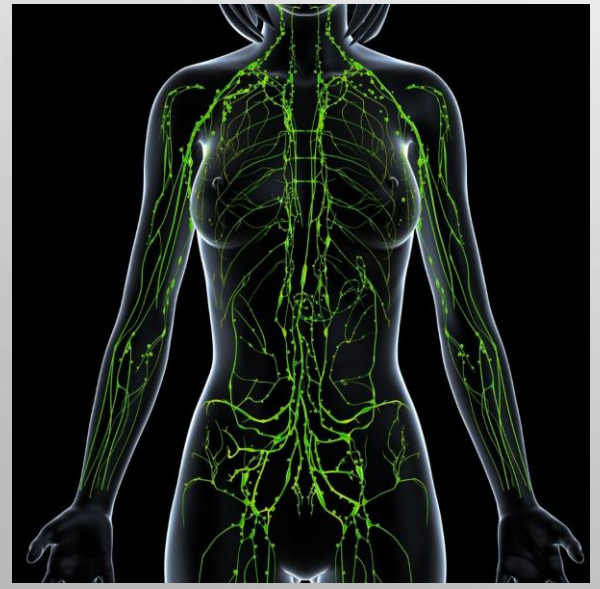
KAZAN FEDERAL (VOLGA REGION) UNIVERSITY
INSTITUTE OF FUNDAMENTAL MEDICINE AND BIOLOGY
DEPARTMENT OF MORPHOLOGY AND GENERAL PATHOLOGY

Lecture 6

Lymphatic System



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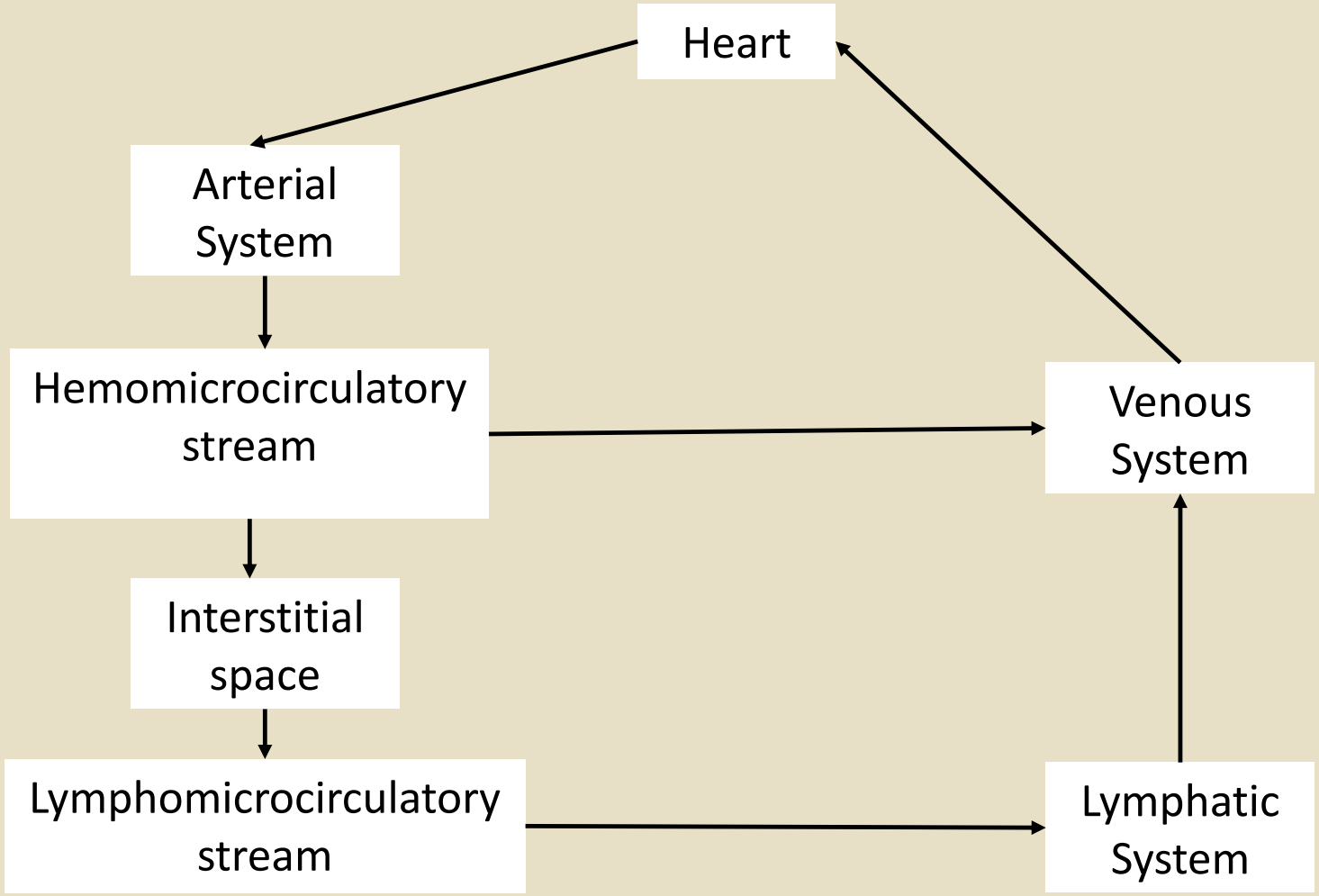
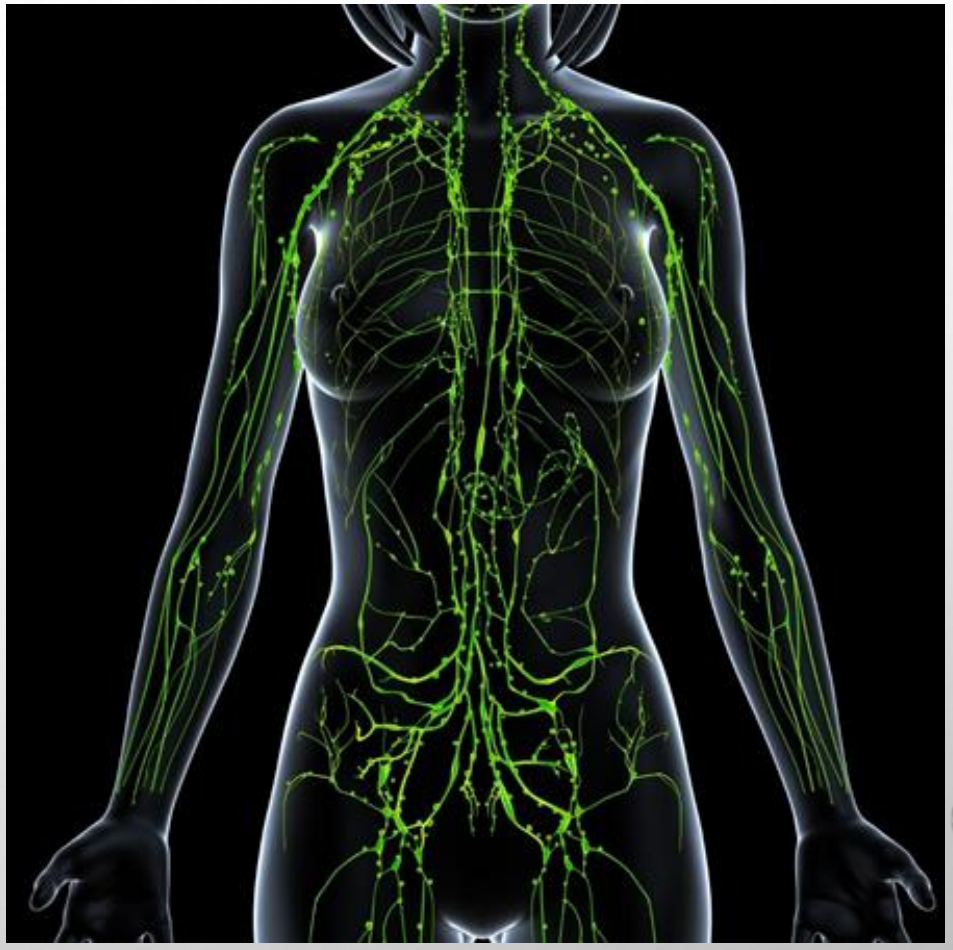
MD, PhD, Senior lecturer

Cardiovascular System



LYMPH FLOWS THROUGH THE LYMPHATIC VESSELS

LYMPH – PURE WATER



FUNCTION OF THE LYMPHATIC SYSTEM

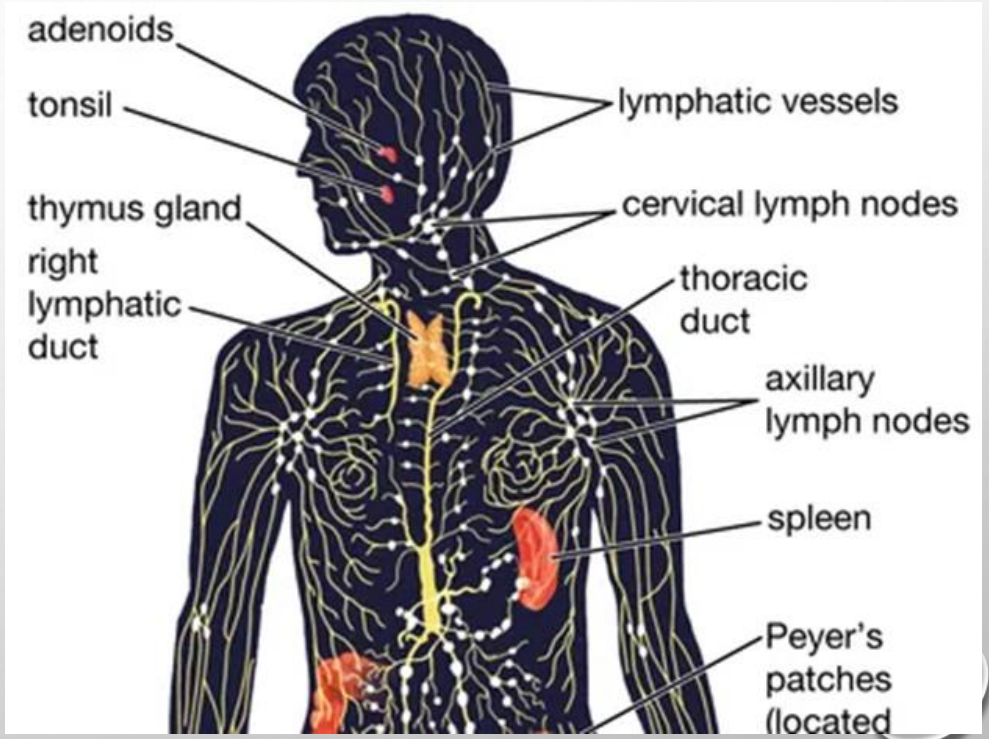
1. drainage of interstitial spaces;

2. transport function:

- it absorbs fluid and proteins which leave the blood stream and cannot be absorbed back into the blood capillaries;
- absorbs lipids, hormones, enzymes, different microelements;
- excretes the metabolic products and foreign bodies;

3. hemopoetic and immune functions.

- lymphocytes differentiate in the lymph
- Lymph nodes play the role of the mechanical and chemical filters which delay the transport of foreign bodies and proteins, bacteria, malignant cells, toxins into blood.



- The substances resorbed into the lymphatic capillaries further pass through the lymphatic vessels into venous system.

- The **lymph nodes** located along the way of the lymphatic vessels play the role of the mechanical and chemical filters which delay the transport of foreign bodies and proteins, bacteria, malignant cells, toxins into blood.

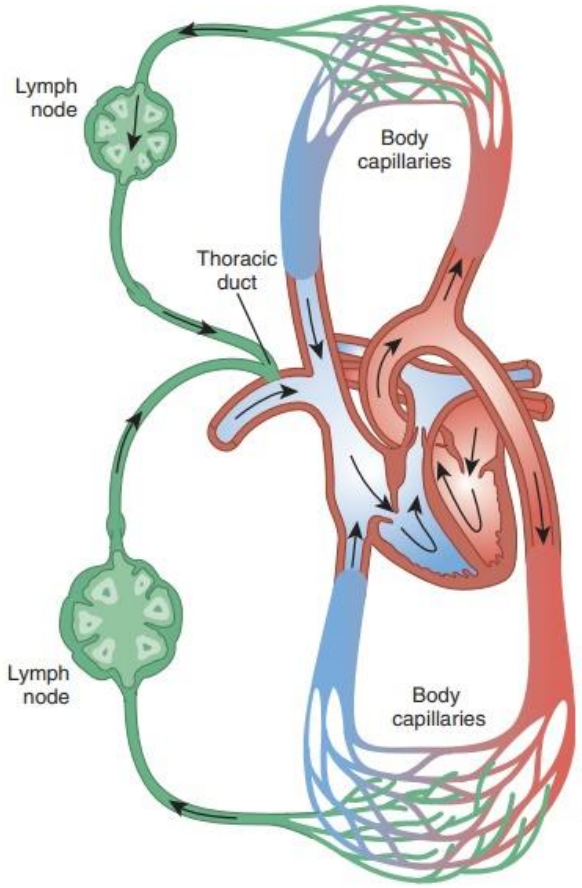


FIGURE The lymphatic system transports fluids through a network of vessels.

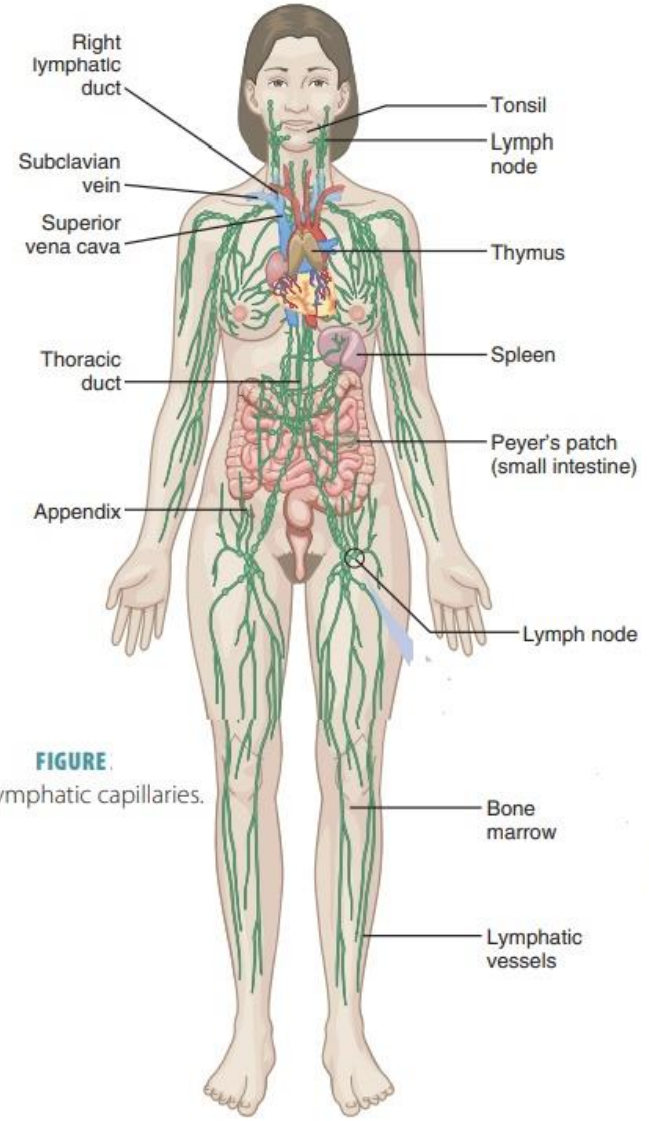
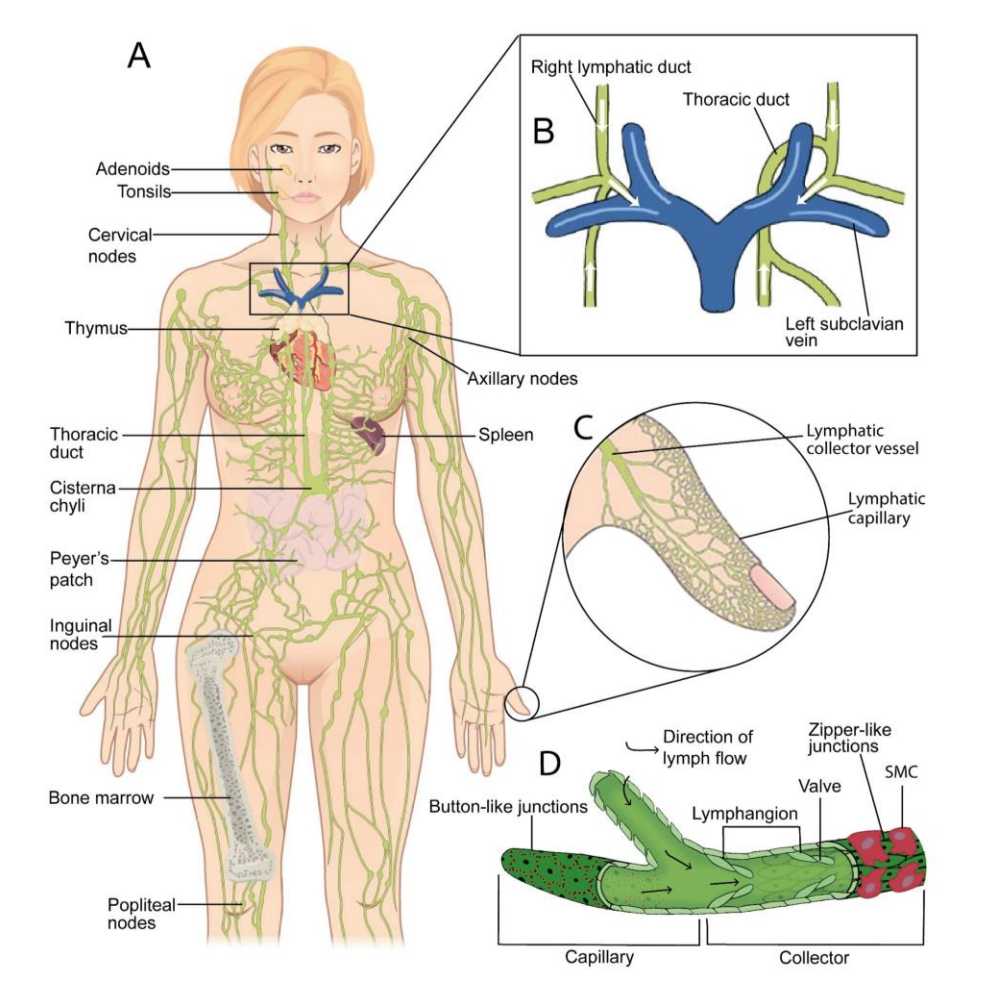


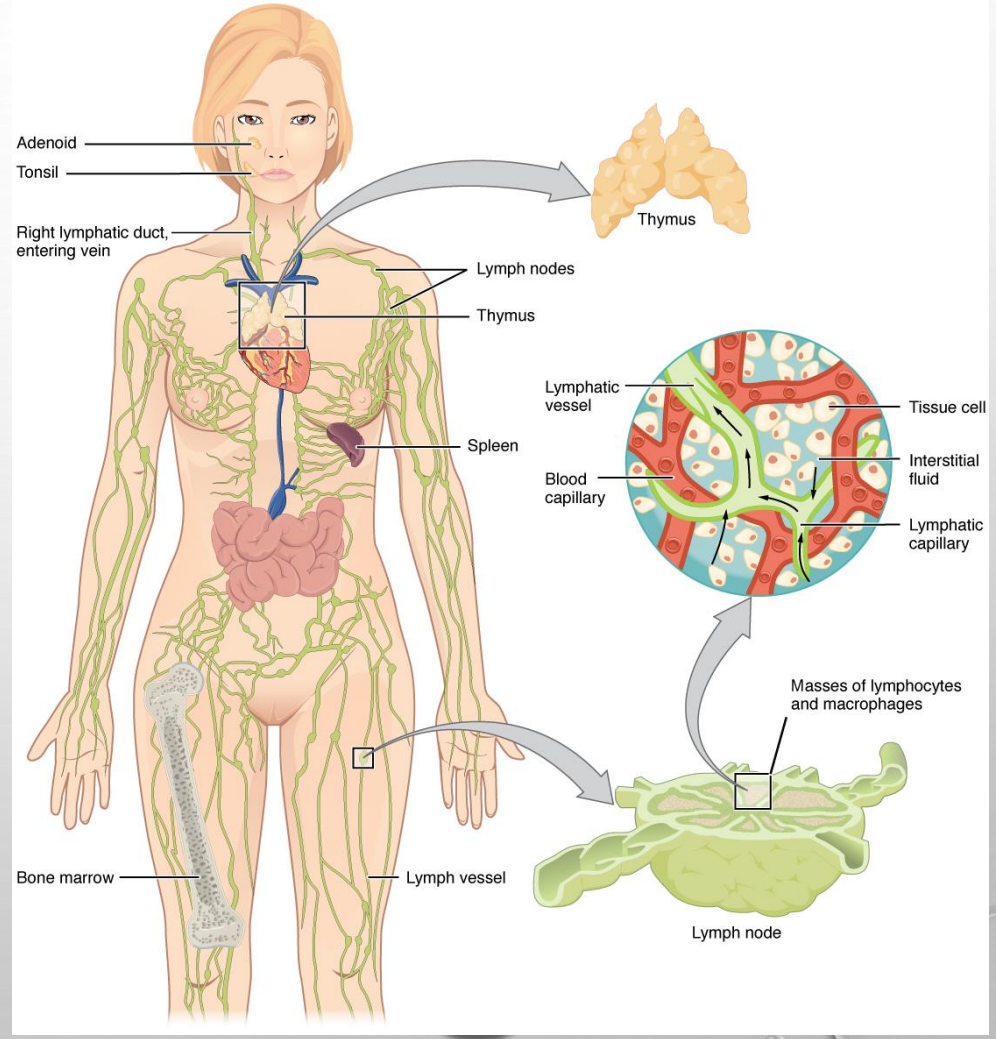
FIGURE
Lymphatic capillaries.

TWO PARTS OF LYMPHATIC SYSTEM

the way of lymph transport

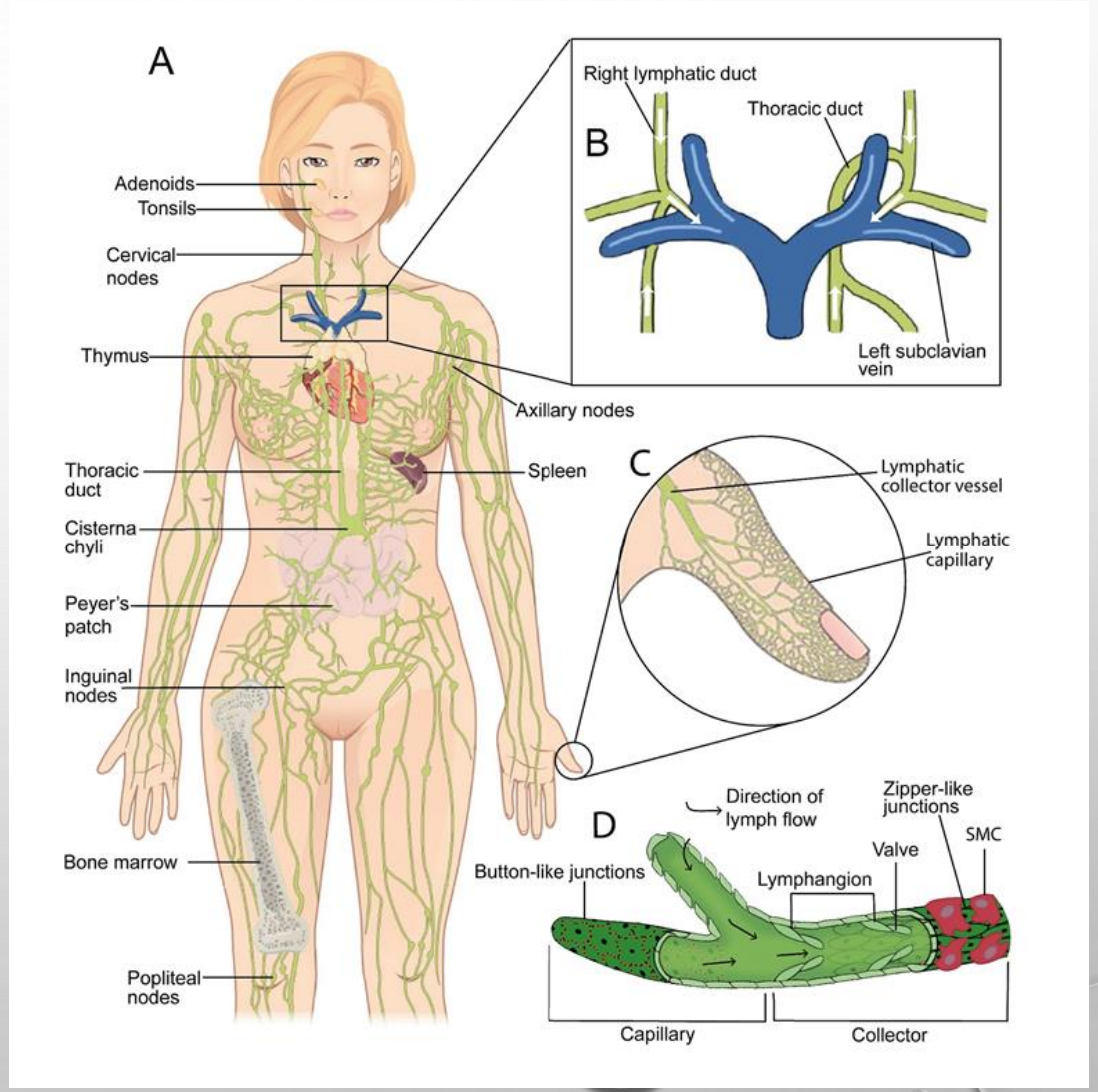


lymphoid organs
(which belong to the immune and haemopoetic organs)



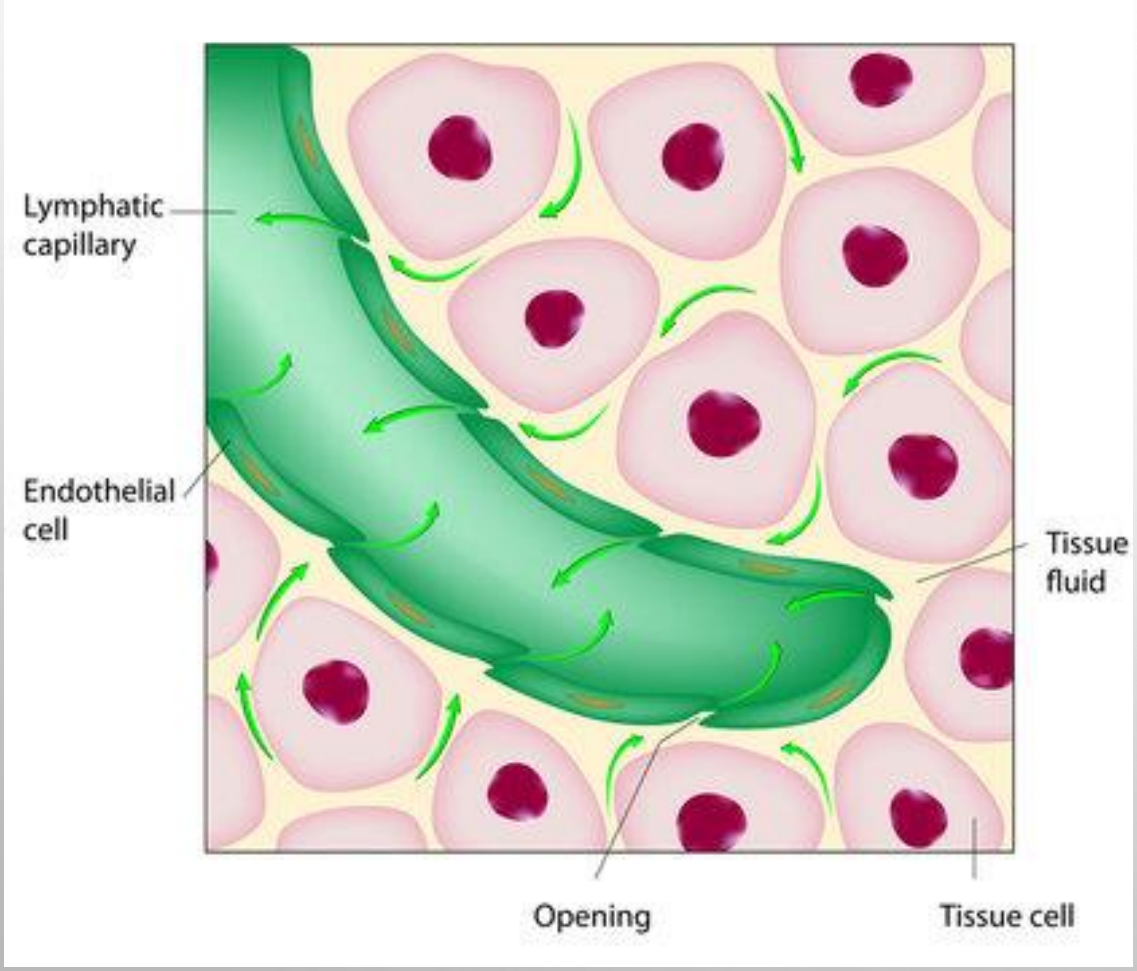
WAYS OF LYMPH TRANSPORT

- Capillaries (endothelial cells; without valves)
- Postcapillaries (endothelial cells; has valves)
- Lymphatic vessels (endothelial cells, smooth muscles, adventitia, valves)
- Lymphatic nodes
- Lymphatic trunk
- Lymphatic ducts (thoracic and right)



LYMPHATIC CAPPILARIES

(endothelial cells, without valves; starts blindly)



As soon as interstitial fluid enters the lymphatic capillary, it is called <u>lymph.</u>

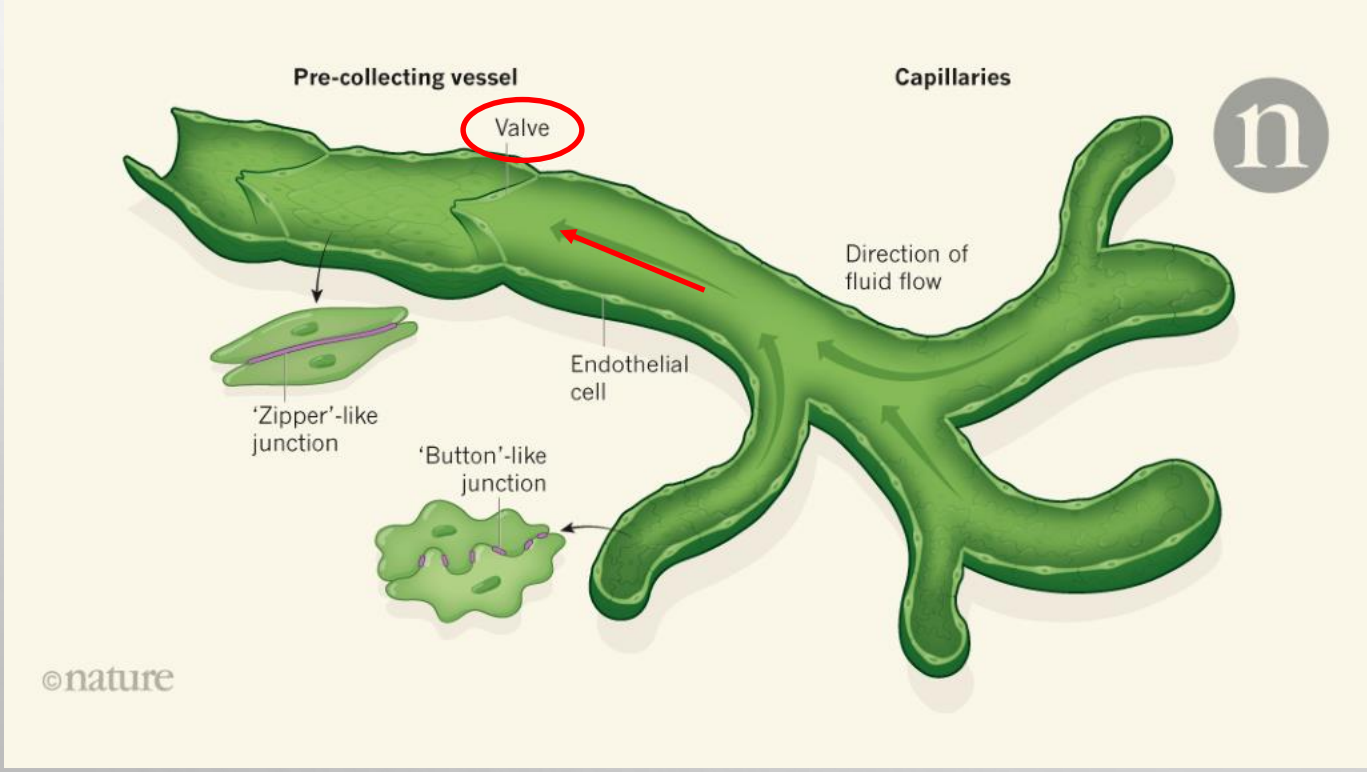
If it exits the lymphatic capillary, it is again called interstitial fluid (there are no valves, so it might just exit).

The lymphatic capillary can change its size and shape.

POSTCAPILLARIES

(PRE-COLLECTING VESSELS)

(endothelial cells, has valves)



Lymph movement through postcapillaries becomes orderly, and lymph flows in only one direction

Lymphatic vessels

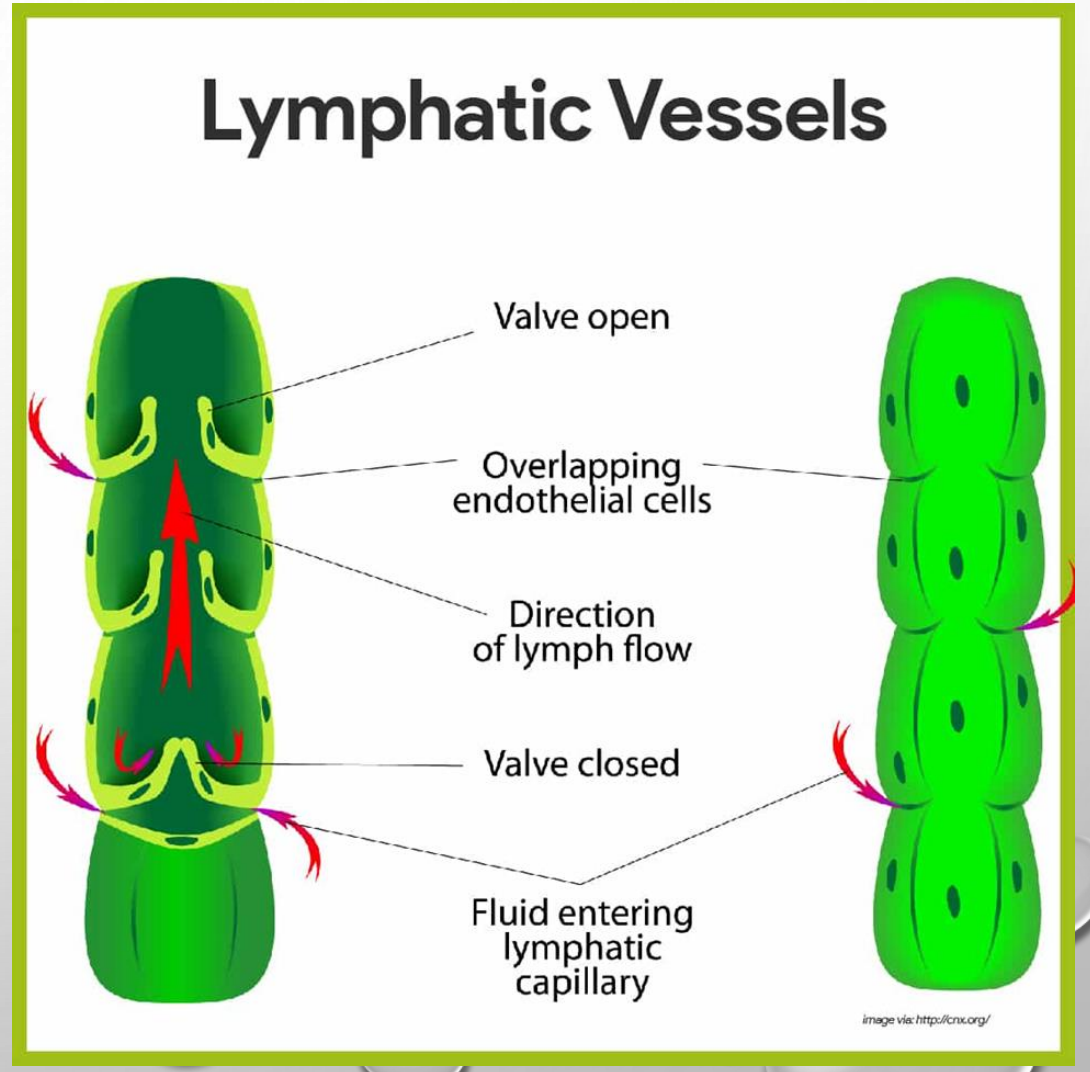
(endothelial cells, smooth muscles, adventitia, valves)

- Form the plexuses inside and outside the viscera, with numerous anastomoses.
- Lymphatic vessels freely communicate with veins.
- Depending on location, the lymphatic vessels can be:

- superficial (lie over the superficial fascia in subcutaneous tissue and take lymph from the skin, fat and superficial fascia)

- deep (lie under the superficial fascia and usually accompany blood vessels and nerves)

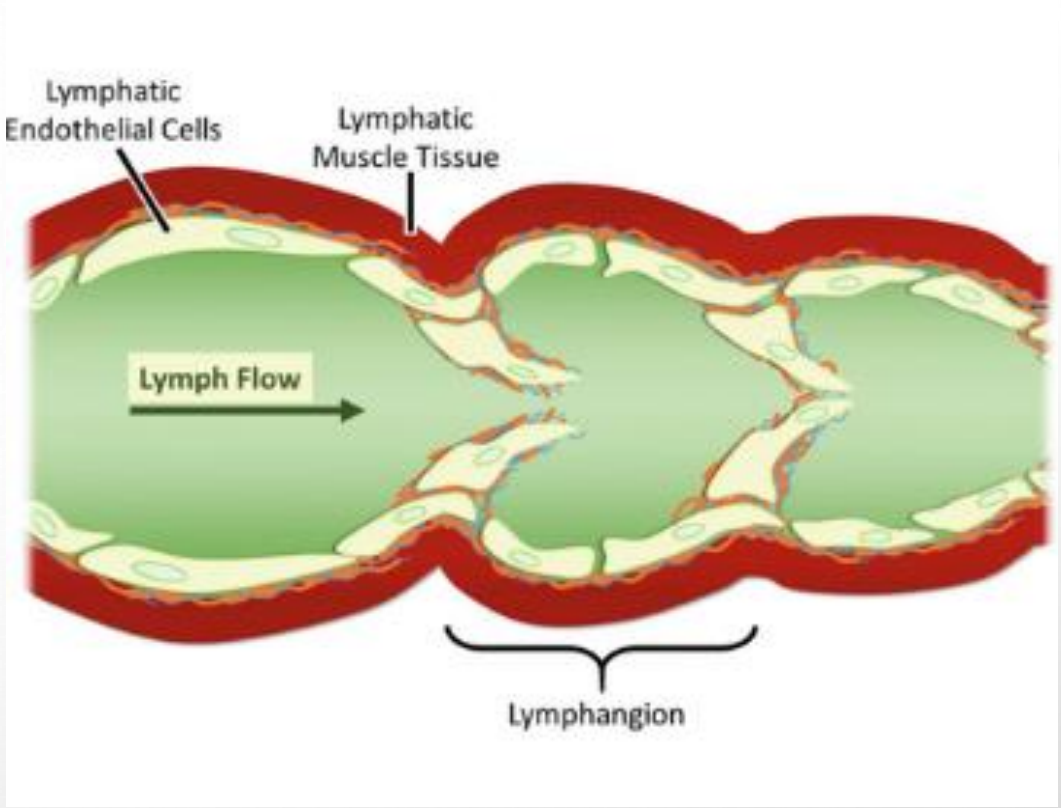
- Relatively to the lymph node, there are afferent and efferent lymphatic vessels

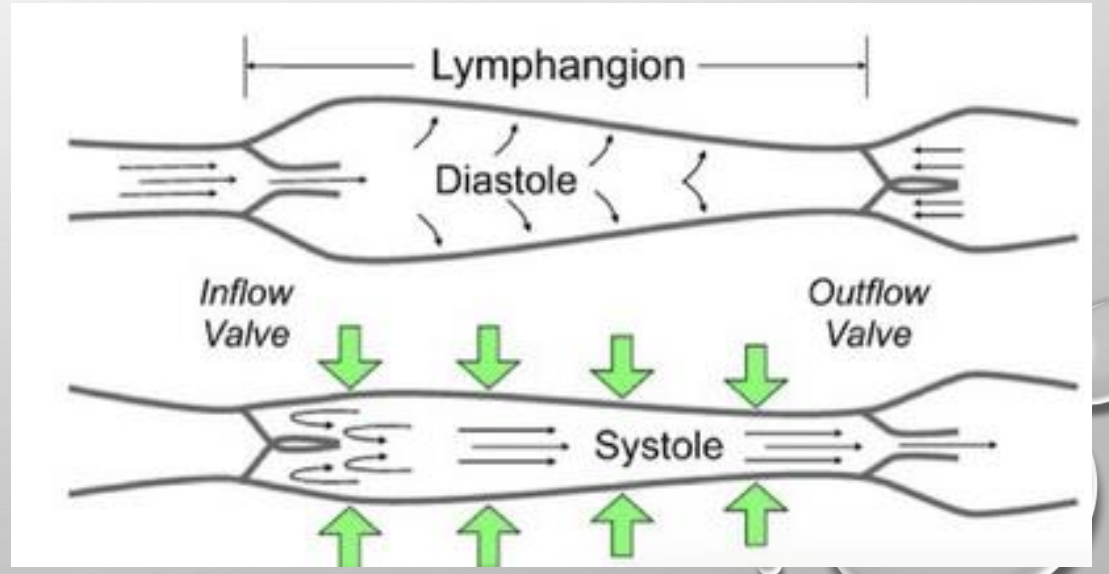


- A part of a lymphatic vessel between two valves is called **lymphangion.**

- In the wall of lymphagion there is a muscle cuff consisting of three layers of spirally oriented myocytes: internal, middle and external.

- The contractile activity of each lymphangion plays the main role in the lymph outflow.





Lymphatic nodes

- Lie on the way of lymphatic vessels from the organs of tissues
- They are solitary or aggregated
- Regional and far lymph nodes
- Superficial and deep

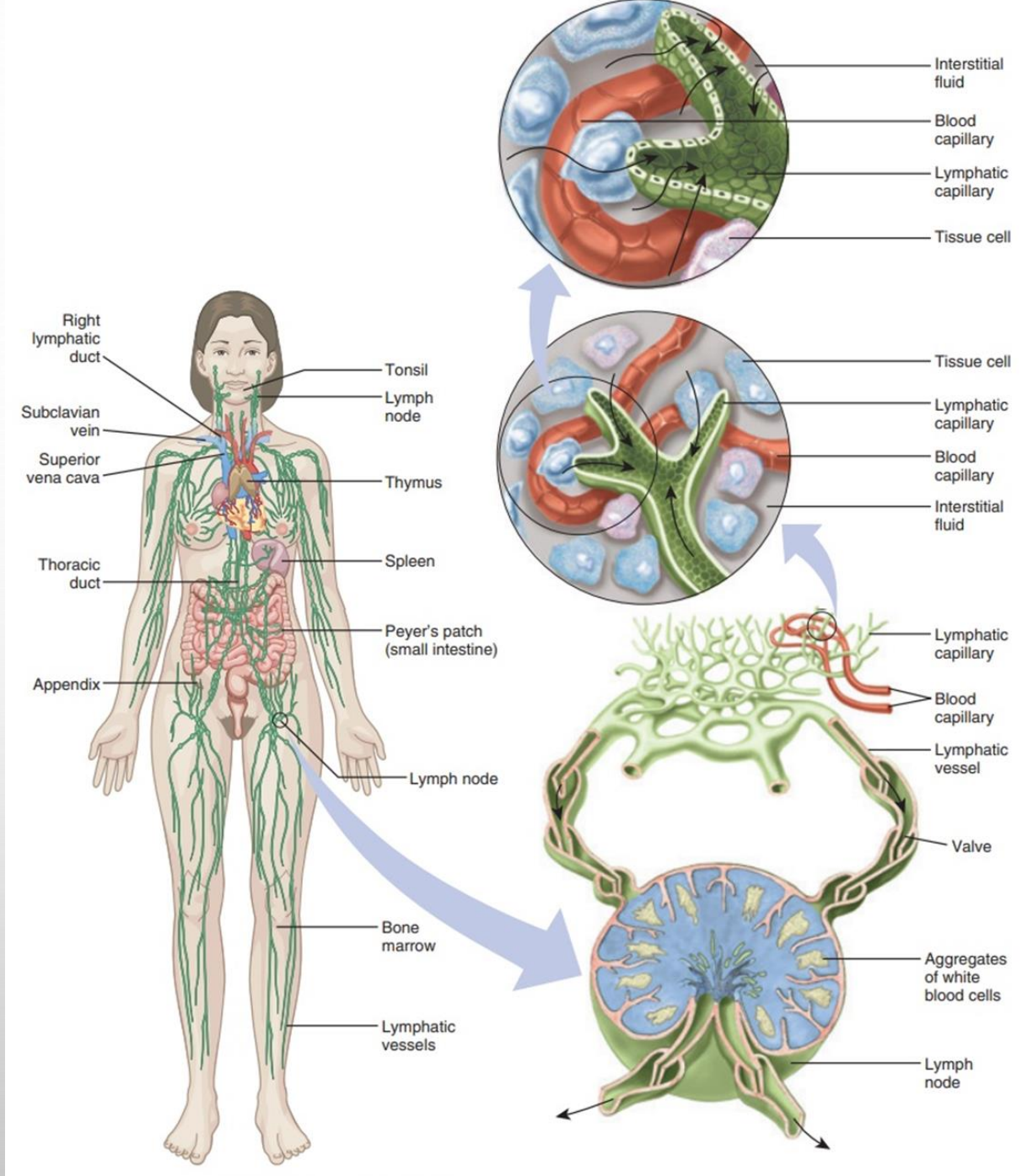
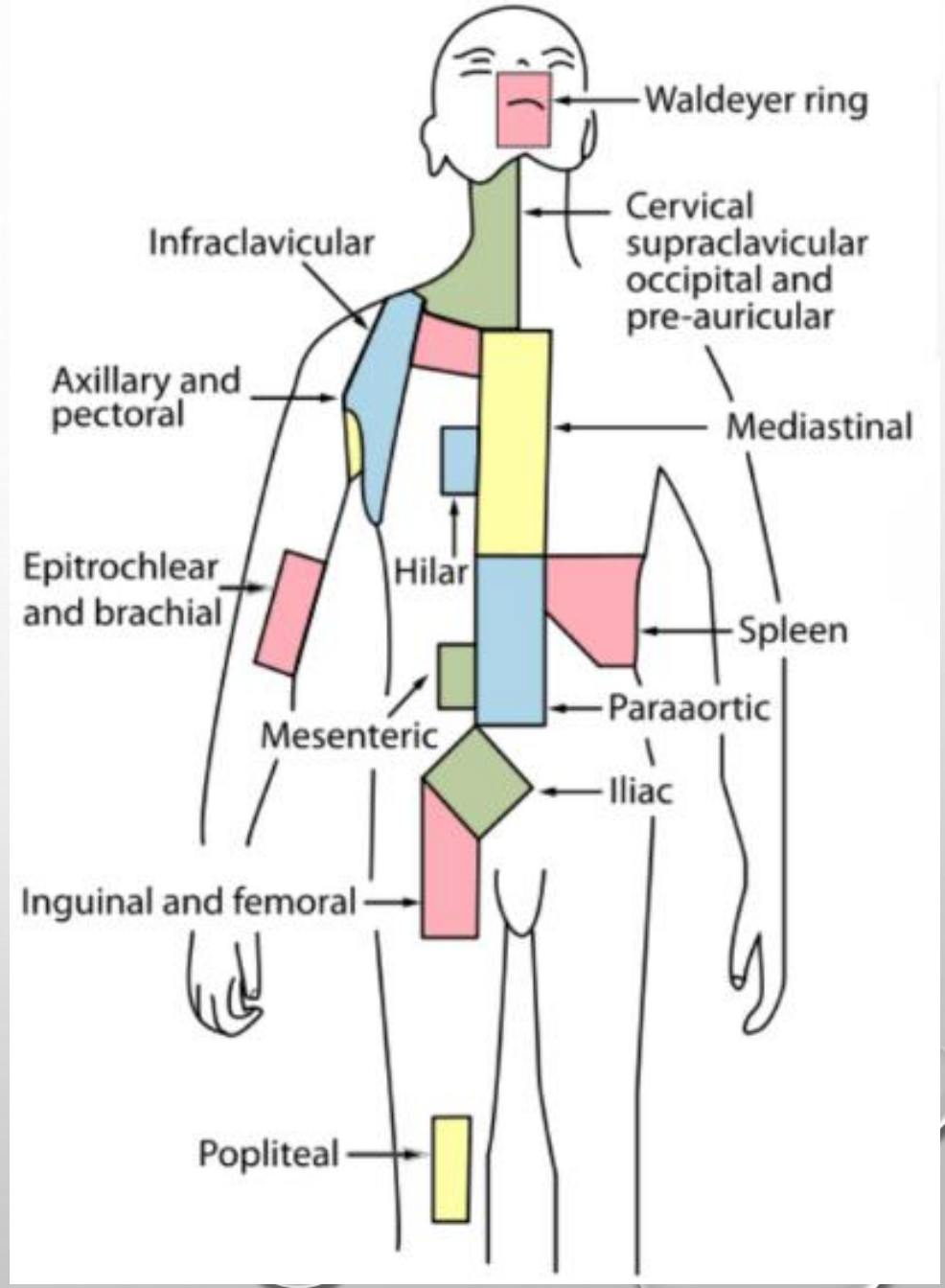


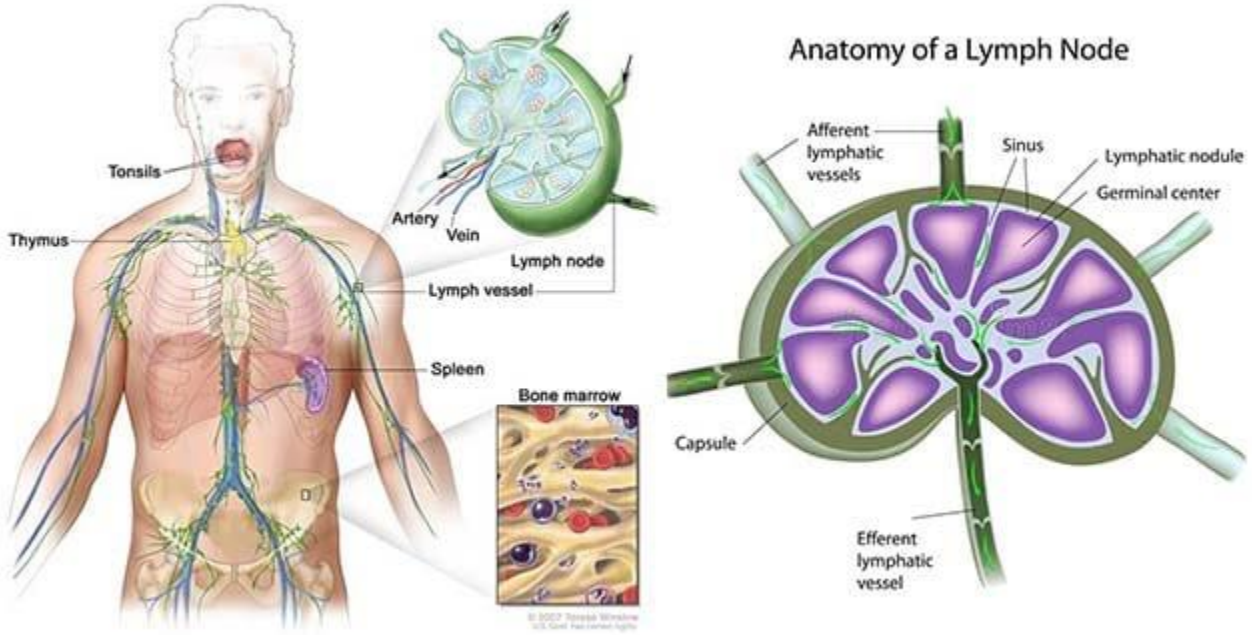
FIGURE 20-2 Lymphatic capillaries.

MAIN GROUPS OF LYMPHATIC NODES

- Occipital
- Cervical
- Preauricular
- Submandibular
- Submental
- Supraclavicular
- Infraclavicular
- Axillary
- Epitrochlear
- Inguinal
- Femoral
- Popliteal
- etc.

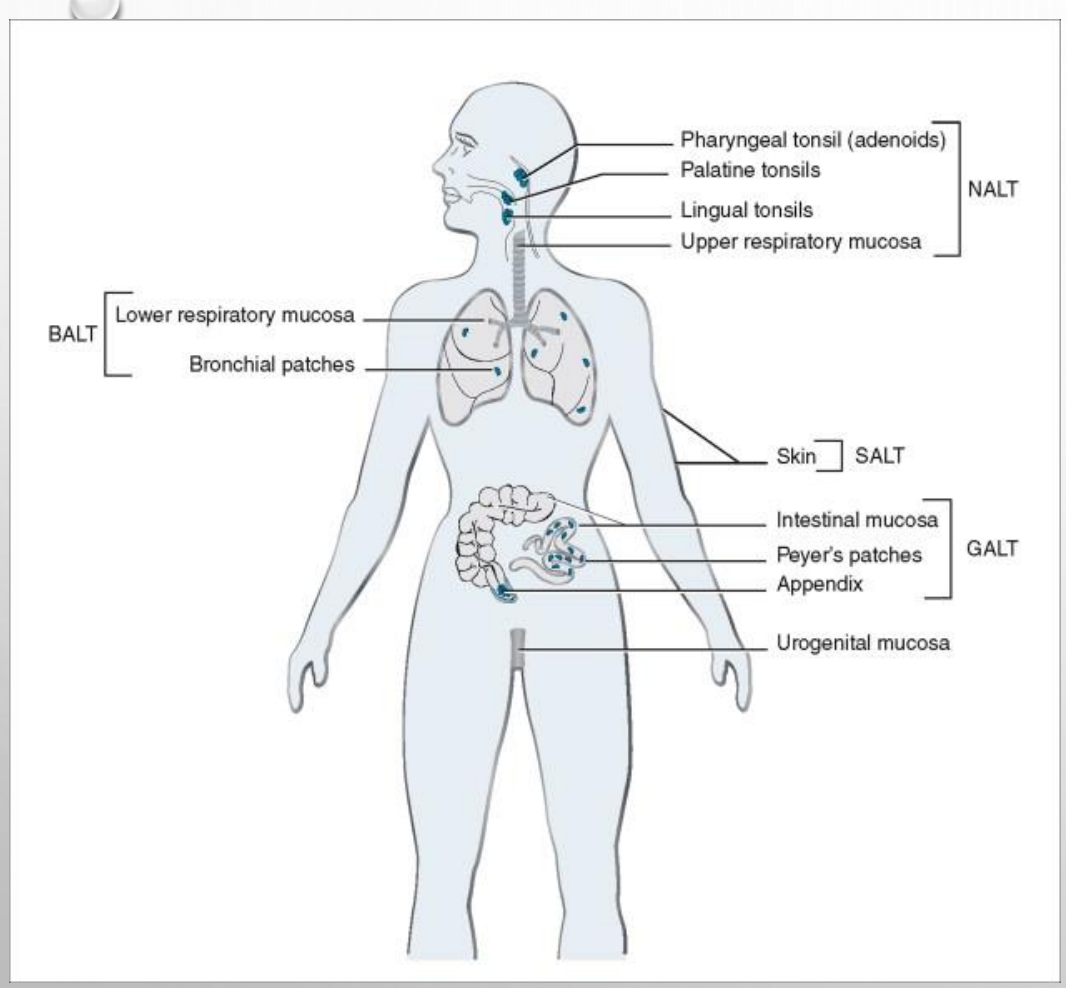


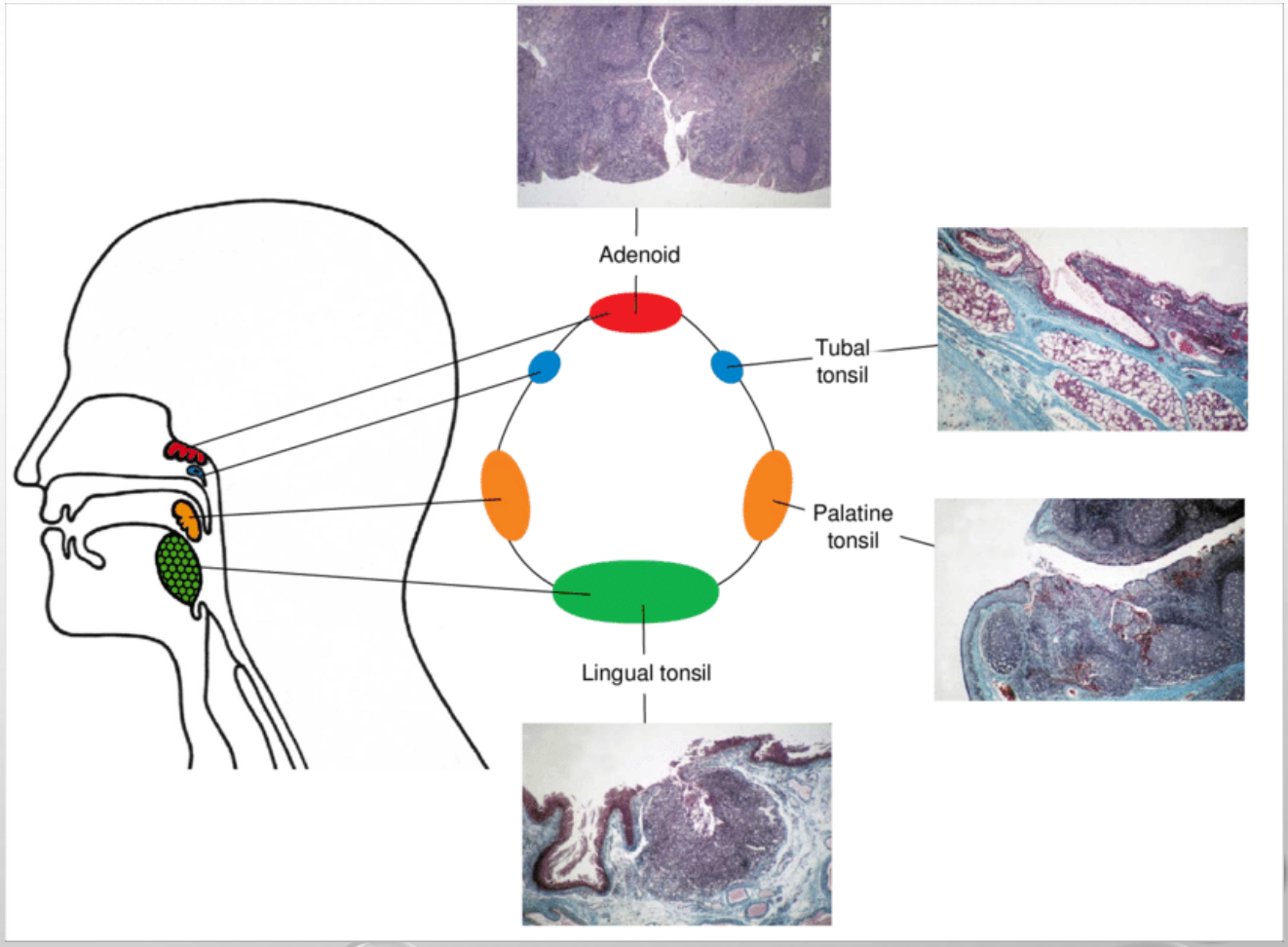
LYMPHATIC NODES FUNCTION



- 1) lymphopoetic;
- 2) immunopoetic (plasma cells are produced in the nodes);
- 3) barrier and filtration (delay foreign bodies, bacteria, foreign proteins and tumor cells);
- 4) reserve (deposition of flowing lymph);
- 5) metabolic (participate in metabolism of proteins, fats, vitamins etc.);
- 6) propulsive (contribute the lymph flow).

LYMPHOEPITHELIAL FORMATIONS IN THE ALIMENTARY TRACT

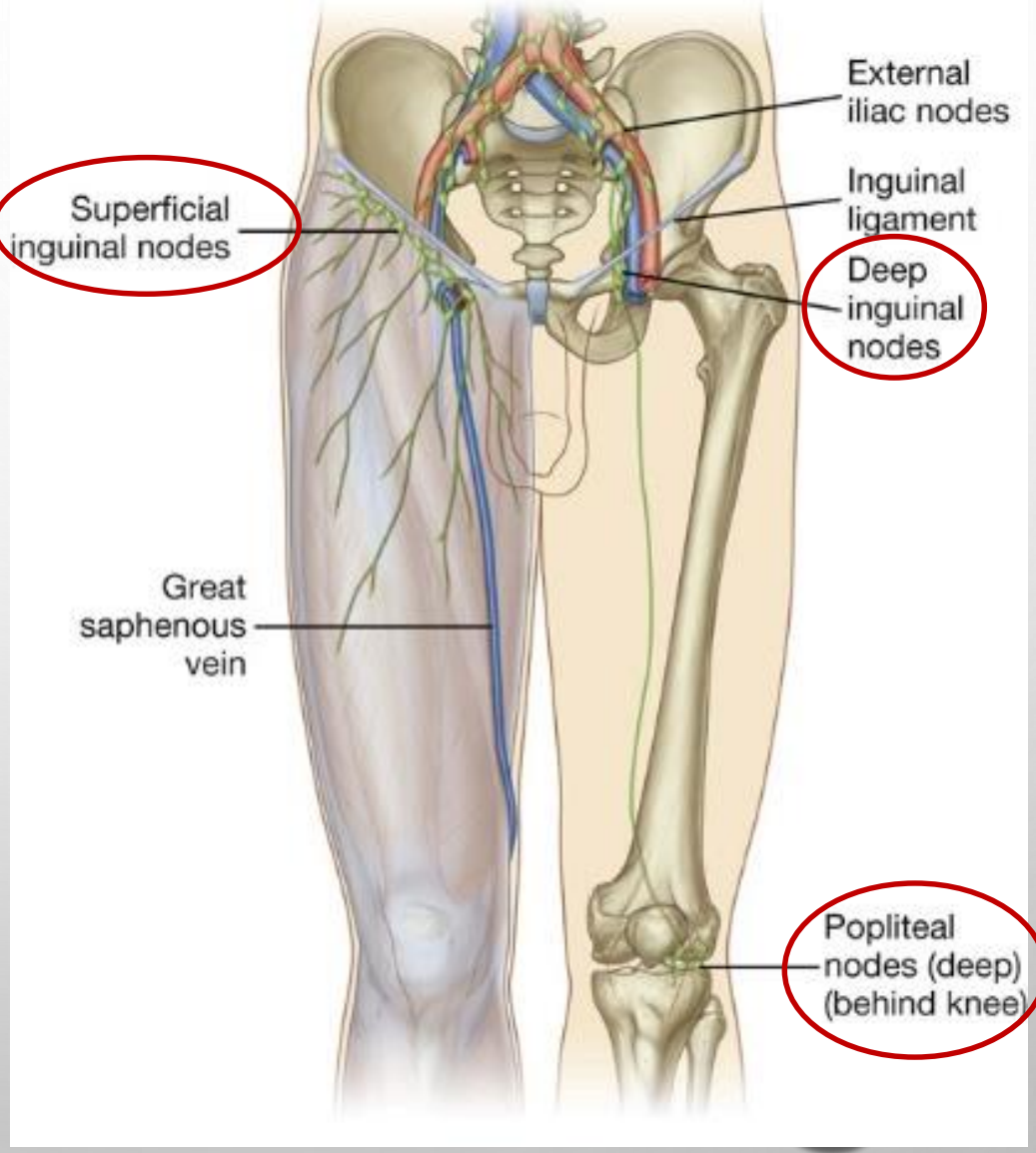


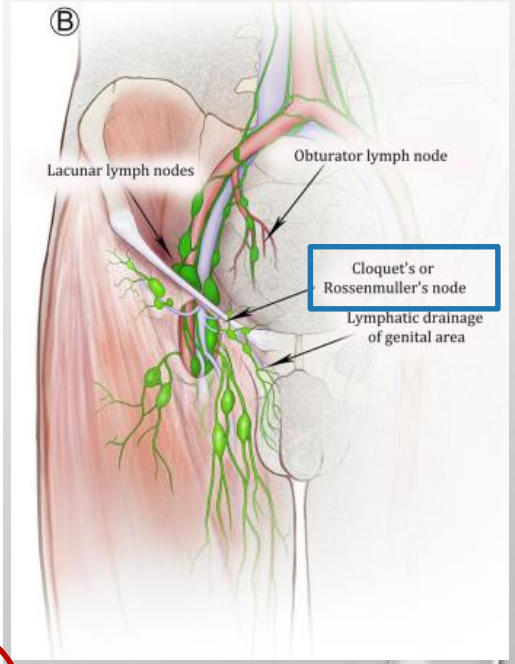


LYMPH VESSELS AND NODES OF THE LOWER EXTREMITY

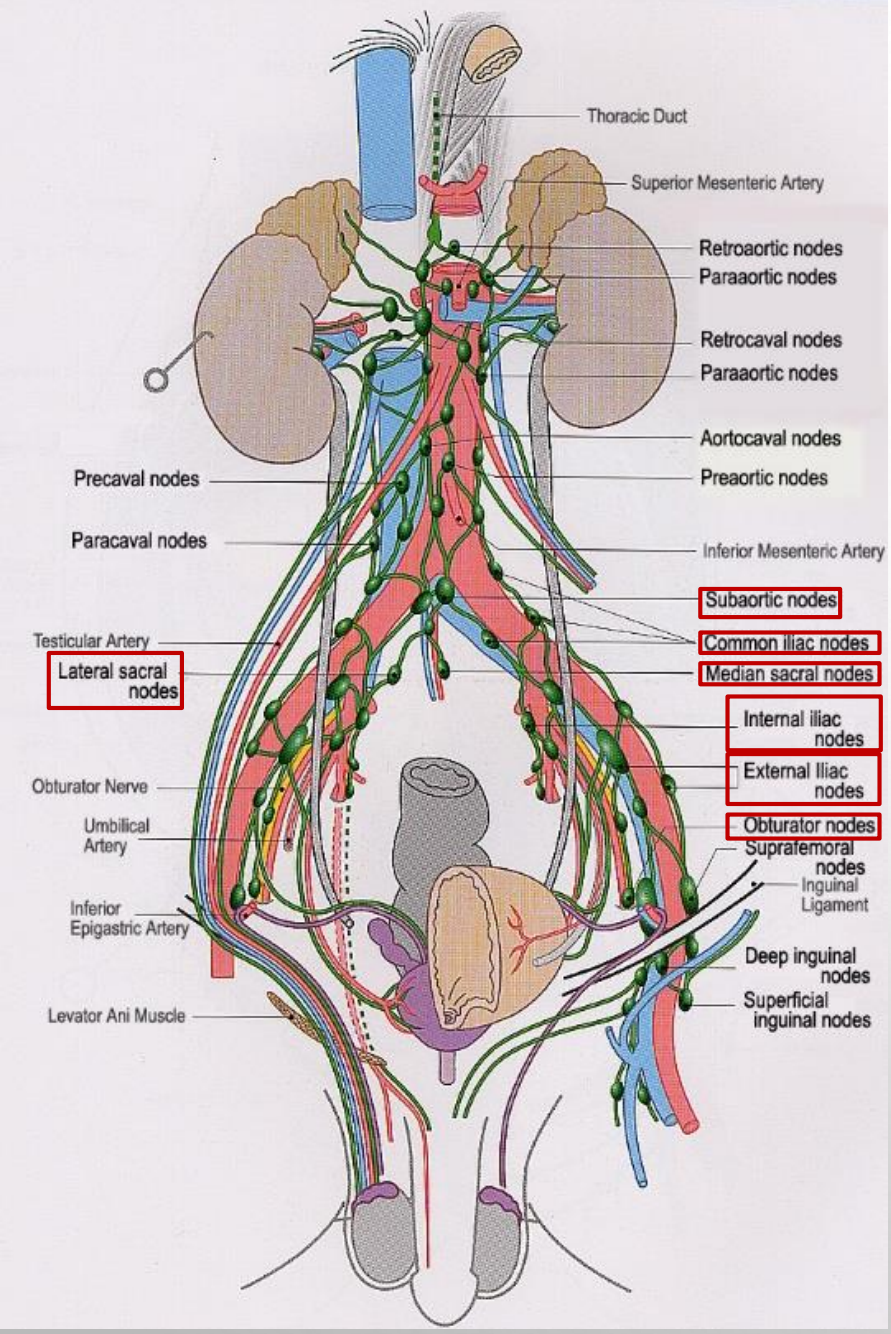
lymph vessels in the lower limb

- superficial
  - lie over the superficial fascia
    - take lymph from the skin and subcutaneous fat
- deep
  - accompany the large arteries in the leg and tight and join the deep lymphatic nodes
    - drain the muscles, fascia, bones, nerves, synovial bursae and joint capsules and tendinous sheats

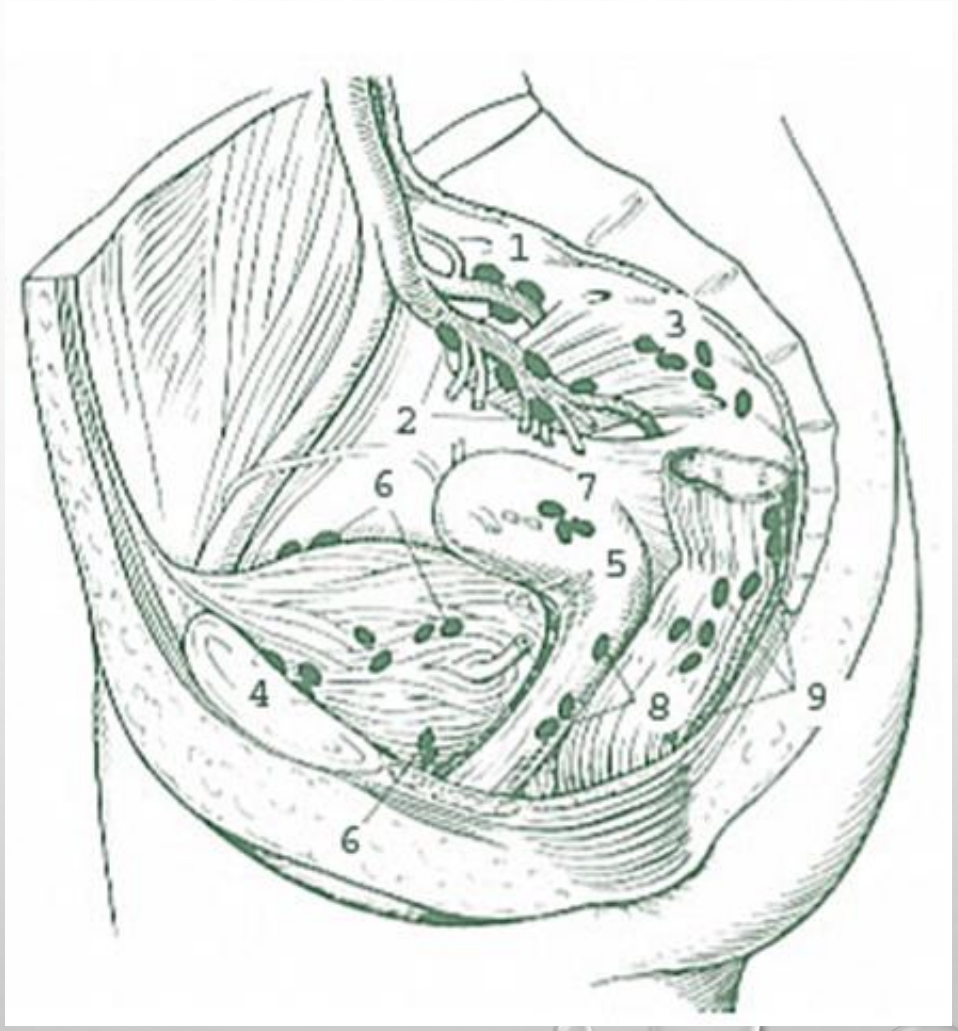




PELVIC LYMPHATIC VESSELS AND NODES



parietal



visceral

Lymph Nodes

Parietal

1 – Superior gluteal

2 – Inferior gluteal

3 – Sacral

Visceral

4 – Prevesical

5 – Postvesical

6 – Lateral vesical

Paravesical

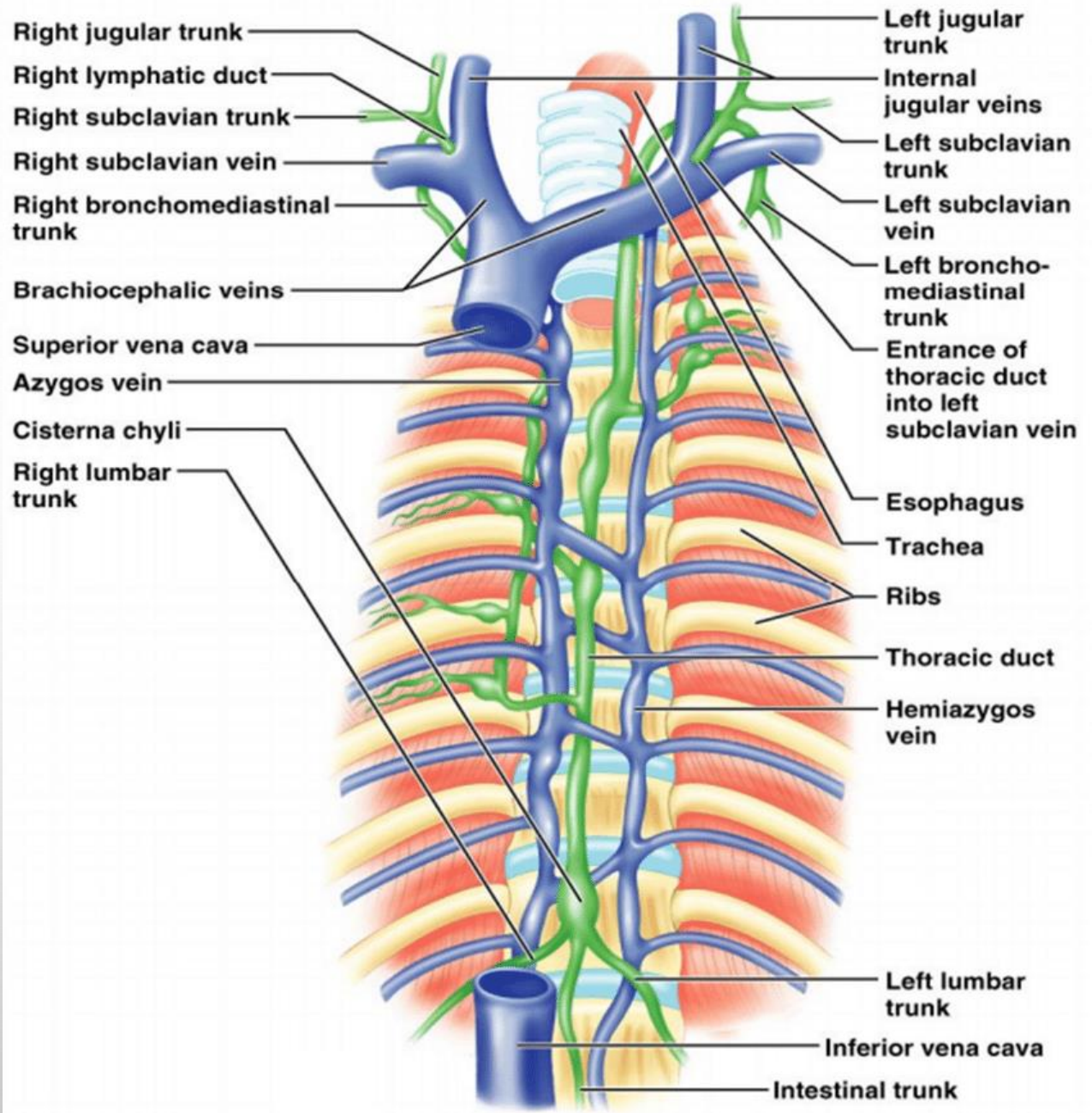
7 – Parauterine

8 – Paravaginal

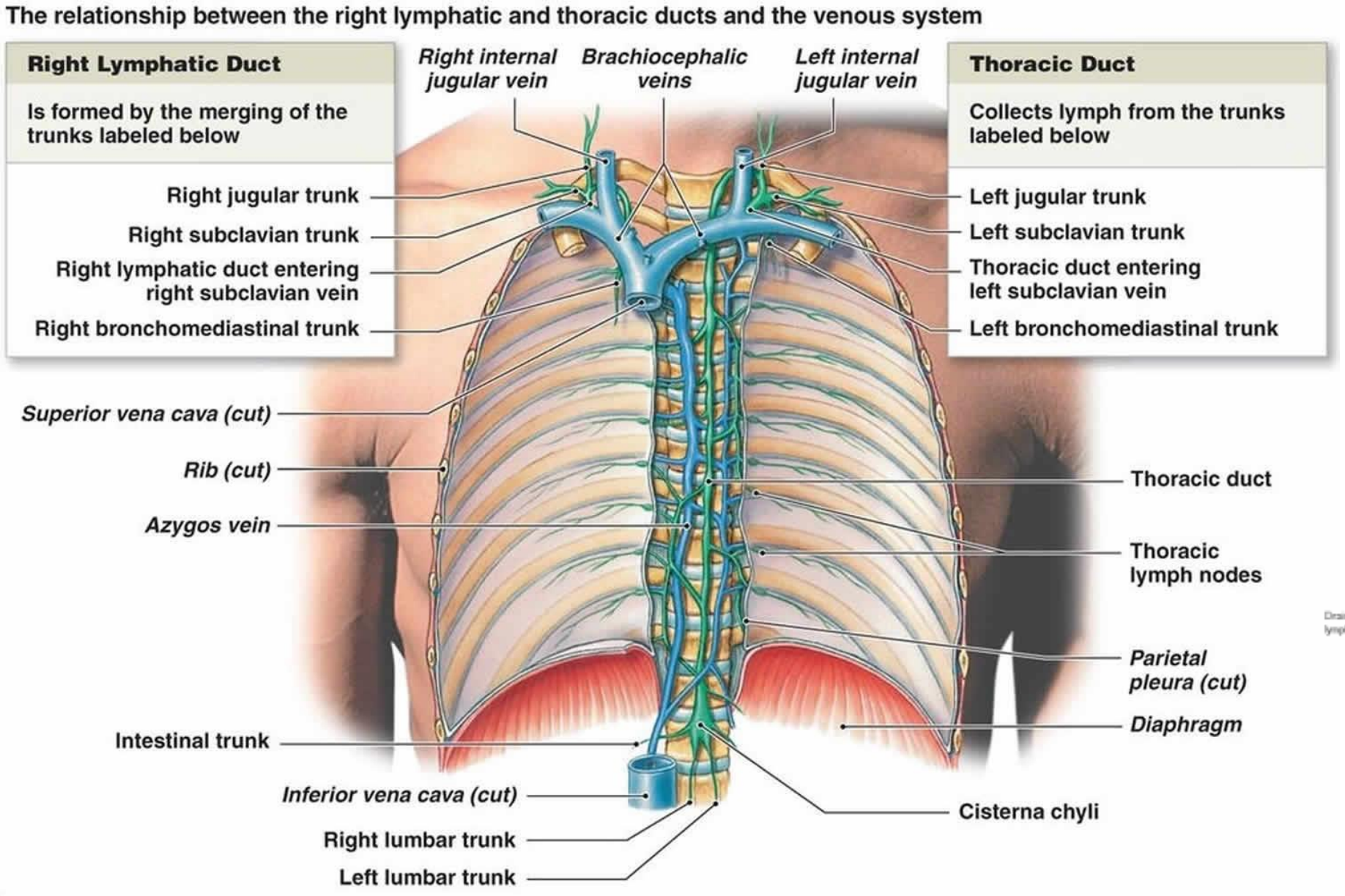
9 – Anorectal (pararectal)

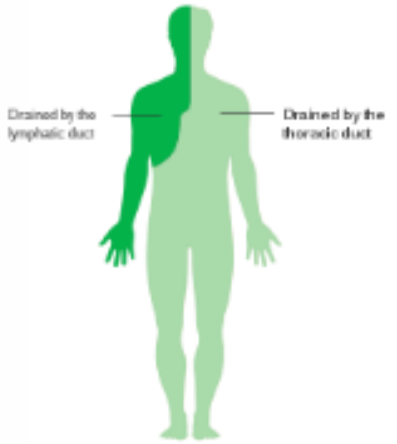
LYMPHATIC TRUNKS

- After the lymphatic vessels pass the last group of the lymph nodes, they unite into the lymphatic trunks.
- Intestinal
- Paired:
- Jugular
- Subclavian
- Bronchomediastinal
- Lumbar

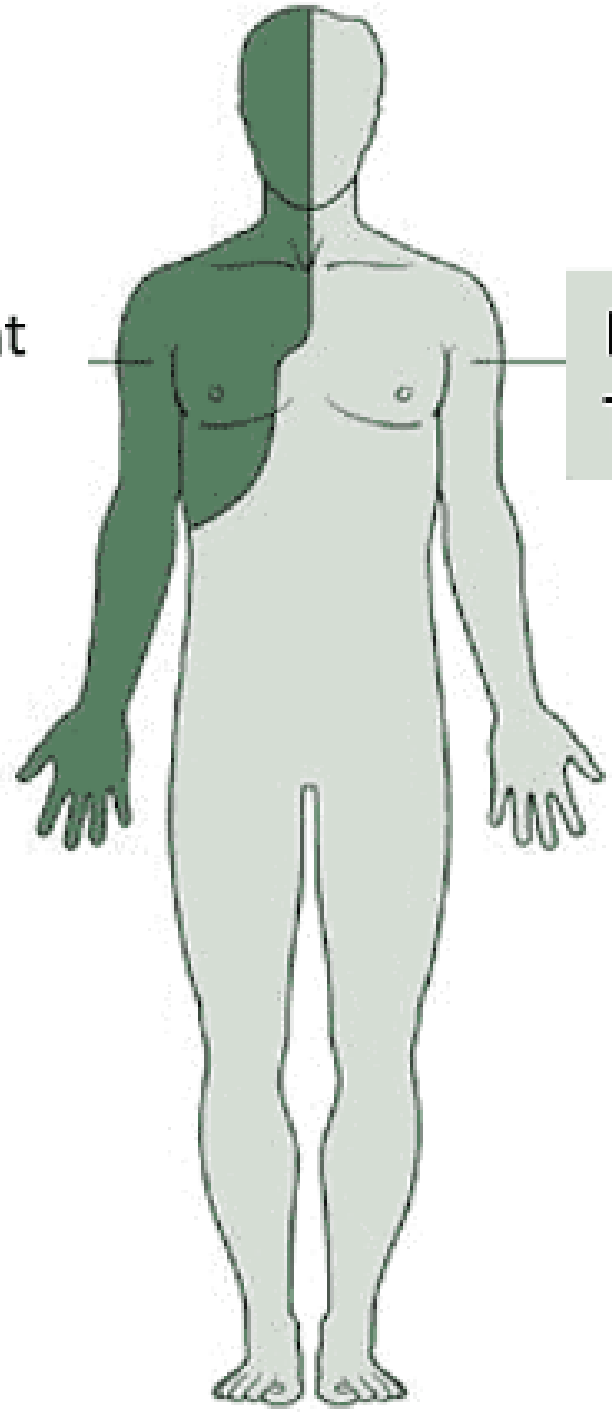


All the trunks unite into two ducts: right lymphatic duct and thoracic duct which drain into the large veins.





Drained by right lymphatic duct



Drained by **Thoracic duct**

1/4 of all lymph:

- the right half of the head and neck,
- right upper extremity,
- the right half of the chest and thoracic organs

3/4 of all lymph:

from almost whole body, <u>excluding</u> the right half of the head and neck, right upper extremity, the right half of the chest and thoracic organs

SOME ORGANS AND TISSUES DO NOT HAVE LYMPHATIC VESSELS

- Cartilagineous tissue
- Tooth cement
- Cornea
- Nails
- Hairs

Placenta, bones, brain tissue also do not have lymphatic vessels by they have light fluid resembling lymph which at first accumulates in intercellular and intraadventitial spaces of these organs and then is absorbed by lymphatic capillaries of nearest organs or drains into veins.

- **Lymphedema** refers to tissue swelling caused by an accumulation of protein-rich fluid that's usually drained through the body's lymphatic system

- Lymphedema can occur when the lymph system is damaged, which can prevent the lymph fluid from returning to the blood.