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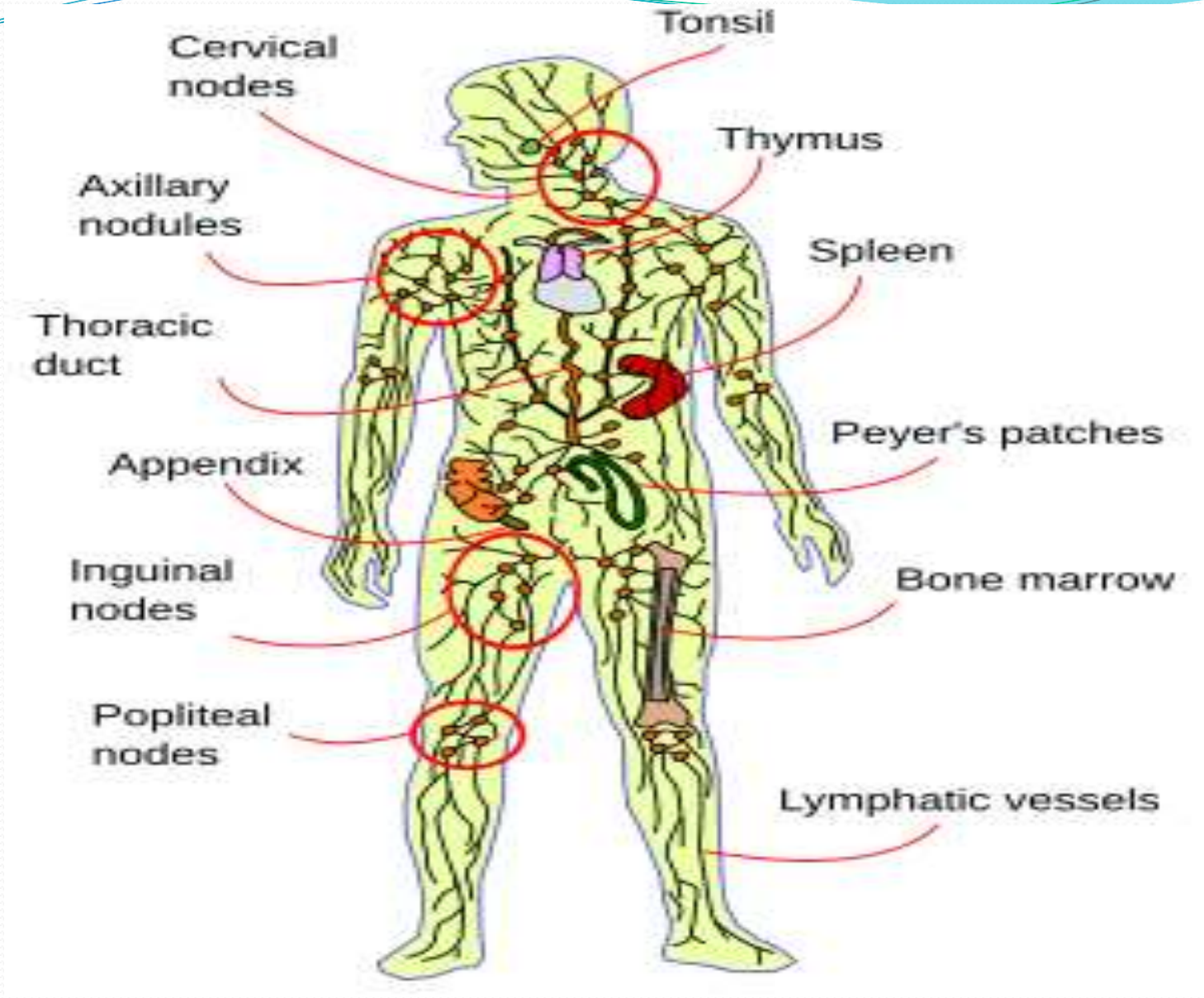
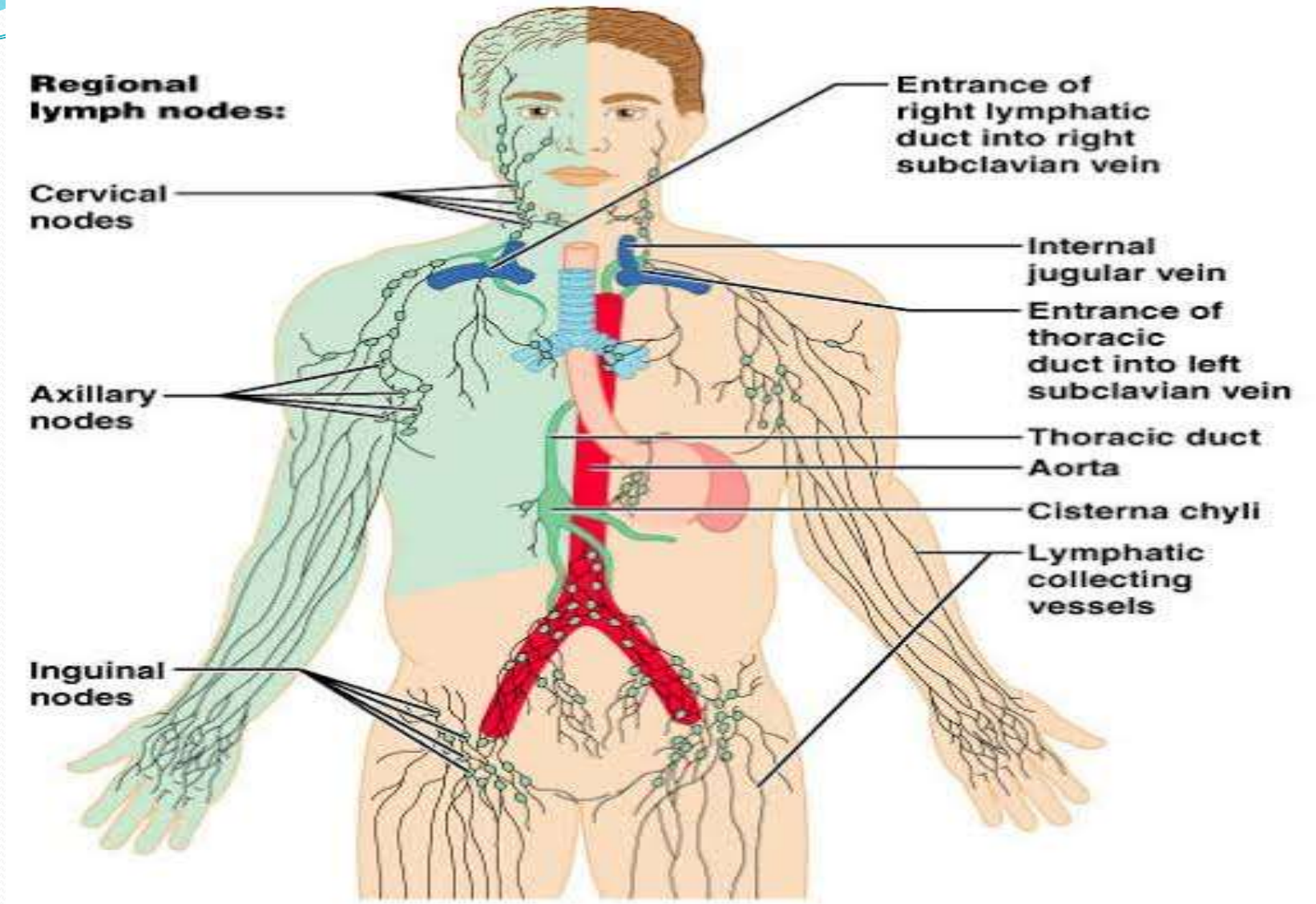
LYMPH

- Lymph = Blood-(RBC+PLATELET+PLASMA PROTEINS)
- It is a colourless liquid connective tissue baths in a liquid called lymph.
- It is similar to that of interstitial fluid(composition) and plasma and it contains less amount of protein.
- Lymph transports the plasma proteins that seeps from capillary beds to blood stream.
- Lymph carries larger particles eg:bacteria and debris from damaged tissuses,which can be filtered and destroyed in the lymph nodes.

LYMPHATIC SYSTEM

- Lymphatic capillaries
- Lymphatic vessels
- Lymph nodes
- Lymph organs(spleen, thymus and tonsils)


Tonsil
Cervical nodes
Thymus
Axillary nodules
Spleen
Thoracic duct
Peyer's patches
Appendix
Inguinal nodes
Bone marrow
Popliteal nodes
Lymphatic vessels



LYMPHATIC CAPILLARIES

- Small,thin walled, lined by endothelium.
- Resting on the basement memebrane where one end is blind.
- It unites to form lymphatic duct.
- Absent: brain,eye ball,spinal cord,internal ear and in bones
- The lymphatic capillaries originating from small intestine are called lacteals.

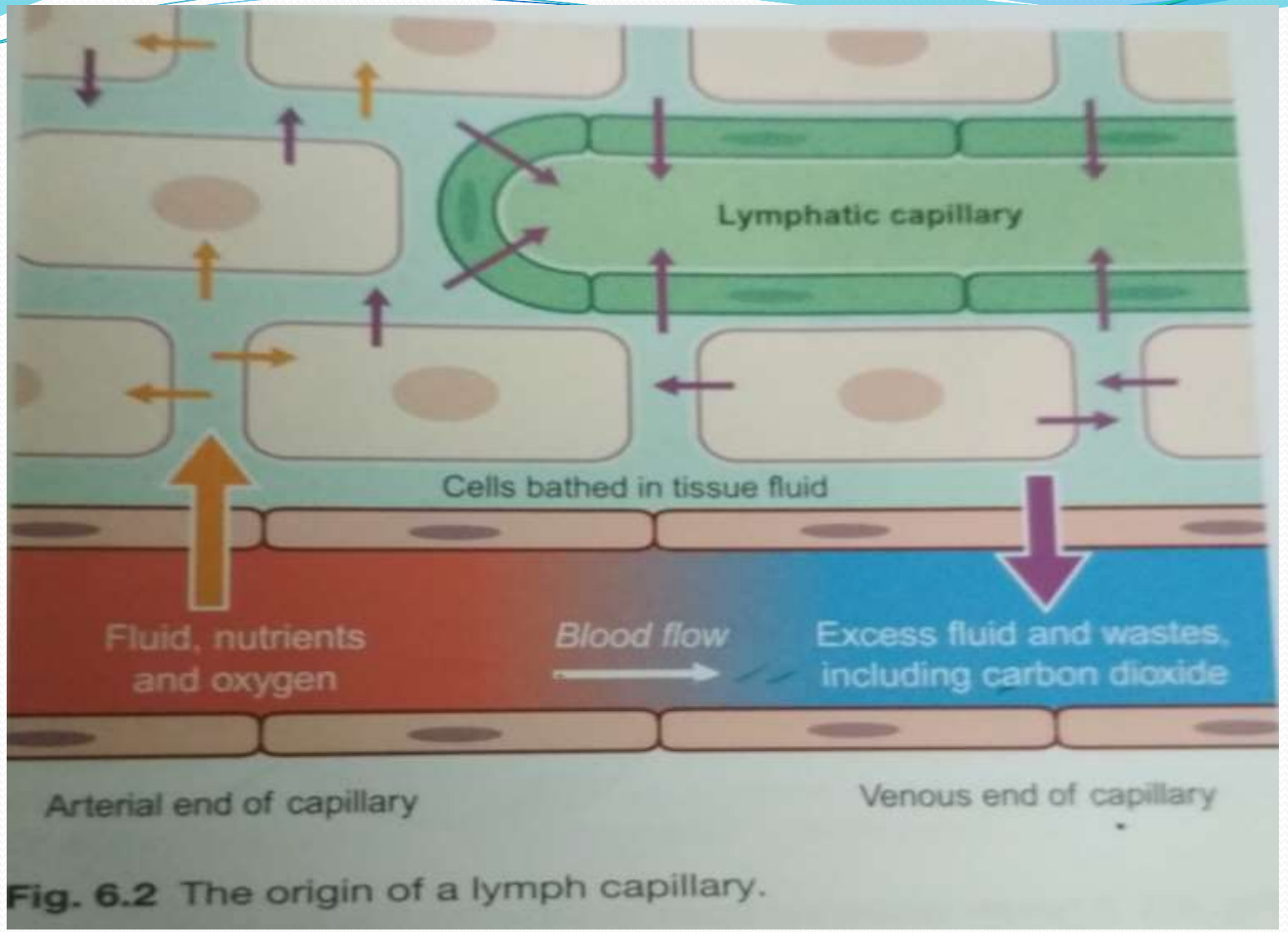
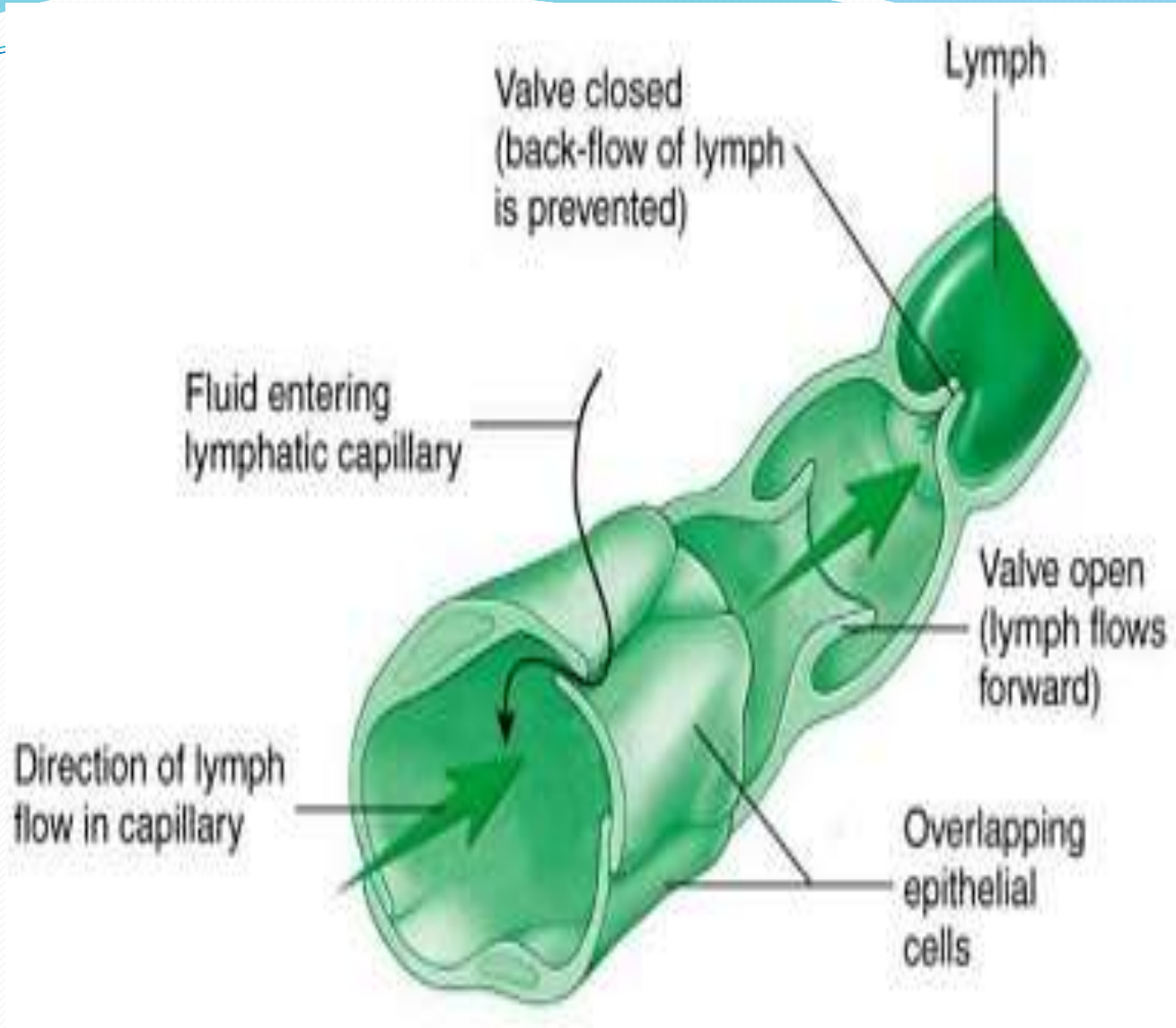


Fig. 6.2 The origin of a lymph capillary.

LYMPH VESSELS

- They are running along side the arteries and veins, like vein it has 3 layers
  1. Tunica externa
  2. Tunica media
  3. Tunica interna
- Has watch packets or semilunar valves to prevent the back flow


Valve closed
(back-flow of lymph
is prevented)
Lymph
Fluid entering
lymphatic capillary
Valve open
(lymph flows
forward)
Direction of lymph
flow in capillary
Overlapping
epithelial
cells

Lymph vessel

Thoracic duct(begins at cisternae chyli)

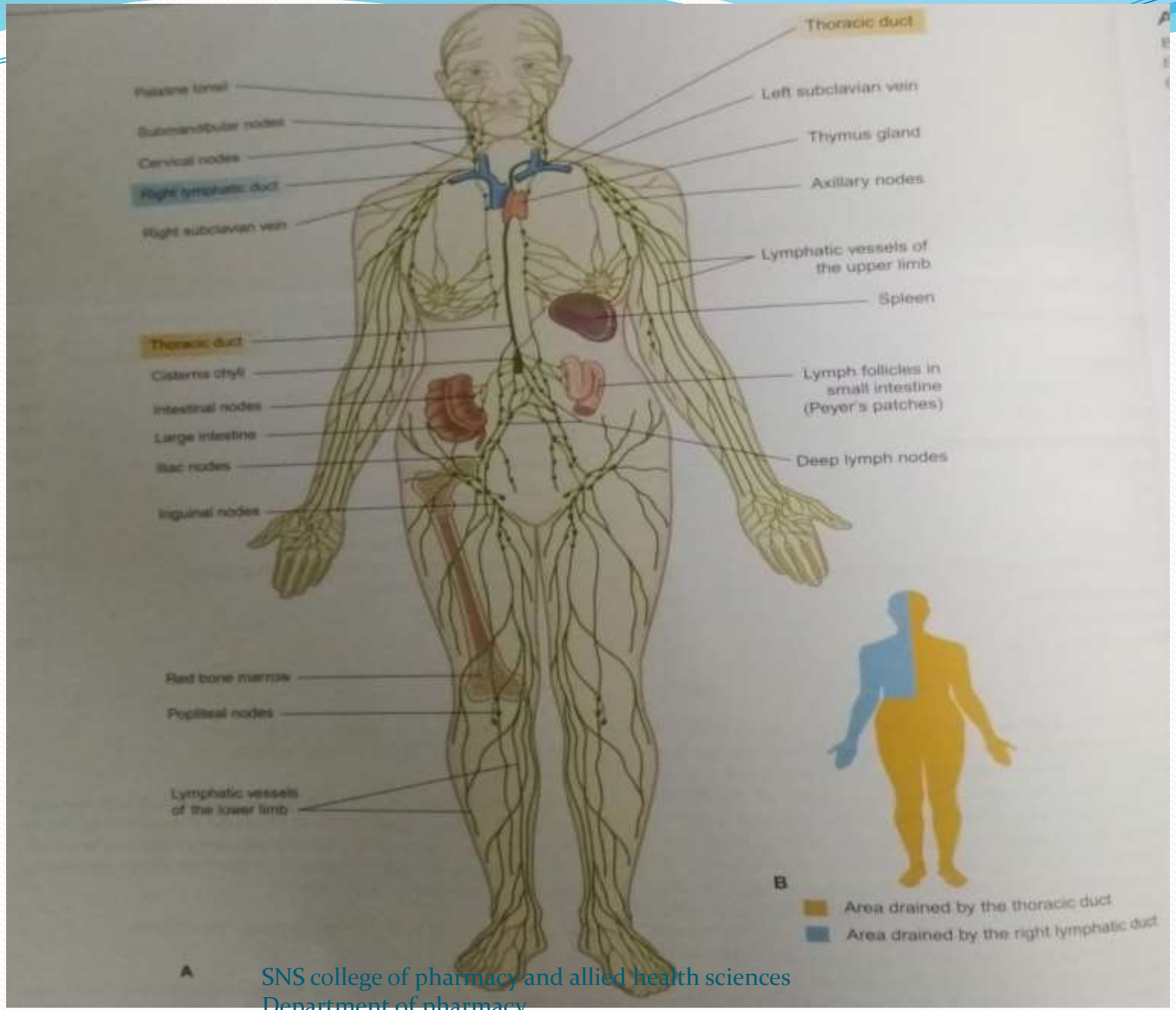
Right sublavian vein(lies in root of neck)

Opens: left subclavian vein

Opens: right subclavian vein

Drains : legs,left half of thorax,head, neck and left arm

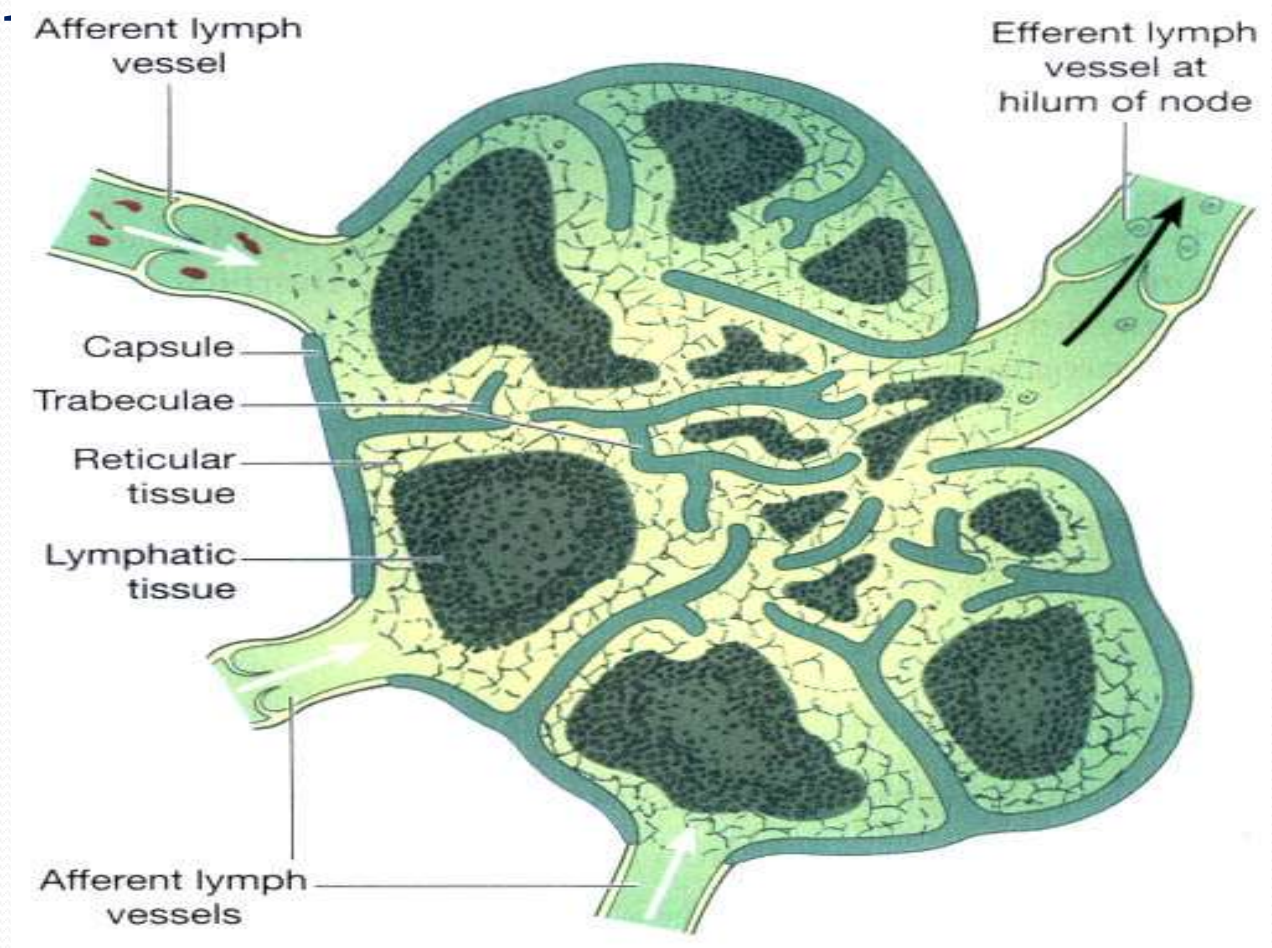
Drains: right half of thorax,head,neck and right arm


Thoracic duct
Palatine tonsil
Submandibular nodes
Cervical nodes
Right lymphatic duct
Right subclavian vein
Left subclavian vein
Thymus gland
Axillary nodes
Lymphatic vessels of the upper limb
Spleen
Thoracic duct
Cisterna chyli
Intestinal nodes
Large intestine
Iliac nodes
Inguinal nodes
Lymph follicles in small intestine (Peyer's patches)
Deep lymph nodes
Red bone marrow
Popliteal nodes
Lymphatic vessels of the lower limb
A
B
Area drained by the thoracic duct
Area drained by the right lymphatic duct

LYMPH NODE

- Lymph nodes are oval or bean-shaped organs that lie, often in groups, along the length of lymph vessels.
- The lymph drains through a number of nodes, usually 8 to 10,before returning to the venous circulation.

STRUCTURE OF LYMPH NODE



1) Outer fibrous tissue or capsule
2) Trabeculae or partitions
3) Reticular cells-produce network of fibres that provide internal structure
4) Lymphatic tissue-packed with immune system and defense cells (lymphocytes and macrophages)
5) Hilum-concave surface were artery enters and its veins and efferent vessels leave
6) Afferent lymph vessels-4 or 5
7) Efferent lymph vessels

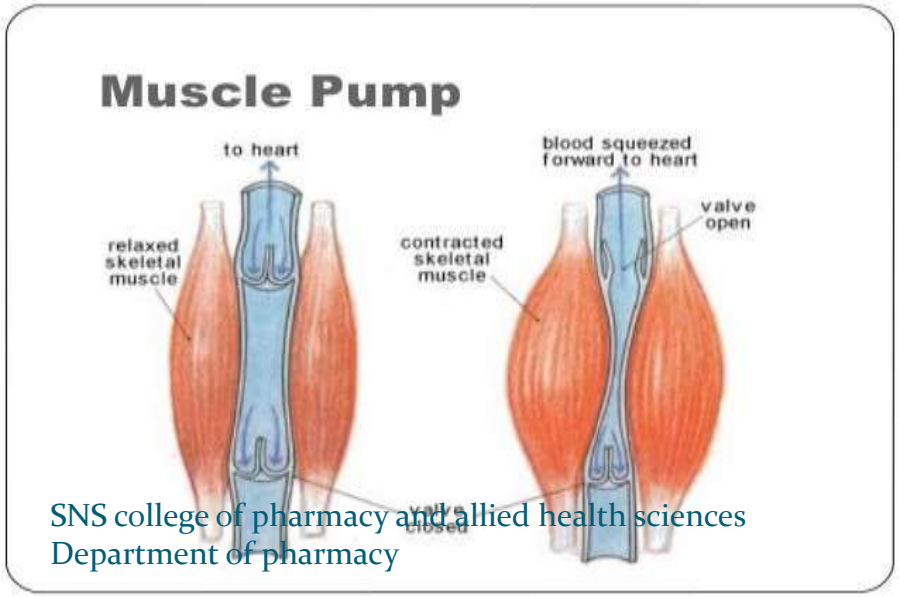
1. Lymph from Upper limb pass through –superficial axillary node
2. Lower limb-inguinal node (knee) and popliteal node (gorin)
3. Head and neck- cervical node

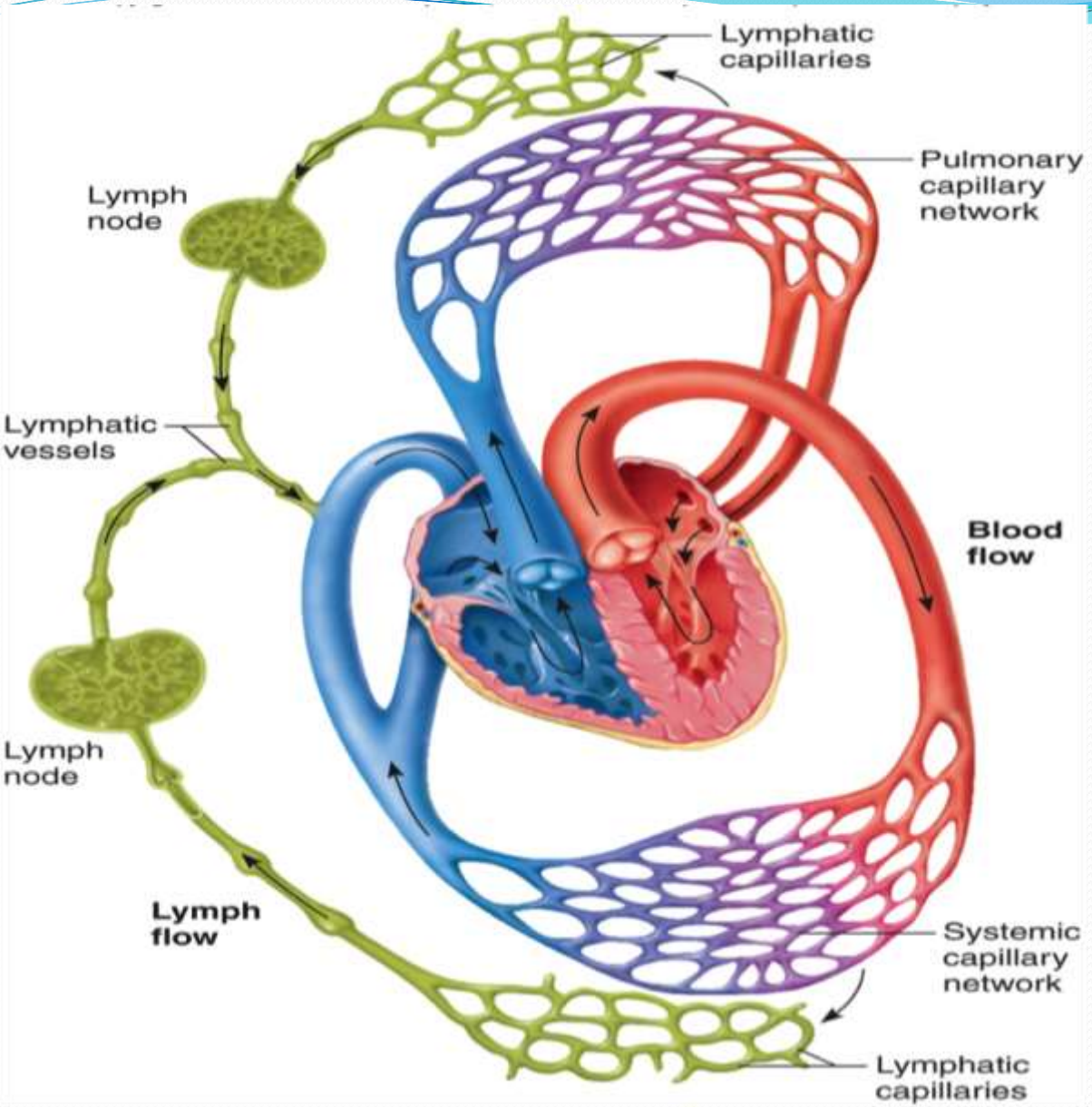
Functions:

- Screening of lymph by phagocytic action(as wbc is present in lymph node).
- Develpoment of immune system.
- Act as mechanical filter.
- Maturation and proliferation of lymphocytes.

LYMPHATIC CIRCULATION

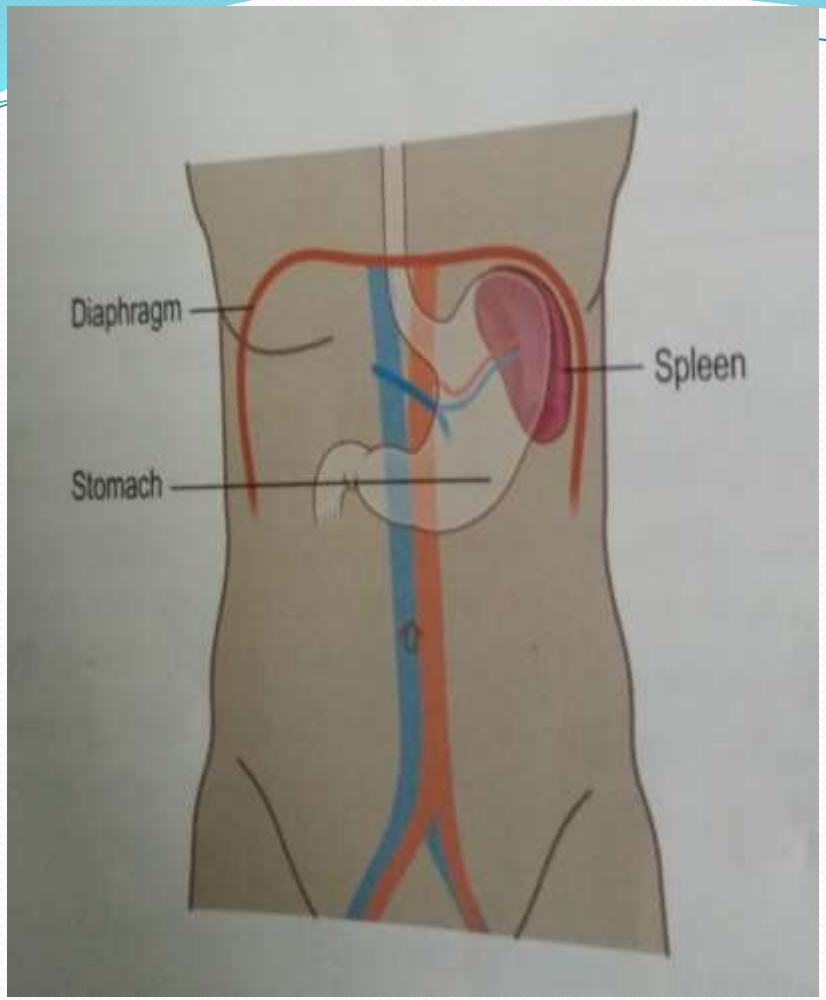
- Lymph vessels are compressed by activity in adjacent action.the milking action on lymph vessel wall helps to push lymph along.
- Changes in thoracic pressure associated with respiratory cycle also assist lymph movement.

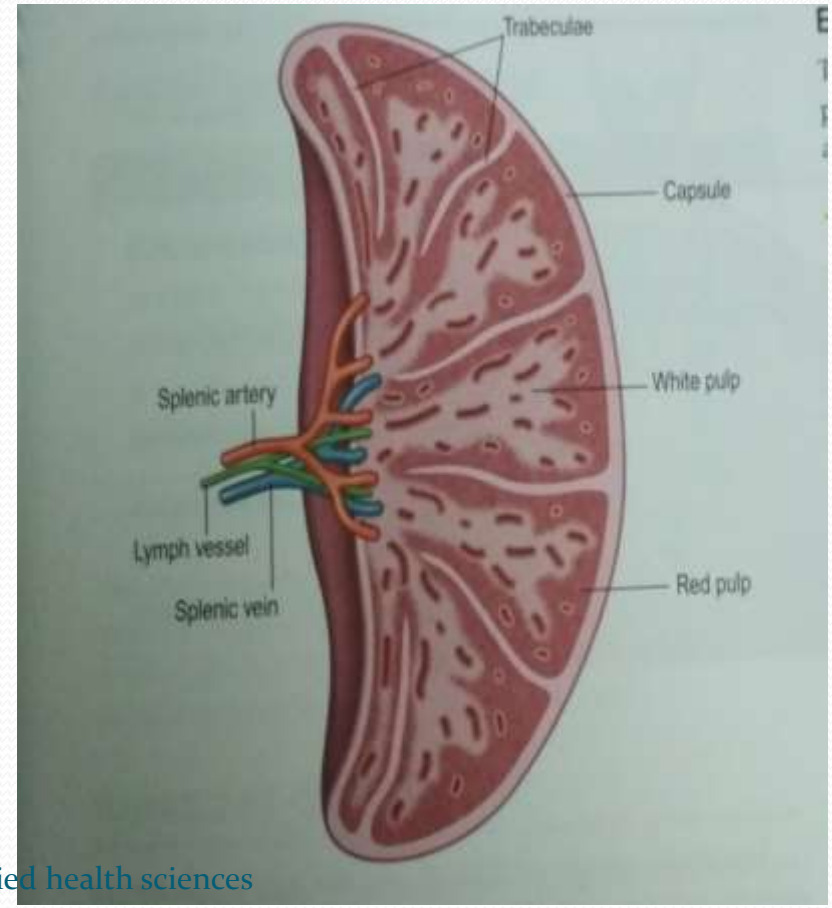



Lymphatic capillaries
Pulmonary capillary network
Lymph node
Lymphatic vessels
Blood flow
Lymph node
Lymph flow
Systemic capillary network
Lymphatic capillaries

SPLEEN

- The spleen is formed by reticular and lymphatic tissue and is the largest lymph organ.
- Location: in the left hypochondriac region of the
- abdominal cavity between the fundus of the stomach and the diaphragm.
- colour :purplish
- size:12 cm long, 7 cm wide and 2.5 cm thick.
- weight: about 200 g.


Diaphragm
Spleen
Stomach


Trabeculae
Capsule
White pulp
Splenic artery
Lymph vessel
Splenic vein
Red pulp

FUNCTIONS OF SPLEEN

Phagocytosis:

old and abnormal erythrocytes are destroyed in the spleen and the breakdown products, bilirubin and iron, are passed to the liver via the splenic and portal veins. Other cellular material, e.g. leukocytes, platelets and microbes, are phagocytosed in the spleen.

Storage of blood

The spleen contains up to 350 ml of blood, and in response to sympathetic stimulation can rapidly return a large part of this volume to the circulation, e.g. in haemorrhage.

Immune response

The spleen contains T- and B-lymphocytes, which are activated by the presence of antigens, e.g. in infection. Lymphocyte proliferation during serious infection can cause enlargement of the spleen *(splenomegaly}.*

Erythropoiesis

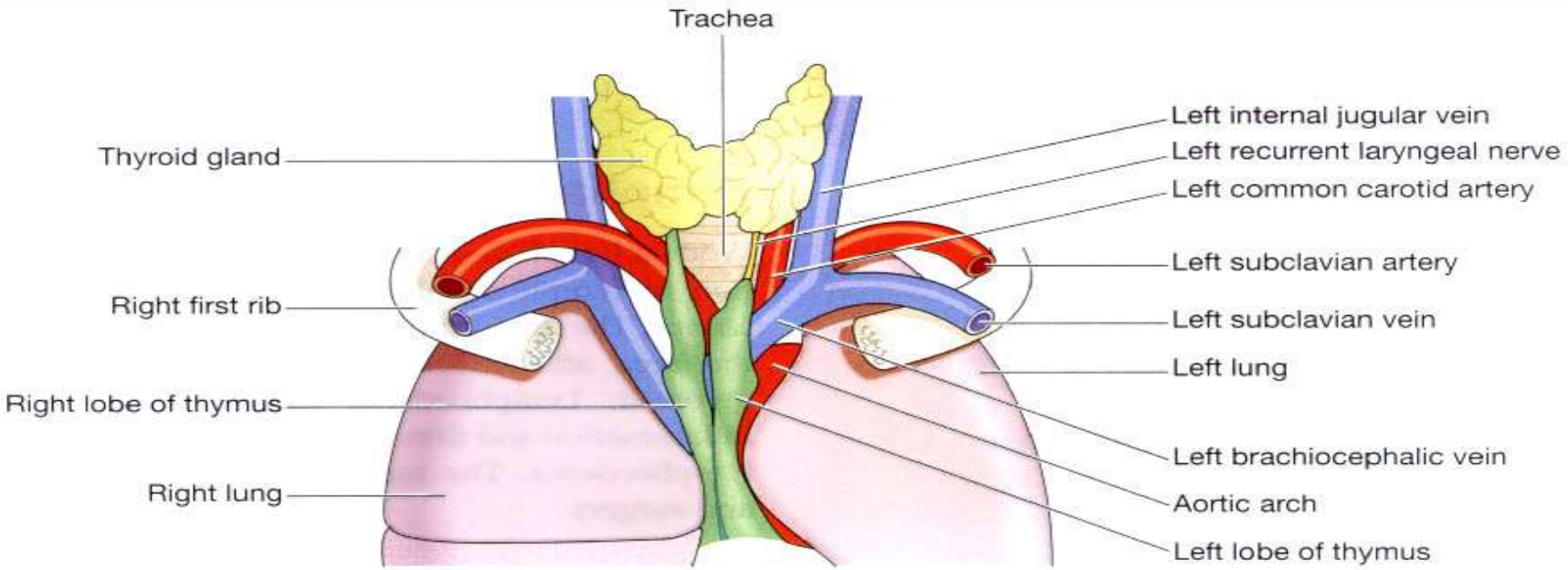
The spleen and liver are important sites of fetal blood cell production, and the spleen can also fulfil this function in adults in times of great need.

THYMUS

- The thymus gland lies in the upper part of the mediastinum behind the sternum and extends upwards into the root of the neck
- Birth-10-15g
- Puberty-30-40g
- Middle age-10-15g

Structure:

- The thymus consists of two lobes joined by areolar tissue.
- The lobes are enclosed by a fibrous capsule which dips into their substance, dividing them into lobules that consist of an irregular branching framework of epithelial cells and lymphocytes.



Functions:

Development of T-lymphocytes,these T-cells defend the body from potentially deadly pathogens such ad bacteria,viruses and fungi.

REFERENCES:

- Anatomy and physiology in health and illness by Ross and Willson