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Zoology – II
Haematology
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Spleen

Spleen is a largest lymphoid tissue in the body. It is bean shaped organ specialized for filtering blood. Spleen is highly vascular haemopoietic organ situated in the left hypochondria beneath the diaphragm above the left kidney and descending colon.

Spleen plays important role in the metabolism and defense mechanism of the body.

Structure of the Spleen:- Spleen is a **bean shaped** organ, covered by **connective tissue capsule** which is again covered by peritoneum. The capsule deeply **indented** in the middle region and is called as **hilus or hilum** of the spleen. **Blood vessels, lymphatics and nerves pass through this hilus**. Many **trabacule** radiate into the substance of the spleen from the outer surface of the capsule.

Trabacule divide the organ into many communicating compartments **or lobules.**

Each lobule is supplied with blood vessels that run along the trabacule. Lobules **are not distinct** as they are not completely surrounded by trabacule.

The **parenchymatous tissue** of spleen is called **splenic pulp,** which is of two distinct type **a) white pulp and b) red pulp.**

White Pulp :- Seen scattered throughout the red pulp, as grey patches. It is the **accumulation of lymphatic tissue**. Surrounding the **major arterial vessel** of the spleen. Lymphatic tissue contains **Lymphocytes, plasma cells macrophages**, or other free cells lying in the mesh work of reticular fibers.

White pulp shows two distinct components

a) Peripheral lymphatic sheath
b) Splenic nodules.

a) **The arteries which leave the trabacule and enter the** parenchymatous tissue**, lose their adventitia** & is **replaced by reticular tissue** with invasion of lymphocytes, this is called **as periarterial lymphatic sheath** of white pulp.
b) In **some areas** of arterial vessels, **the infiltration of lymphocyte is greater** & it forms **spherical or ovoid nodules** of white pulp **Splenic nodules** have **germinal centers where new lymphocytes** are produced.

Red Pulp:- It is a modified lymphatic tissue made up of two components

i) Splenic sinuses or Sinusoids.
ii) Splenic cords.

i) **Splenic sinuses: are long vascular channels** having 35 to45 µm in diameter. They may have an **irregular course** and vary in diameter. They **extend through out the red pulp.**

ii) Splenic cords.: Appear as **continuous partitions** in between the **splenic sinuses.** These cords ultimately form a **spongy network** of lymphatic tissue that gradually merges into white pulp.

Marginal Zone.:- It is a **junctional region** in between the **White pulp and Red pulp**. It consists of a **meshwork of branched reticular cells** in association with extra cellular reticular into which many arterial vessels open

Blood supply. : At the hilus of the spleen, **artery enters** and divides into several trabecular branches which pass along the trabeculae and then enter the splenic parenchyma. Later they lose their adventitia and become reticular tissue, which get infiltrated with lymphocytes, at various points where there is greater infiltration of lymphocytes, splenic nodule is formed in white pulp.

From white pulp arterioles enter the red pulp and then sub divide several branches which look like a brush called **penicillar vessels.**

Penicillar vessels have three components:

i) First large component with thin smooth muscle –Pulp arteriole.
ii) Middle portion within thick muscle called as sheathed arteriole.
iii) Terminal portion is arterial capillary, which end in the splenic venous sinuses.

Splenic Venous Sinuses are irregular anastomizing tunnels throughout red pulp. The wall of the sinus is composed of specialized reticular cells. Which are **phagocytic in nature.(R.E.Cells)**

The blood from splenic sinuses empty in to the pulp vein, which combine to form the large veins which ultimately open into trabecular vein.

In the hilus many trabecular veins join to form the large splenic vein which leave the spleen.

Functions of the Spleen:- i) In embryo :- The spleen functions as haemopoietic organ (not in adult.)

ii)Blood cell destruction : The old and Senile W.B.C. and R.B.C.s are destroyed by R.E. cells of the spleen.

iii) Reservoir of blood : Spleen acts as a great reservoir of blood and can release about 150 ml of blood (mainly R.B.C.s)in circulation

iv)In spleen haemoglobin is broken down in to haem and globin . The Hb further splits into iron & pigment bilirubin. The liberated iron is stored in splenic pulp cells & then transferred to other places. Fe component is stored in the form of Haemosiderin in the spleen.

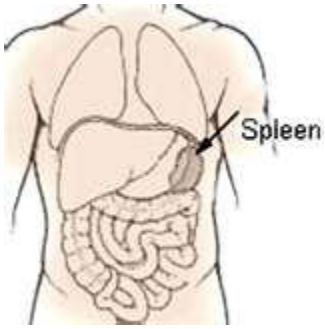
v)Defensive Mechanism :- Many plasma cells are found in the splenic red pulp & hence the spleen is a chief site of immune body formation (Ab formation)

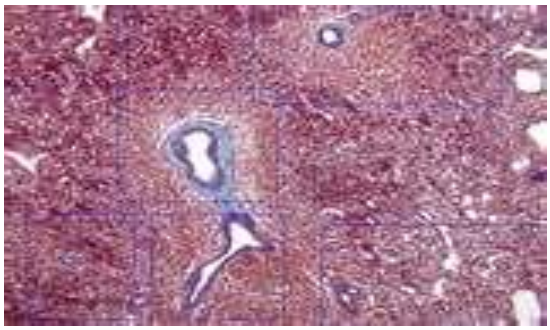
The R.E.cells engulf bacteria, parasites, and other foreign particles.

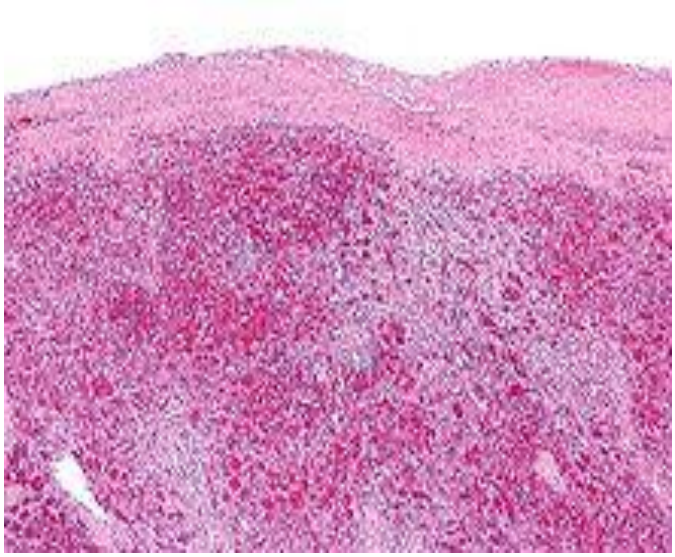
The pulp cells unite with certain toxins, specially Diptheria toxins and remove them.

Lymphoid cells of spleen react against pathogenic micro organisms.

Manufacture of Haemolycine :- When R.B.C. of one species are injected in another, haemolysines are formed in the spleen.







Capsule

White pulp

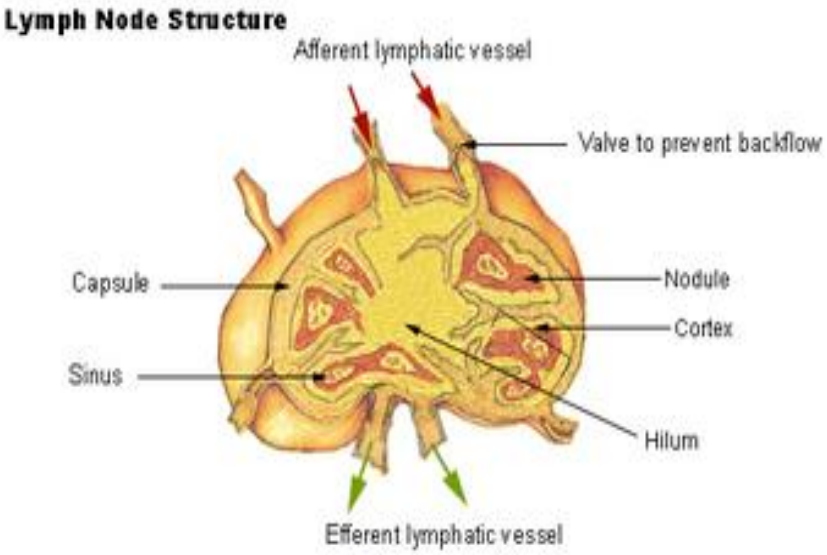
Red pup

Spleen : Histology

Lymph Node

Lymph nodes are small, oval or bean shaped collection of lymphoid tissue lying along the lymphatic vessels. They are surrounded by a connective tissue capsule from which trabacule penetrate to the nodes. Trabaculae undergo branching in the tissue of nodes.

Number of afferent lymphatic vessels enter the node through whole outer surface by piercing the capsule. They are thinner and & more numerous than efferent.



After entering they undergo branching, run along trabacule & then traverse through whole lymphoid tissue.

They drain whole node & then converge & form efferent lymph vessel, which leave the lymph node at the hilus.

Nodal tissue is differentiated into an outer cortex and inner medulla. In the cortex ,there are accumulations of lymphocytes called as **primary lymphoid follicles.**

Germinal centers or secondary follicles develop within primary lymphoid follicles, during antigenic stimulation.

Follicles contain proliferating **lymphocytes, macrophages** which capture & process the antigens.

In the Medulla lymphocytes, plasma cells & macrophages are arranged as elongated branching cords called **medullary cords**.

Cortical & medullary region contain B-lymphocytes & constitute the bursa or **B-dependant areas**. In between the cortical follicles & medullary cords, there is a broad ill-defined zone called as Para cortical area which contains T- lymphocytes & inter digitating cells, which constitutes **Thymus dependant area.**

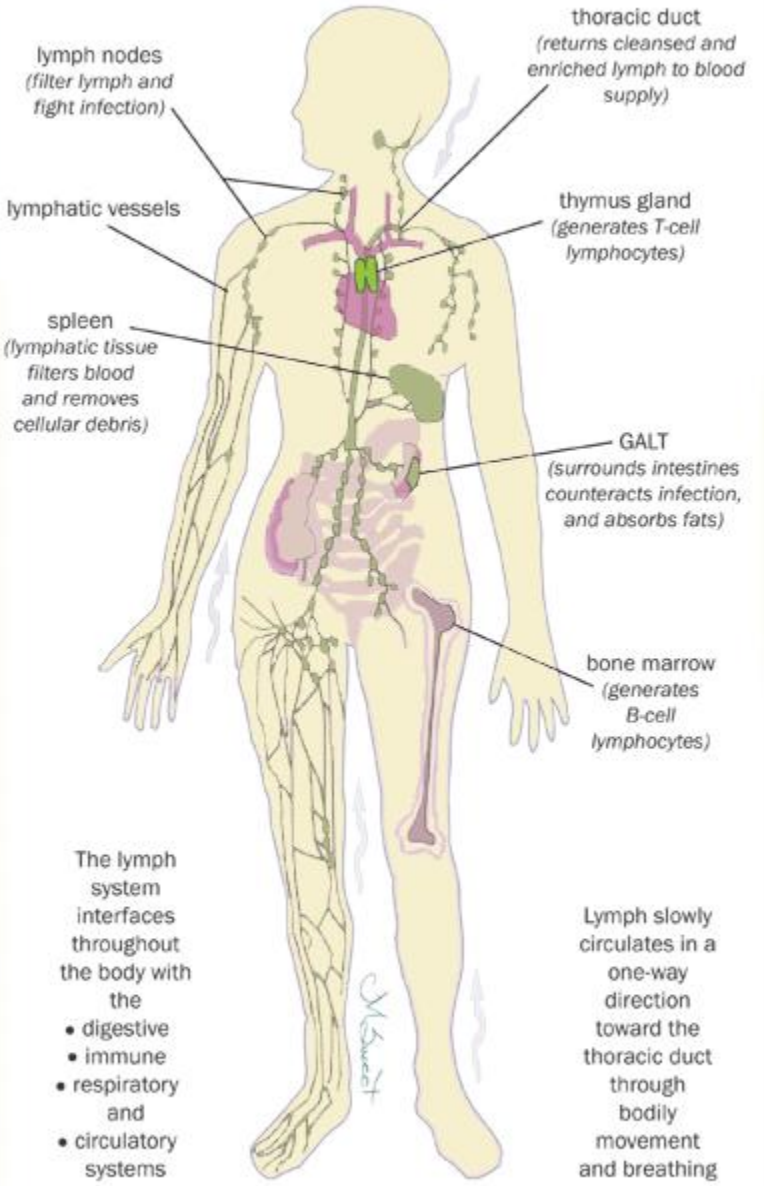
Functions

Lymph nodes act **as filter for lymph.** Each group of lymph nodes drains a specific part of the body. As lymph nodes are rich in phagocytes **they phagocytose** foreign material including micro organisms.

They help in **prolipheration& circulation of T & B cells**. **They enlarge** following **local antigenic stimulation**.

Lymph nodes are also responsible for the **initiation & development of humoral and cell mediated immune response by possessing both T dependant & B dependent areas.**

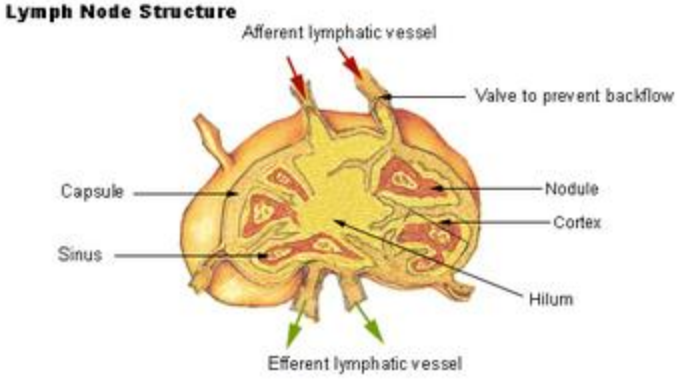
Lymphatic System



The lymph system interfaces throughout the body with the
- digestive
- immune
- respiratory

and
- circulatory systems

Lymph slowly circulates in a one-way direction toward the thoracic duct through bodily movement and breathing


Lymph Node Structure
Afferent lymphatic vessel
Valve to prevent backflow
Capsule
Nodule
Cortex
Sinus
Hilum
Efferent lymphatic vessel