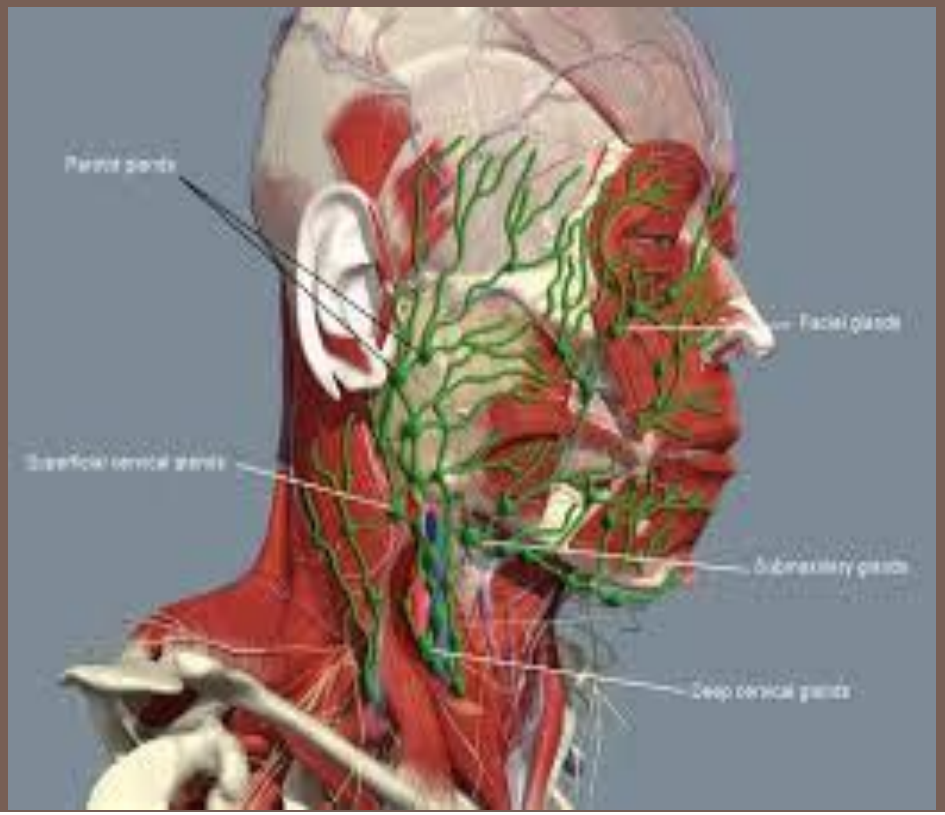
LYMPHATIC SYSTEM

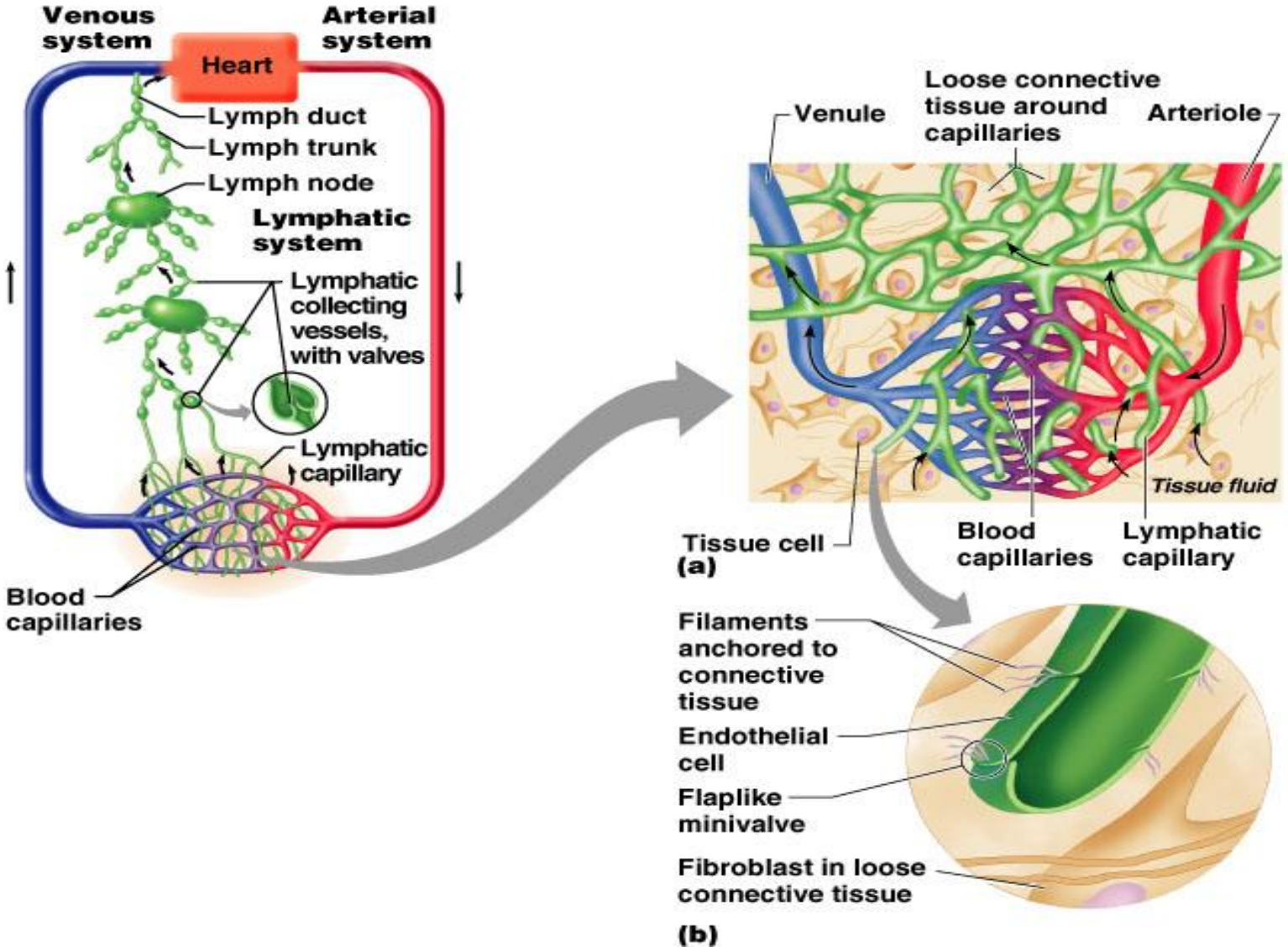


LYMPH

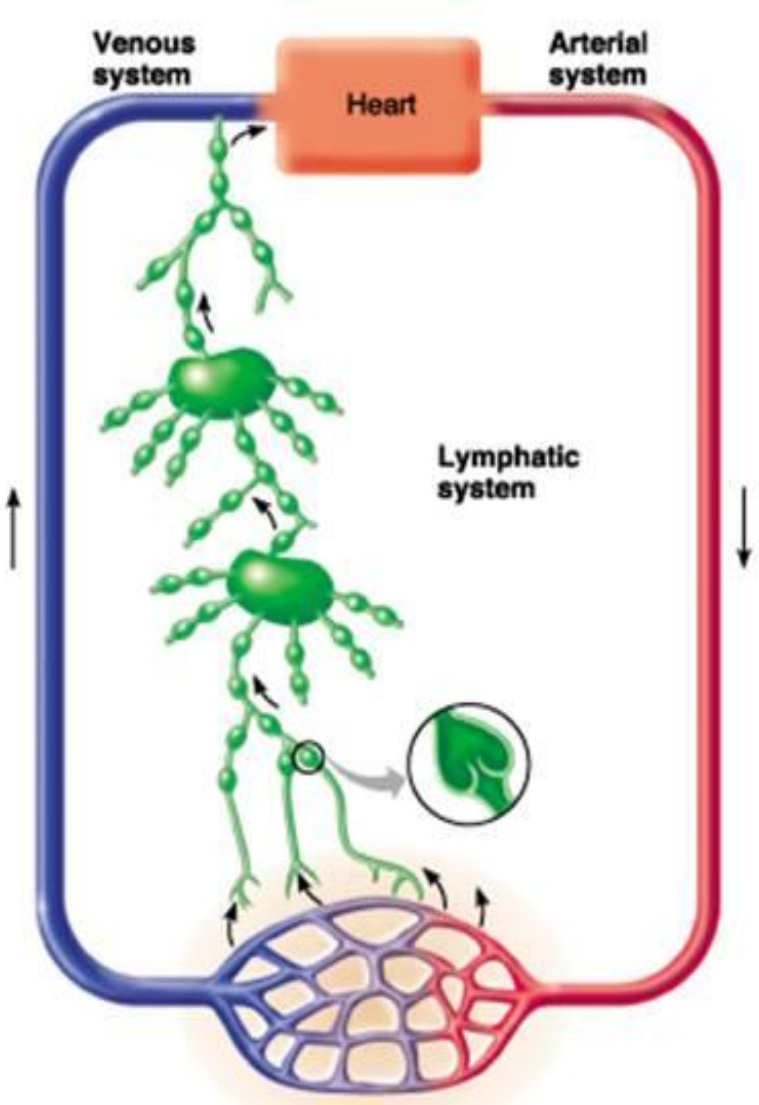
- **What is lymph ?**

  Tissue fluid (interstitial fluid) that enters the lymphatic vessels

FORMATION AND TRANSPORT OF TISSUE FLUID



LYMPHATIC SYSTEM



Essentially a drainage system accessory to venous system

larger particles that escape into tissue fluid can only be removed via lymphatic system

Functions of the Lymphatic System

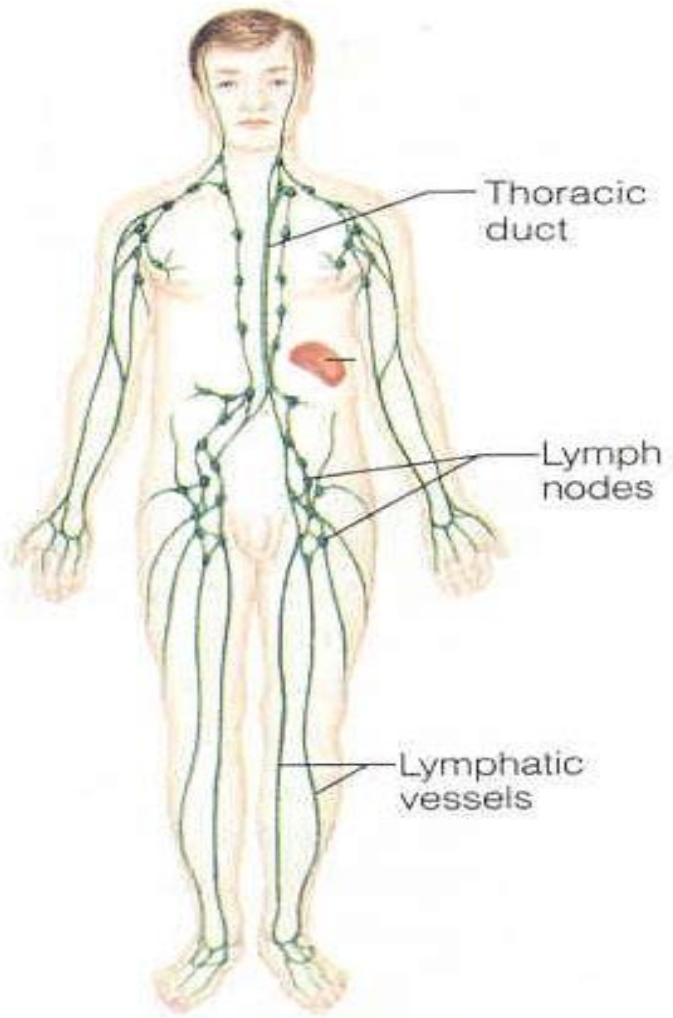
- **Reabsorbs excess interstitial fluid:**
  - returns it to the venous circulation
  - maintain blood volume levels
  - prevent interstitial fluid levels from rising out of control.

- **Transport dietary lipids:**
  - transported through lacteals
  - drain into larger lymphatic vessels
  - eventually into the bloodstream.

- **lymphocyte development, and the immune response.**

Components of the Lymphatic System

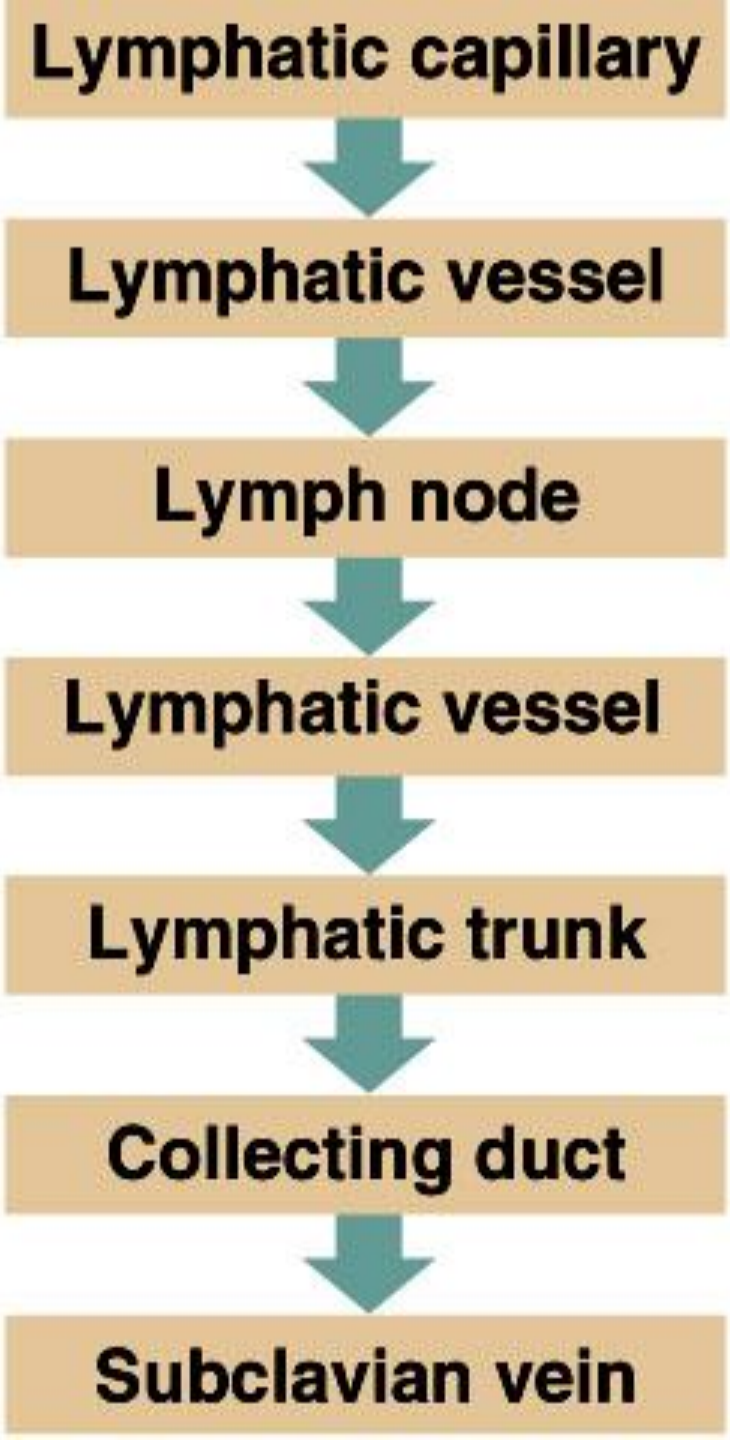
- Lymph
- Lymphatic Vessels
  - Lymphatic Capillaries
  - Lymphatic Vessels
  - Lymphatic Trunks
  - Lymphatic Ducts
- Lymphatic Organs
  - Thymus
  - Lymph Nodes
  - Spleen
  - Tonsils
- Lymphatic cells



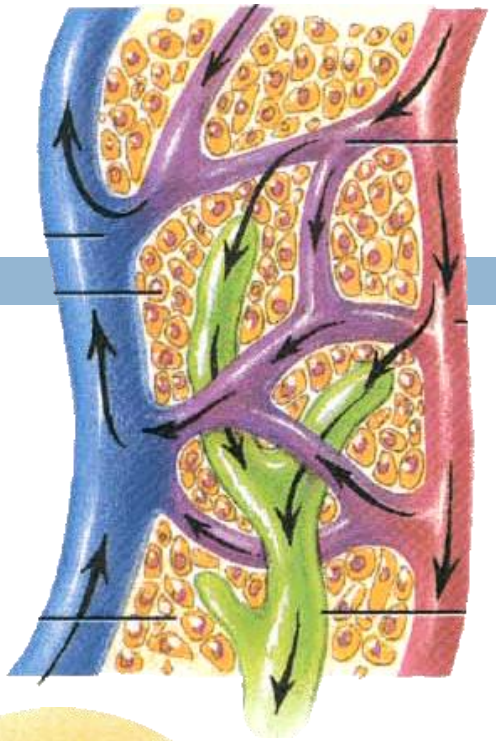
Lymphatic system

Lymph Vessels

- Lymphatic **capillaries –**
- Lymphatic **collecting vessels**
- Lymphatic **trunks –**
- Lymphatic **ducts –**

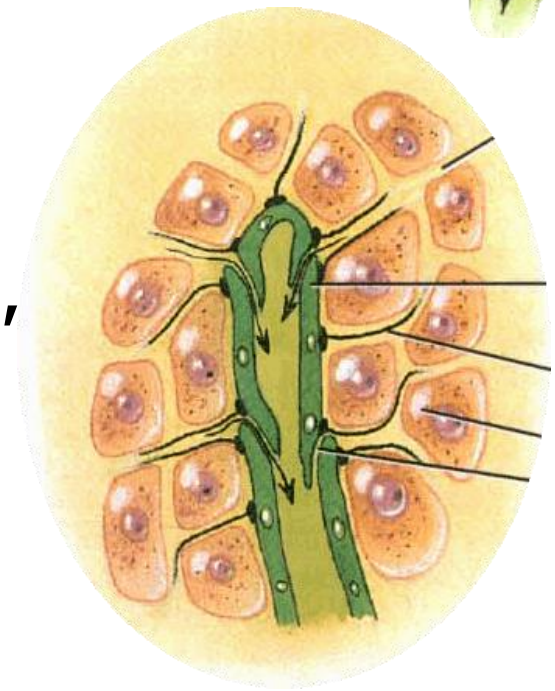

Lymphatic capillary
Lymphatic vessel
Lymph node
Lymphatic vessel
Lymphatic trunk
Collecting duct
Subclavian vein

Lymphatic Capillaries



Features of structure:

- Blind end
- Single layer of overlapping endothelial cells
- More permeable than that of blood capillary
- Absent from avascular structures, brain, spinal cord splenic pulp and bone marrow



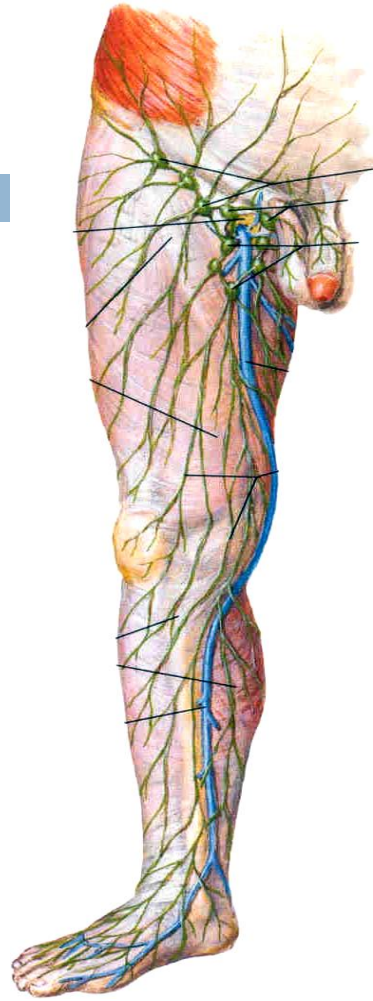
Lymphatic Capillaries – Lacteals

- The small intestine contains special types of lymphatic capillaries called lacteals.
- Lacteals pick up not only interstitial fluid, but also dietary lipids and lipid-soluble vitamins.
- The lymph of this area has a milky color due to the lipid and is also called chyle.

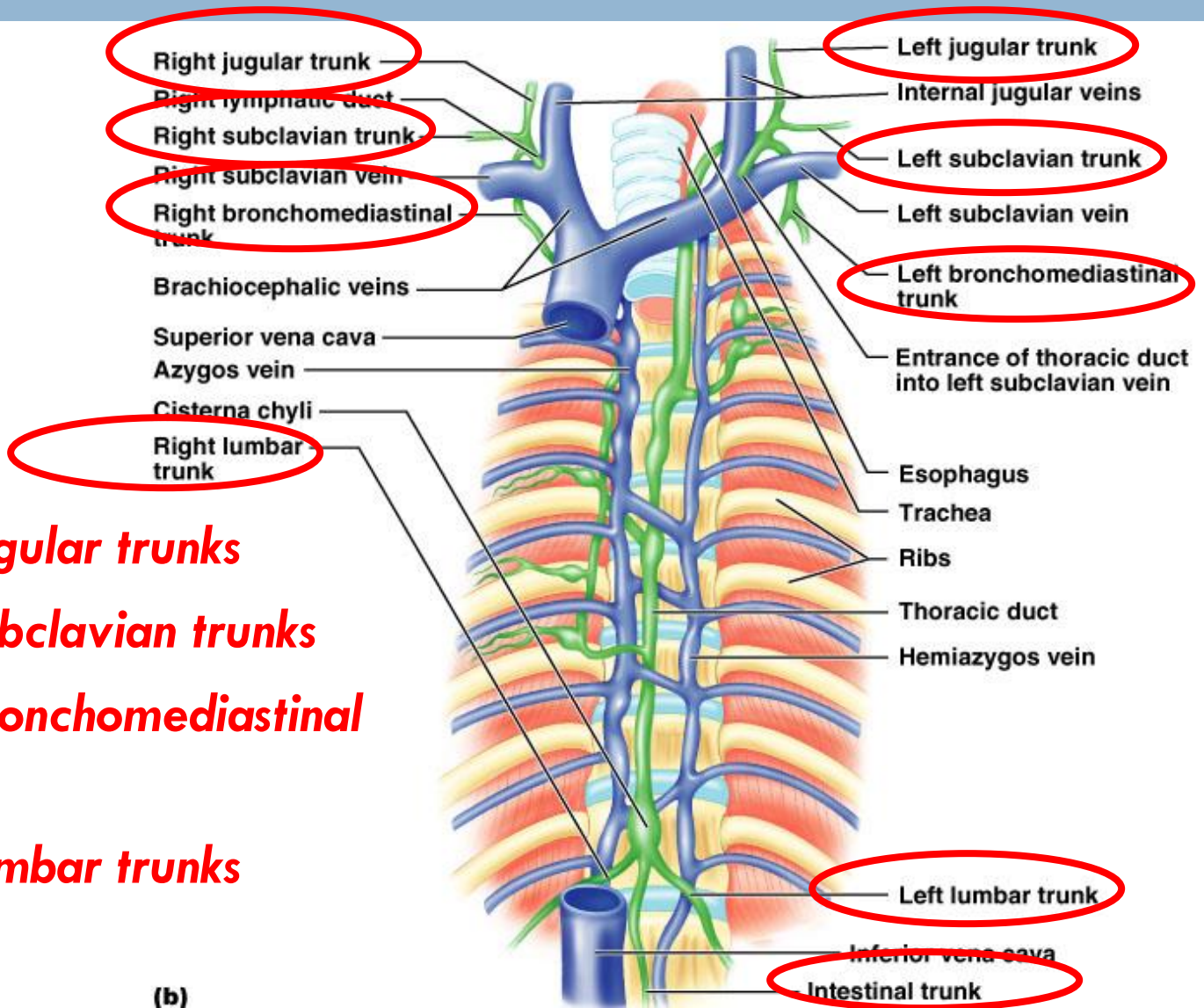
Lymphatic Vessels

Features of structure

- Three layered wall but thinner than vein,
- More numerous valves than in vein
- Interposed by lymph nodes at intervals
- Arranged in superficial and deep sets



LYMPH TRUNKS



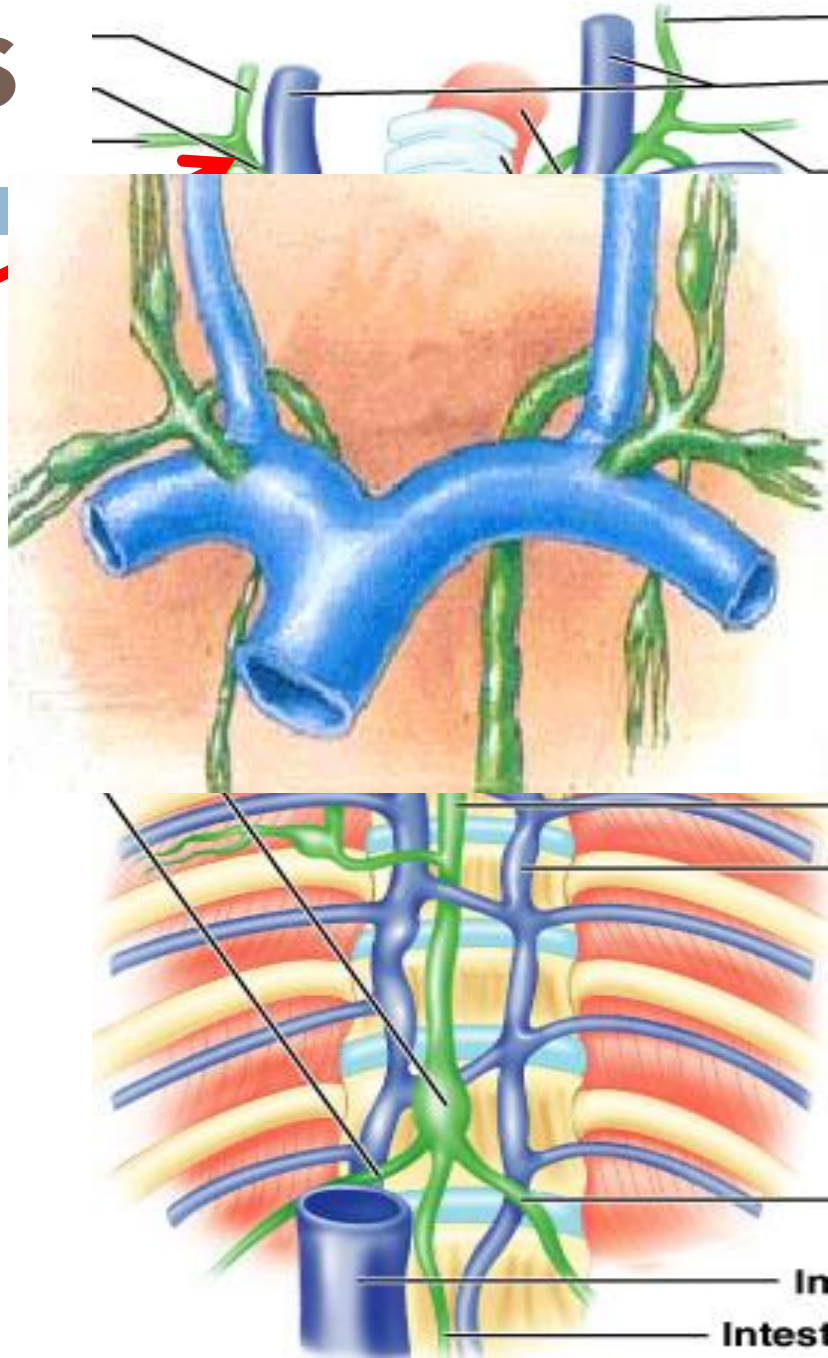
- *right and left jugular trunks*
- *right and left subclavian trunks*
- *right and left bronchomediastinal trunks*
- *right and left lumbar trunks*
- *intestinal trunk*

LYMPHATIC DUCTS

24-

Right lymphatic duct

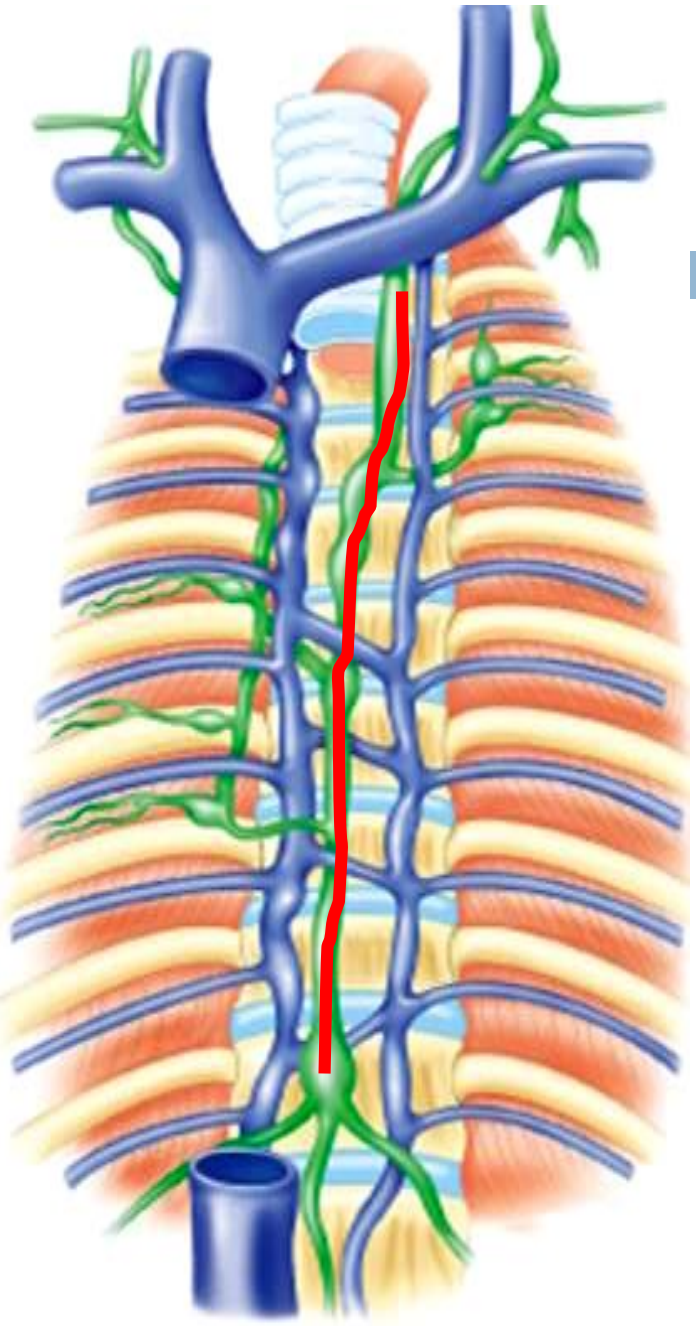
- Formed by union of right jugular, subclavian, and bronchomediastinal trunks
- Ends by entering the right venous angle



LYMPHATIC DUCTS

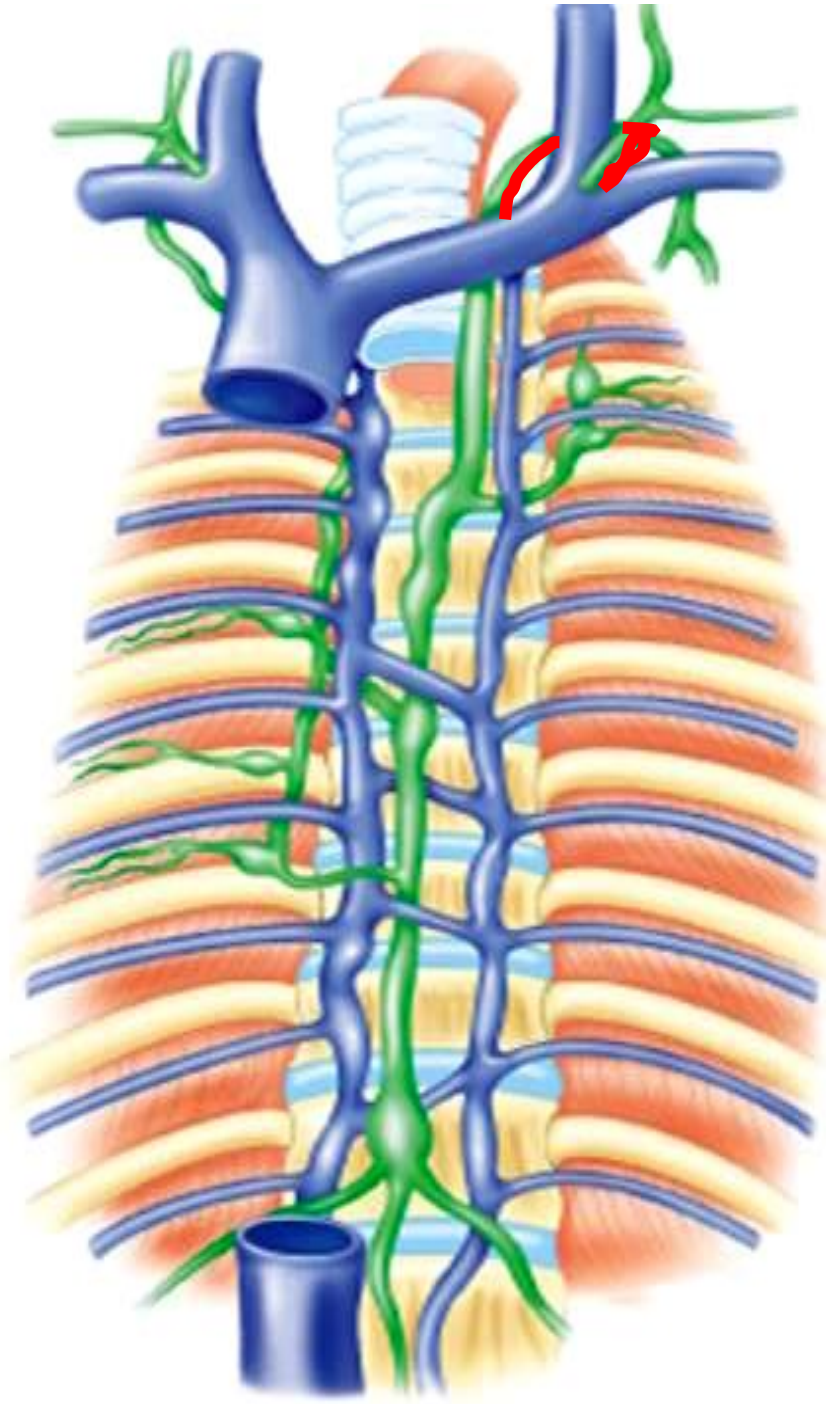
Thoracic duct

- Begins in front of L1 as a dilated sac, the cisterna chyli
- formed by left and right lumbar trunks and intestinal trunk
- Enter thoracic cavity & ascends
- Travels upward, veering to the left at the level of T5



THORACIC DUCT…..

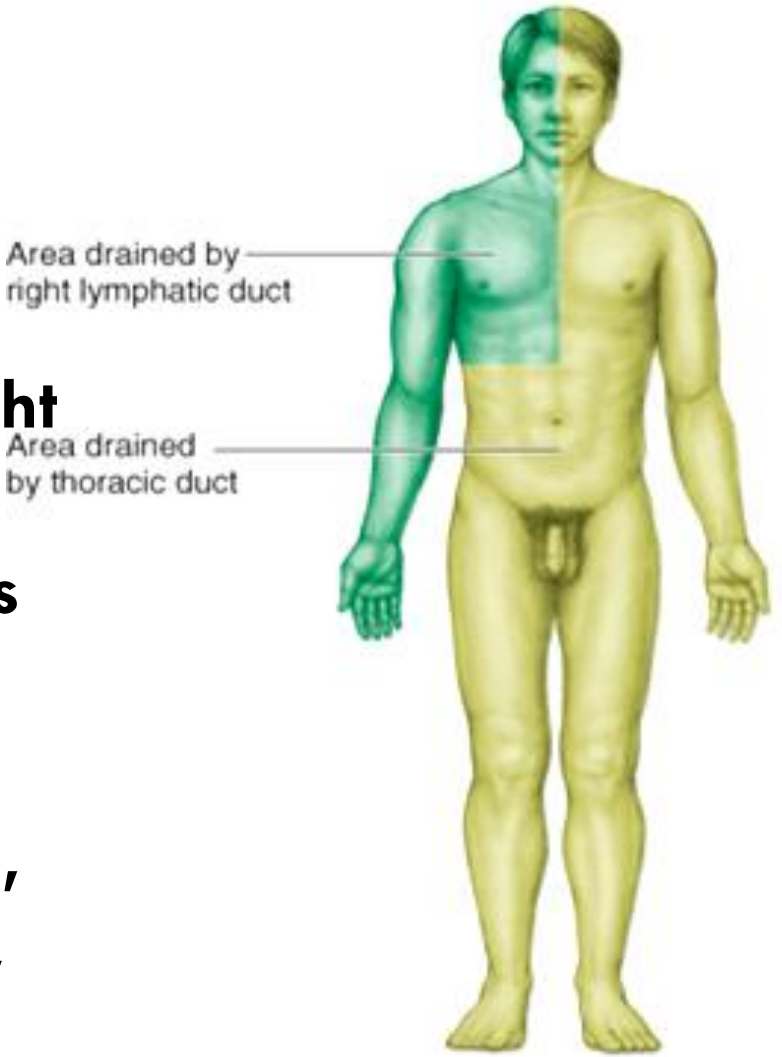
- At the root of the neck, it turns laterally
- arches forwards and descends to enter the left venous angle
- before termination, it receives the left jugular, Subclavian and broncho-mediastinal trunk



DRAINAGE PATTERN

RIGHT LYMPHATIC DUCT - Receives lymph from right half of head, neck, thorax and right upper limb, right lung, right side of heart, right surface of liver

THORACIC DUCT - Drains lymph from lower limbs, pelvic cavity, abdominal cavity, left side of thorax, and left side of the head, neck and left upper limb



(b) Lymph drainage pattern

Lymphatic Cells

- Also called **lymphoid cells.**
- Located in both the lymphatic system and the cardiovascular system.
- Work together to elicit an **immune response.**
- Types of lymphatic cells are:
  - **macrophages**
  - **epithelial cells**
  - **dendritic cells**
  - **lymphocytes**

LYMPHATIC ORGANS

Primary organs

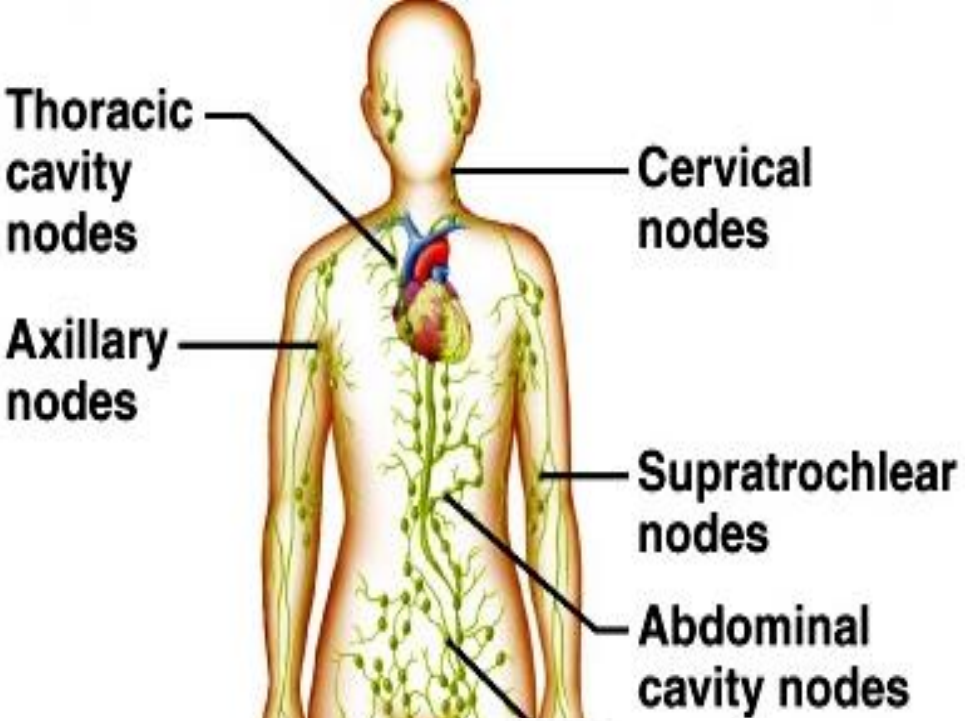
- Red bone marrow
- Thymus gland

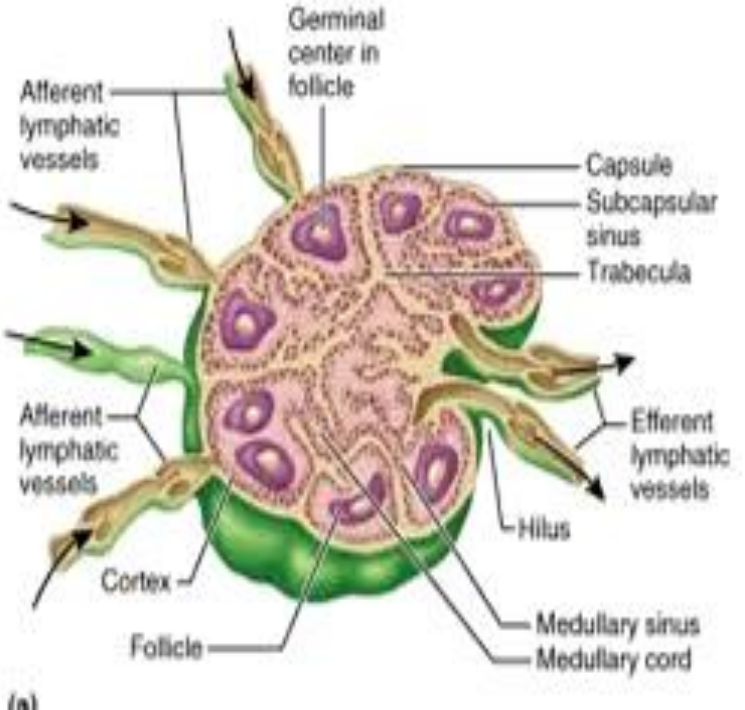
Secondary organs

- Lymph nodes
- Lymph nodules
- Spleen

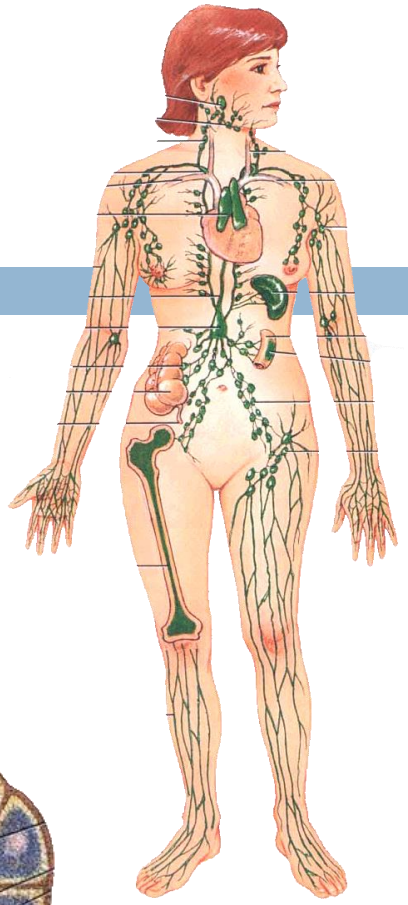
Lymph Nodes

- Small, round or oval
- located along the pathways of lymph vessels.
- length from 1 - 25 millimeters
- Typically found in clusters
- receive lymph from many body regions.
- Lymph nodes are also found individually



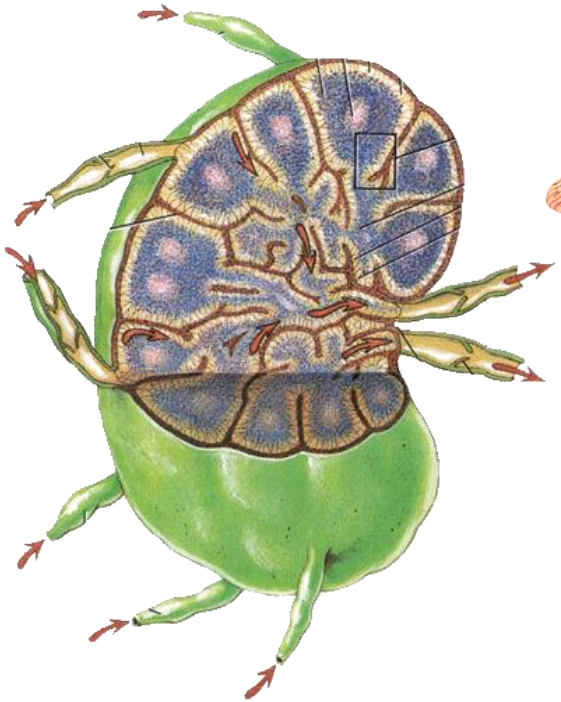


Lymph node

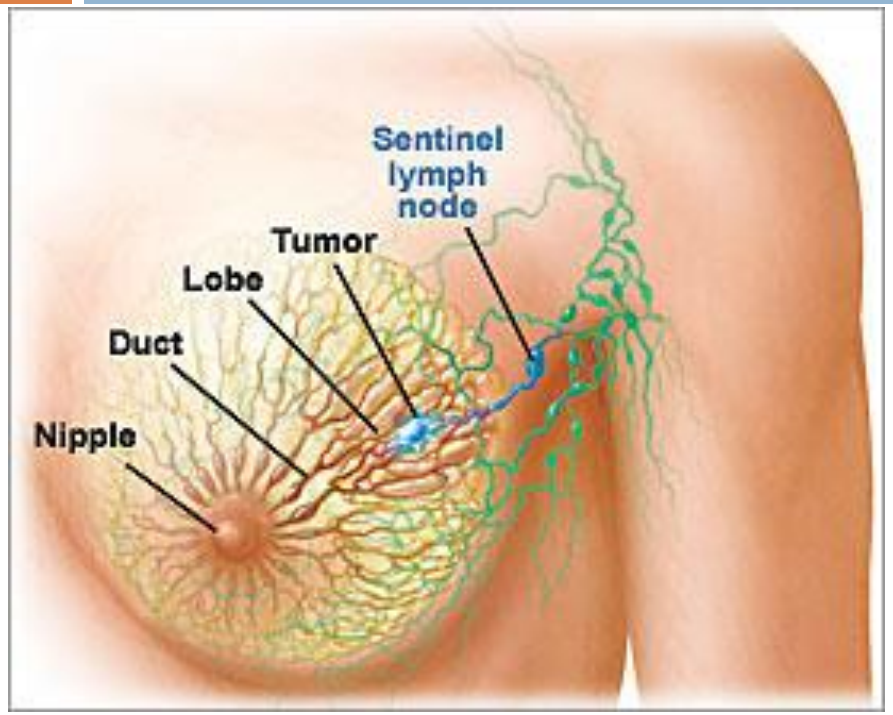


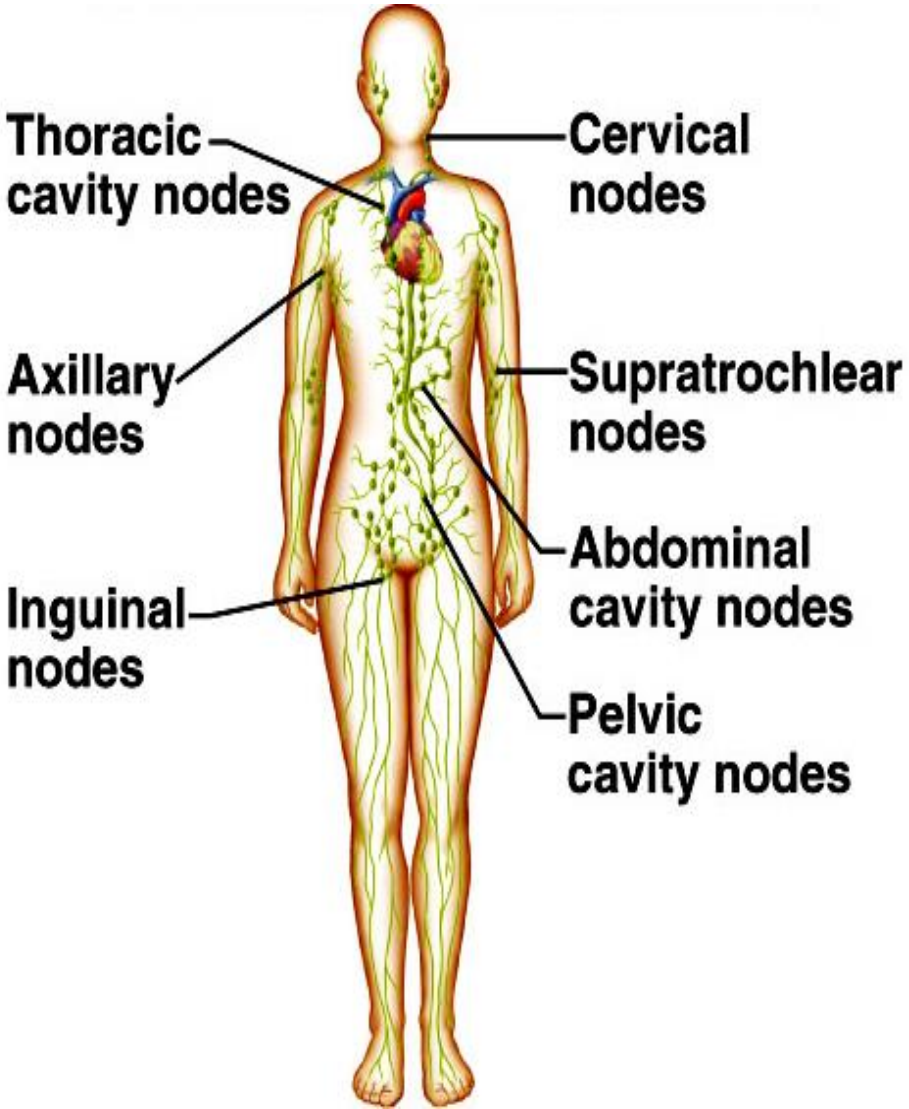
Features

- Bean-shaped bodies
- With **afferent vessels** (entering at the periphery) and **efferent lymph vessels**(emerging at the hilus)
- Arranged in groups, along the blood vessels or the flexural side of the joint
- Divided into **superficial and deep** groups



Regional Lymph drainage

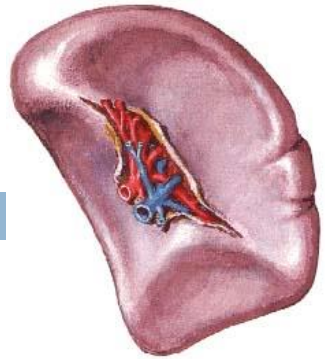


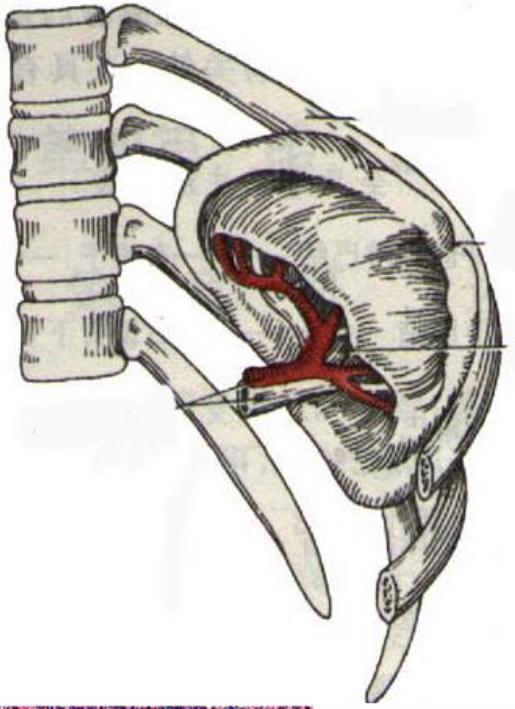


- **Regional Lymph Node** is the lymph node where the lymph of the organ or part of the body drainge to firstly

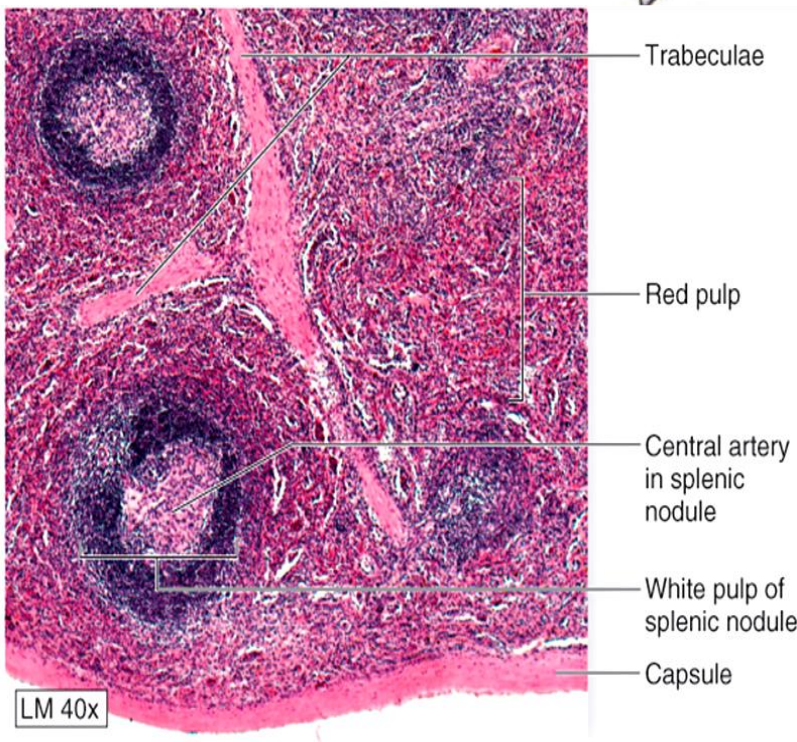
Sentinel Lymph Node(in clinic)

Spleen





- Location
  - Left epigastric region
  - between 9th-11th rib
  - in line of 10th rib
- Largest lymphatic organ in the body.
- Can vary considerably in size and weight

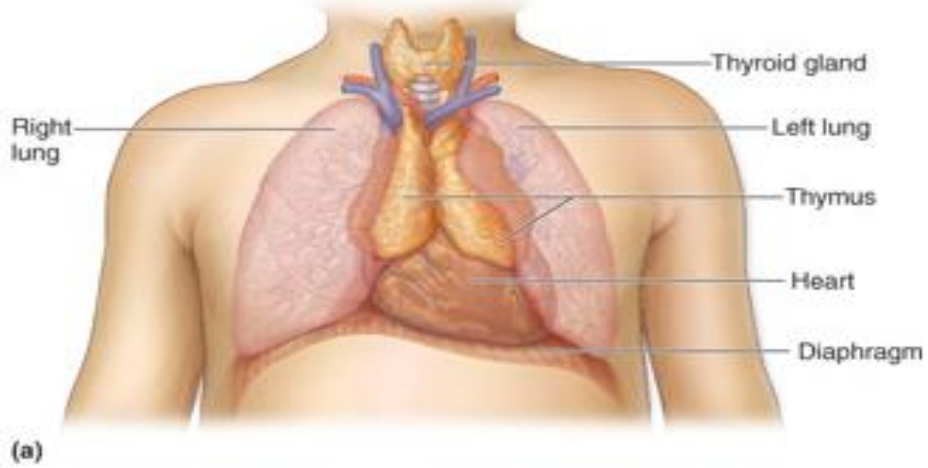


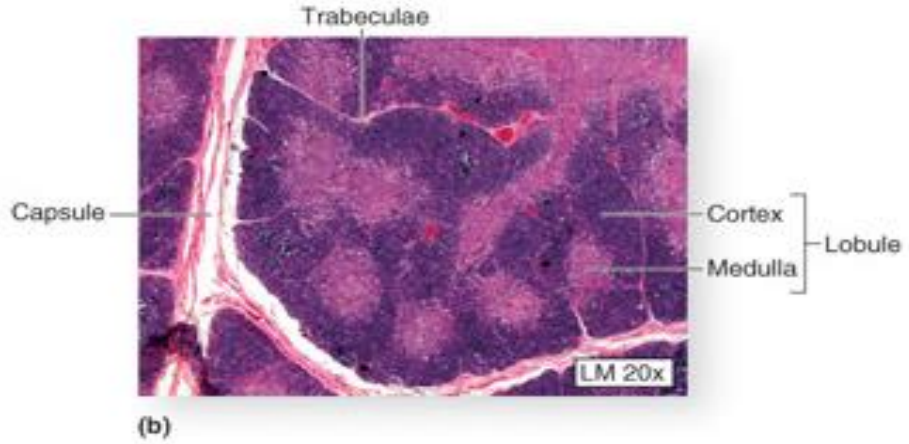
- Function

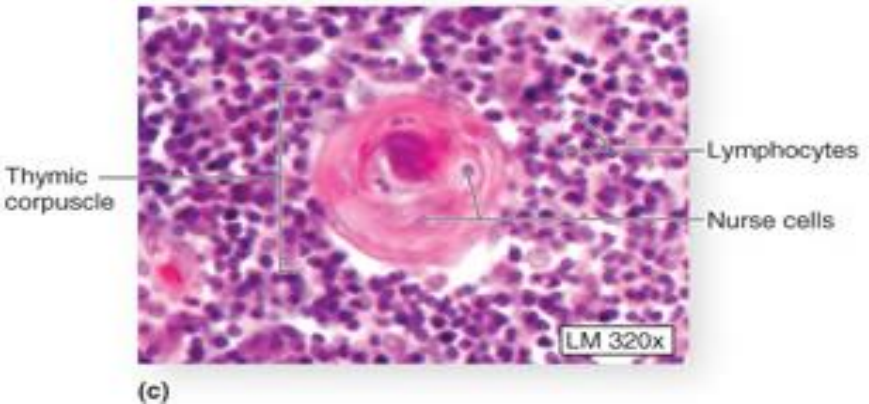
THYMUS

Features

- Consists of two elongated lobes
- Is a large organ in the fetus
- Occupies the thoracic cavity behind the sternum
- Secrete lymphopoietin







Lymphatic Nodules

- **Oval clusters of lymphatic cells with some extracellular matrix that are not surrounded by a connective tissue capsule.**

- Filter and attack antigens.

- In some areas of the body, many lymphatic nodules group together to form larger structures.
  - mucosa-associated lymphatic tissue (MALT) or tonsils
  - very prominent in the mucosa of the small intestine, primarily in the ileum
    - **Peyer patches**
  - also present in the appendix

MALT

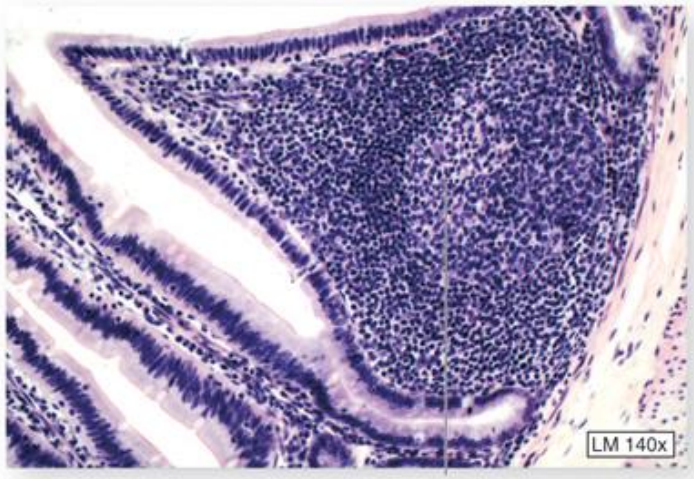
- MALT – mucosa-associated lymphatic tissue:
  - Peyer's patches, tonsils, and the appendix (digestive tract)
  - Lymphoid nodules in the walls of the bronchi (respiratory tract)
- MALT protects the digestive and respiratory systems from foreign matter

Tonsils

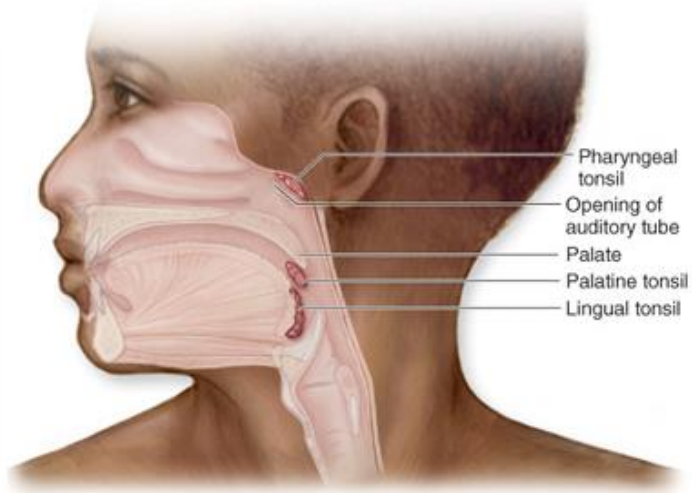
- clusters of lymphatic cells and extracellular matrix not completely surrounded by a connective tissue capsule.
- Consist of multiple germinal centers and crypts

- Several groups of tonsils form a protective ring around the pharynx.
  - pharyngeal tonsils (or adenoids) in nasopharynx
  - palatine tonsils in oral cavity
  - lingual tonsils along posterior one-third of the tongue

MALT (Mucosa Associated Lymphoid Tissue)



(a)



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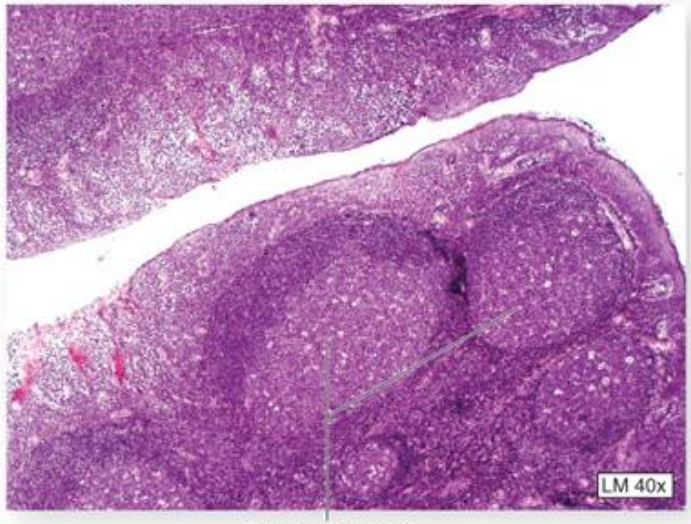


APPLIED ANATOMY

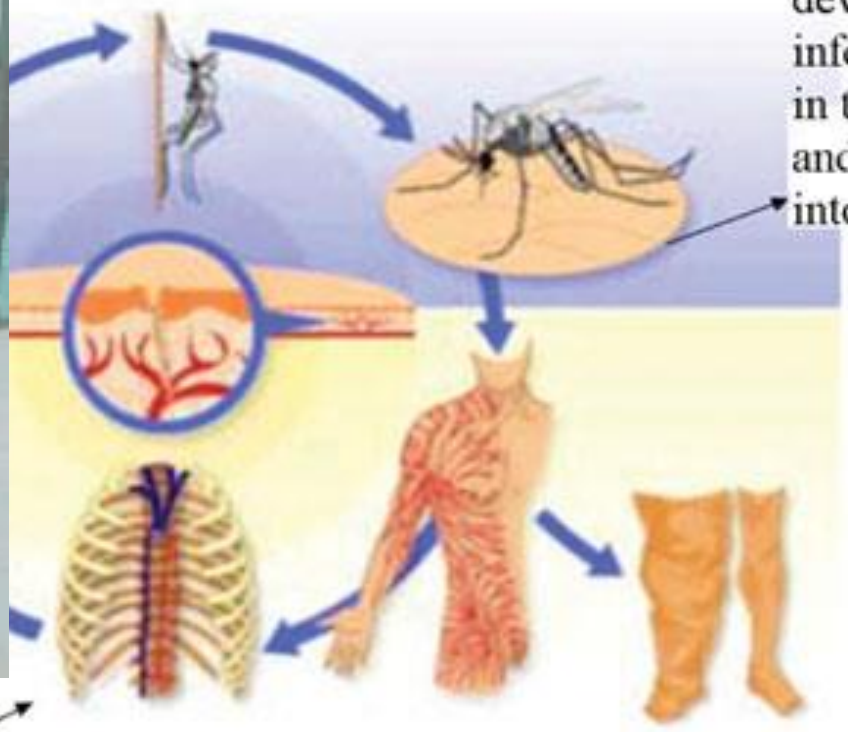
LYMPHANGITIS

Inflammation of the lymph vessels

Commonest cause bacteria called streptococcus pyogenes(most common).

- Lymph vessels appear as red streaks through the skin

FILARIASIS


(b) Microfilaria develop into infective larvae in the mosquito and are injected into a new host
(c) Larvae mature into adult worms and spread through the lymphatic vessels, where they mate and lay eggs

LYMPHEDEMA

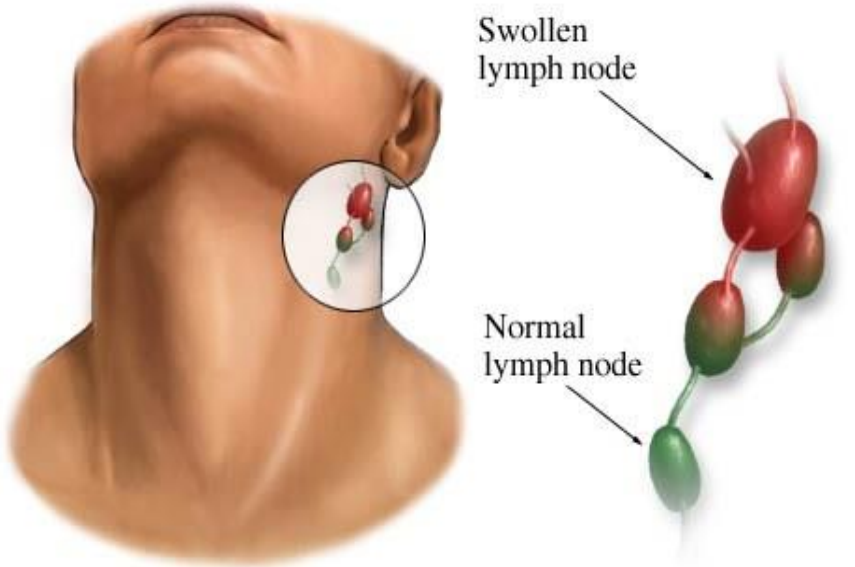
- Occurs due to **accumulation of lymphatic fluid** in the interstitial tissue

- Sometimes can be appreciated after wearing tight clothing or jewellary on affected limb

LYMPHADENOPATHY

- Means a **disease of the lymph nodes**

- Lymph nodes become swollen/ **enlarged** and may be painful to touch



LYMPHOMAS

- Cancers originating either from the lymphocytes in the lymph nodes or the lymphatic tissue in organs

- Risk factors -- **HIV, HEPATITIS, EBV infections**

TONSILLITIS

- **Infection of the pharyngeal tonsils**
- **Tonsils are swollen,**
- **Fever and pain during swallowing usually present**
- **Treatment – surgical removal of tonsils (TONSILLECTOMY)**

SPLENOMEGALY

- Enlarged Spleen
- Various causes