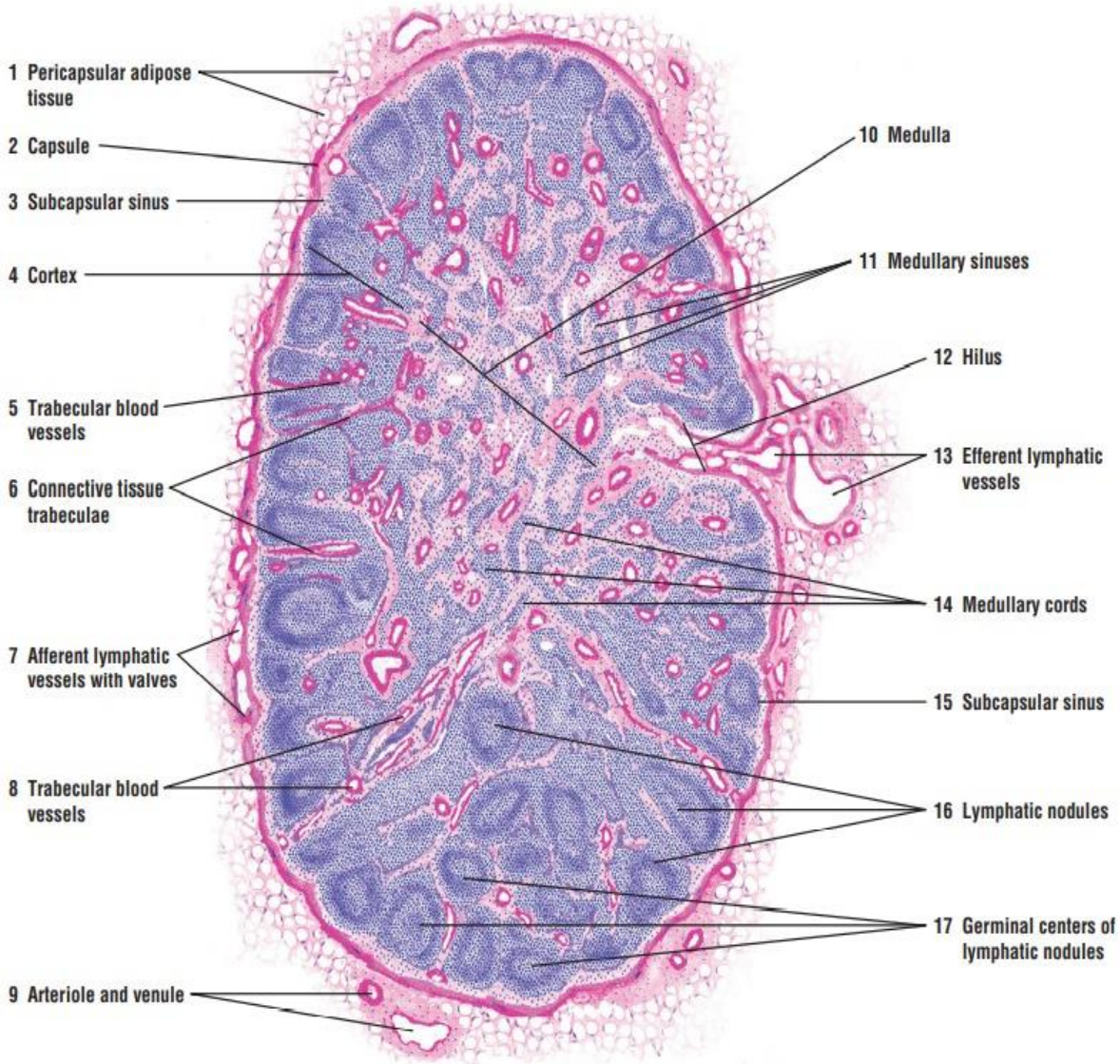
- **CORTEX:-**
- **Cortex is the darkly stained peripheral part of the lymph node, laying underneath the capsule.**
- **It is packed with lymphocytes.**
- **Plasma cells and macrophages are also present.**
- **It divided into the outer cortex and inner cortex.**
- **OUTER CORTEX:-**
- **Lies underneath the capsule.**
- **Contains mainly B lymphocytes with spherical lymphoid nodule.**
- **Some of these nodules show a light-stained zone in the central called germinal center, which is the site of B lymphocyte proliferation.**

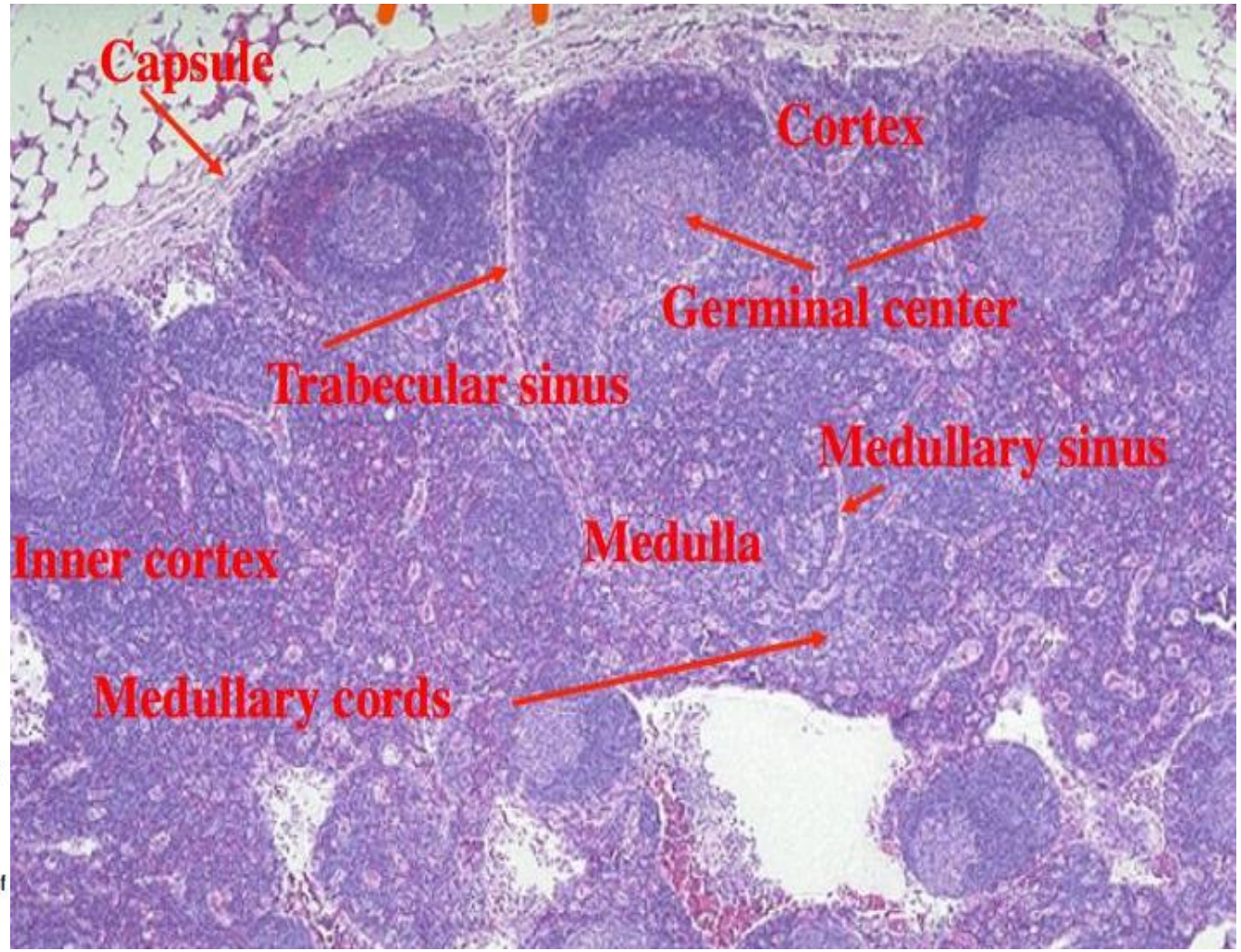
Histological Structure of Lymph Node

- **INNER CORTEX:-**
- **Lies underneath the outer cortex and surround the medulla.**
- **Also known as paracortex.**
- **It has mainly T lymphocytes; hence, it is also called thymus-dependent cortex.**
- **No lymphoid nodule is seen.**
- **MEDULLA:-**
- **Light – stained central part of the lymph node.**
- **It consists of medullary cords are extensions of the inner cortex separates by medullary sinuses.**

Histological Structure of Lymph Node

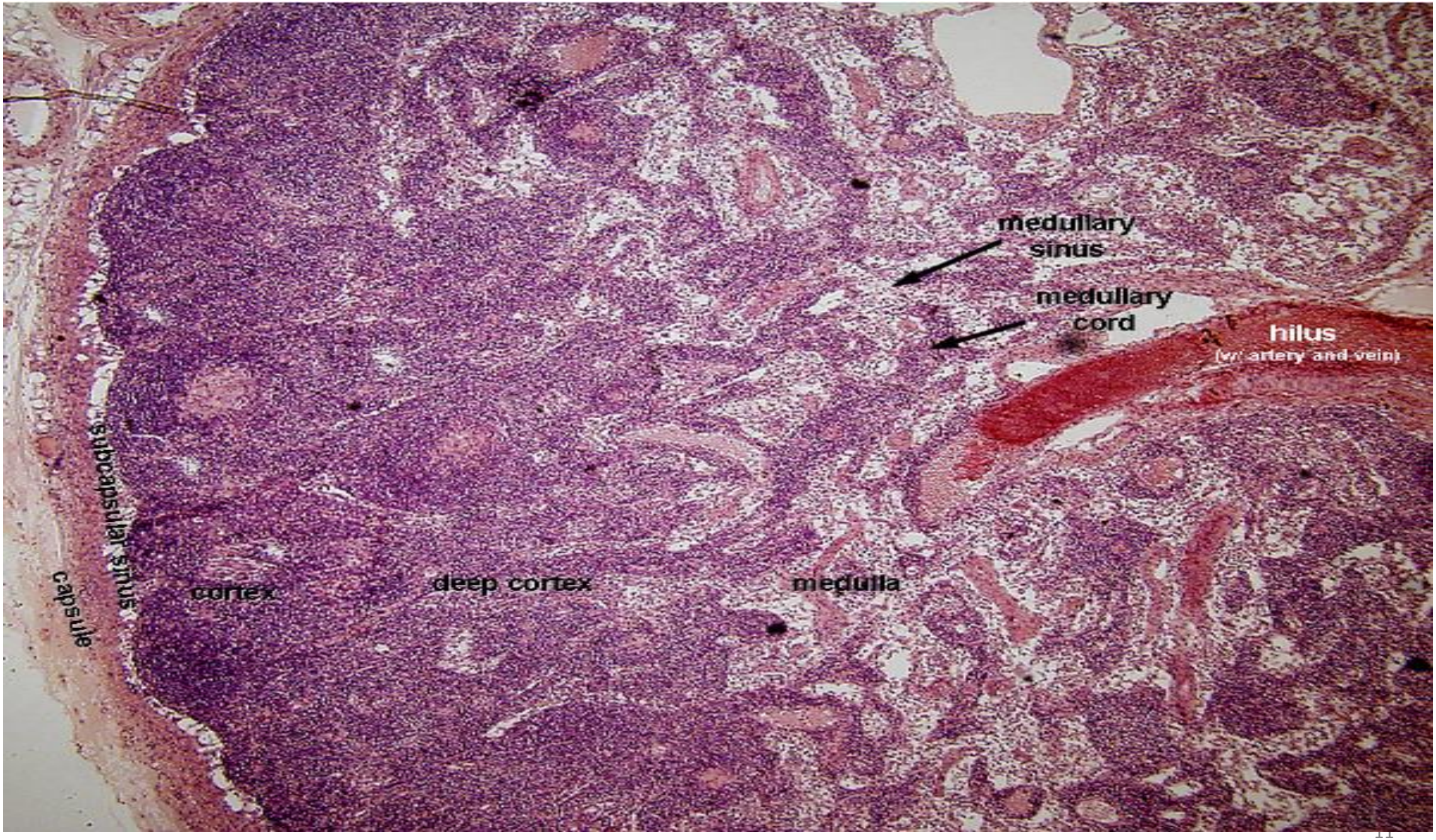
- **SINUSES:-**
- **Lymph passes through various sinuses of lymph nodes and gets filtered in them.**
- **Subcapsular sinus, present between the capsule and the outer cortex.**
- **Intermediate sinus, present on both sides of the trabecular and connects subcapsular sinus to medullary sinus.**
- **Medullary sinuses, these are anastomosing sinuses present in between the medullary cord in the medulla.**


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


Capsule
Cortex
Germinal center
Trabecular sinus
Medullary sinus
Medulla
Inner cortex
Medullary cords

Lymph Circulation in the lymph node

- **Afferent lymphatic vessels cross the capsule and pour lymph into the subcapsular sinus.**
- **From there, lymph passes through the cortical sinuses and then into the medullary sinuses.**
- **During this passage, the lymph infiltrates the cortex and the medullary cords and is filtered and modified by immune cells.**
- **The lymph is collected by efferent lymphatics at the hilum and valves in both lymphatics assure the unidirectional flow of lymph**


medullary sinus
medullary cord
hilus
(v,' artery and vein)
subcapsular sinus
capsule
cortex
deep cortex
medulla

Spleen / Functions of spleen

- **Largest lymphoid organ, located on the left side of the abdominal cavity just behind stomach and beneath the diaphragm.**
- **It is served by the splenic artery and vein, which enter and exit at the hilus**
- **FUNCTIONS:-**
- **Site of lymphocyte proliferation**
- **Immune surveillance and response**
- **Formation of blood cells in fetal life. Stores blood platelets throughout life.**
- **Cleanses the blood. The removal and destruction of aged or defective blood cells. Stores breakdown products of RBCs for later reuse.**
- **Spleen is divided into:-**
- **Red Pulp (RBC / hemoglobin recycling)**
- **White Pulp (responsible for immune functions)**

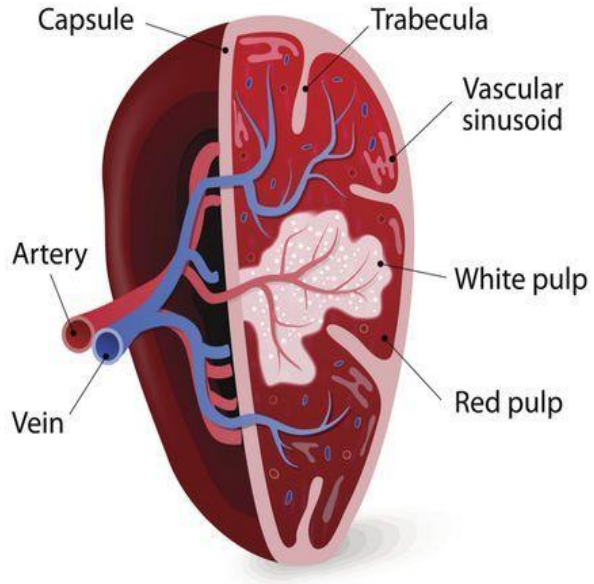
Histological structure of Spleen

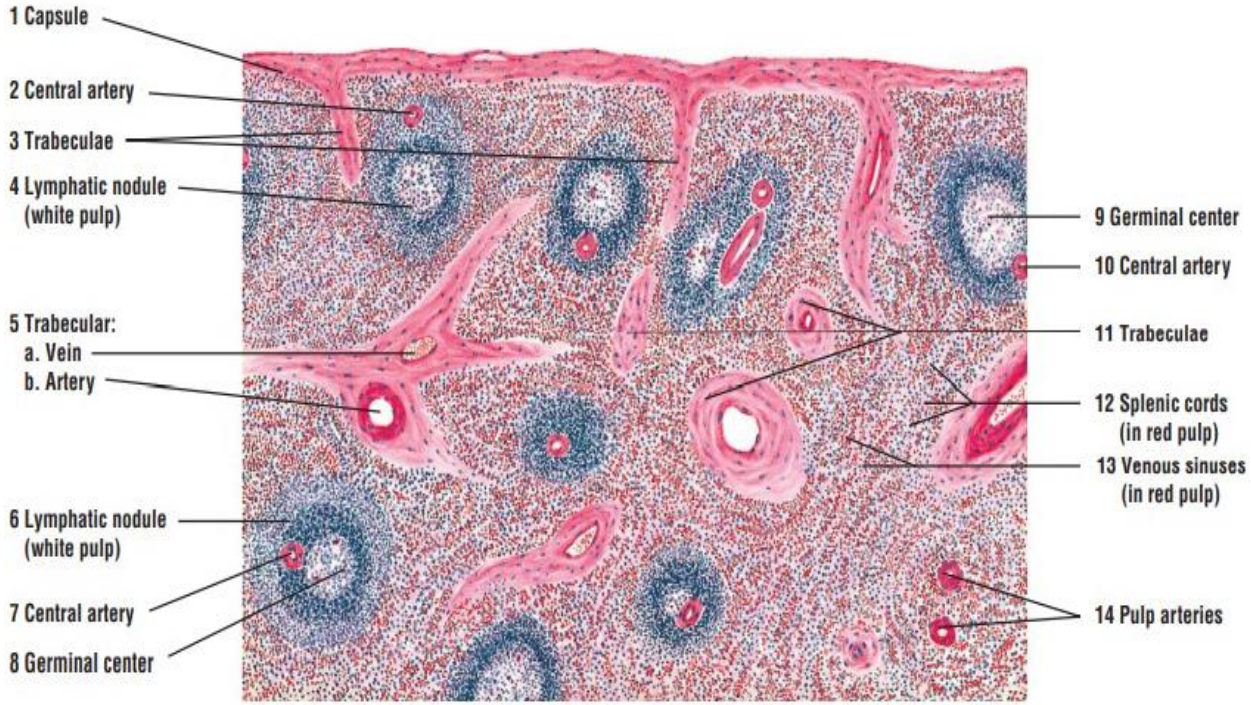
- **The spleen is surrounded by a capsule(dense irregular connective tissue contains some smooth muscle fibers) from which trabeculae extend inward.**
- **Blood vessels present in trabeculae also enter the organ along with it.**
- **Does not exhibit cortex and medulla but contains lymphatic nodules.**
- **WHITE PULP:-**
- **consists of lymphatic nodules with a germinal center around a central artery.**
- **B cells are found in the lymphatic nodules.**
- **Arteries in trabeculae give rise to arterioles. These arterioles, called central arteries.**
- **Lymphoid tissue surrounds the central arteries.**

Histological structure of Spleen

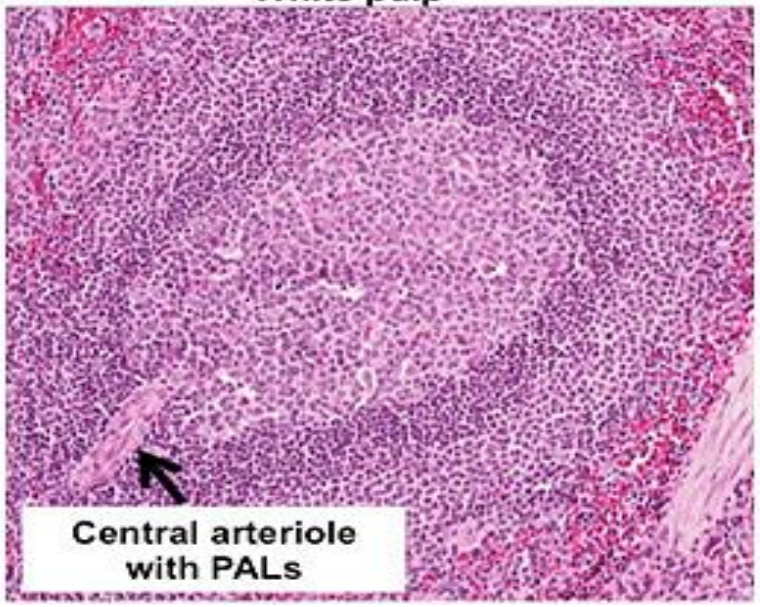
- **RED PULP:-**
- **consists of splenic cords and splenic (blood) sinusoids**
- **Red pulp cords are also called cords of billroth.**
- **Splenic cords contain macrophages, lymphocytes, plasma cells, and different blood cells**
- **They are irregular anastomosing cords surrounding the sinusoids.**
- **Sinusoids have wide lumen; the endothelial cells of sinusoids are elongated and lie parallel.**
- **MARGINAL ZONE:-**
- **forms border between red and white pulp.**
- **The marginal zone contains plasma cells, mainly B- lymphocytes, macrophages, dendritic cells and marginal blood sinuses.**
- **This area play role in (immune response and filtering the blood).**

SPLEEN ANATOMY

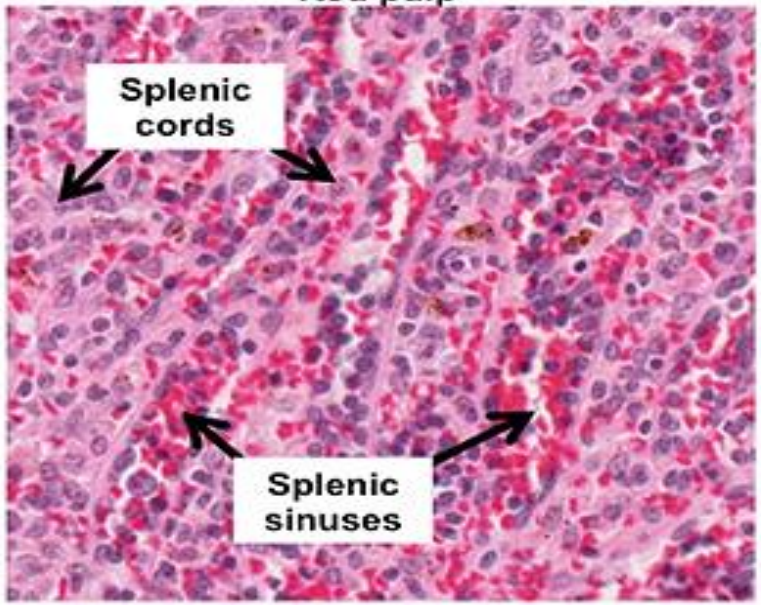


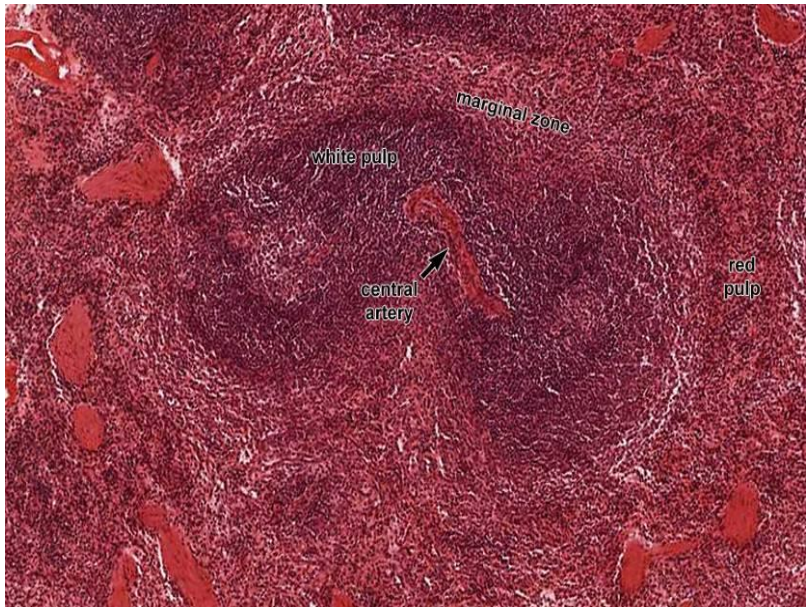


White pulp



Red pulp





Thymus / Functions of Thymus

- **Located in the upper, anterior thorax (chest), above the heart.**
- **A bilobed organ that secrets hormones (thymosin and thymopoietin) that cause T lymphocytes to become immunocompetent.**
- **T lymphocyte maturation.**
- **Is a large organ in the fetus. It increases in size and is most active during childhood. The size of the thymus differs from with age.**
- **It stops growing during adolescence and then gradually atrophies. its functional tissue is slowly replaced with fibrous and fatty tissue.**
- **However, even as it atrophies, the thymus continues to produce immunocompetent cells throughout adulthood (reduced rate)**

Histological structure of Thymus

- **Thymus has a capsule of connective tissue covering both the lobes.**
- **From the capsule, numerous septa containing blood vessels extend into the substance of the organ and divided into incomplete lobules.**
- **Each lobule consists of peripheral cortex and central medulla.**
- **Since the septa do not divide the organ completely, the central part of each lobule is continuous with the medulla of the neighboring lobules.**
- **Lacks B cells (no follicles) ·**

Histological structure of Thymus

- **CORTEX:-**
- **Peripheral dark zone.**
- **Mainly composed of densely packed T lymphocytes.**
- **A part from lymphocytes, cortex also contains epithelial reticular cells and macrophages.**
- **MEDULLA:-**
- **Medulla is the central lighter zone of each lobule.**
- **Lymphocytes in medulla are fewer while epithelial reticular cells are more in number.**
- **Prominent feature in medulla is Hassall's corpuscles, also known as thymic corpuscles.**
- **They consist of concentrically arranged epitheliocytes.**

Thymus Gland