

IN THE NAME OF GOD

General anatomy
For
paramedicine student
By
Dr. Saeednia



The immune system:

Natural immune system

Acquired immune system

Cells:

Phagocyte

Lymphocyte

Antigen presenting cells

In order to immune system perfectly do these functions:

The Lymphoid tissue + Lymphoid organs = Lymphatic system:

Lymph

Lymphatic capillary & vesseles

The Lymphoid tissue:

nodules / diffuse (peyer's patch)

Lymphoid organs:

Thymus / lymph nodes / spleen / tonsils

INTRODUCTION

The lymphatic system is intimately associated with the blood and the cardiovascular system. Both systems transport vital fluids throughout the body and both have a system of vessels that transport these fluids. The lymphatic system transports a fluid called lymph through special vessels called lymph capillaries and lymphatics. This lymph eventually gets returned to the blood from where it originated. In addition to fluid control, our lymphatic system is essential to helping us control and destroy a large number of microorganisms that can invade our bodies and cause disease and even death. The lymphatic system consists of lymph, lymph vessels, lymph nodes, and four organs. The organs are the tonsils, the spleen, the thymus gland, and Peyer's patches. Figure 15-1 shows the vessels and organs of the lymphatic system.

Lymph

The primary function of this system is to drain from tissue spaces, protein-containing fluid that escapes from the blood capillaries. Other functions are to transport fats from the digestive tract to the blood, to produce lymphocytes, and to develop immunities.

In our bodies where blood capillaries are close to the cells of tissues, the blood pressure in the cardiovascular system forces some of the plasma of blood through the single-celled capillary walls. When this plasma moves out of the capillaries and into the spaces between tissue cells it gets another name and is called **interstitial** (in-ter-STISH-al) **fluid**. Most, but not all, of this fluid gets reabsorbed into the capillary by differences in osmotic pressure. However, some does not, and this interstitial fluid must be drained from the tissue spaces to prevent swelling or **edema** (eh-DEE-mah) from occurring. It is the role of the lymphatic capillaries to drain this fluid. Once the interstitial fluid enters a lymphatic capillary, it gets a third name and is now called **lymph** (**LIMF**).

In the villi of the small intestine, there are special lymphatic vessels called **lacteals** (**LACK**-teelz) whose role is to absorb fats and transport them from the digestive tract to the blood. Fats from the intestine travel through the lymphatic system, which

delivers them to the blood, when the lymph rejoins the blood at the right and left subclavian veins. Lymph in the lacteals looks milky because of the fat content and is called **chyle** (**KYLE**).

Lymphoid tissue
(containing lymphocytes
and macrophages)

Blood vessels

Capsule

Heart

Capillary bed

Lymph node

Interstitial fluid

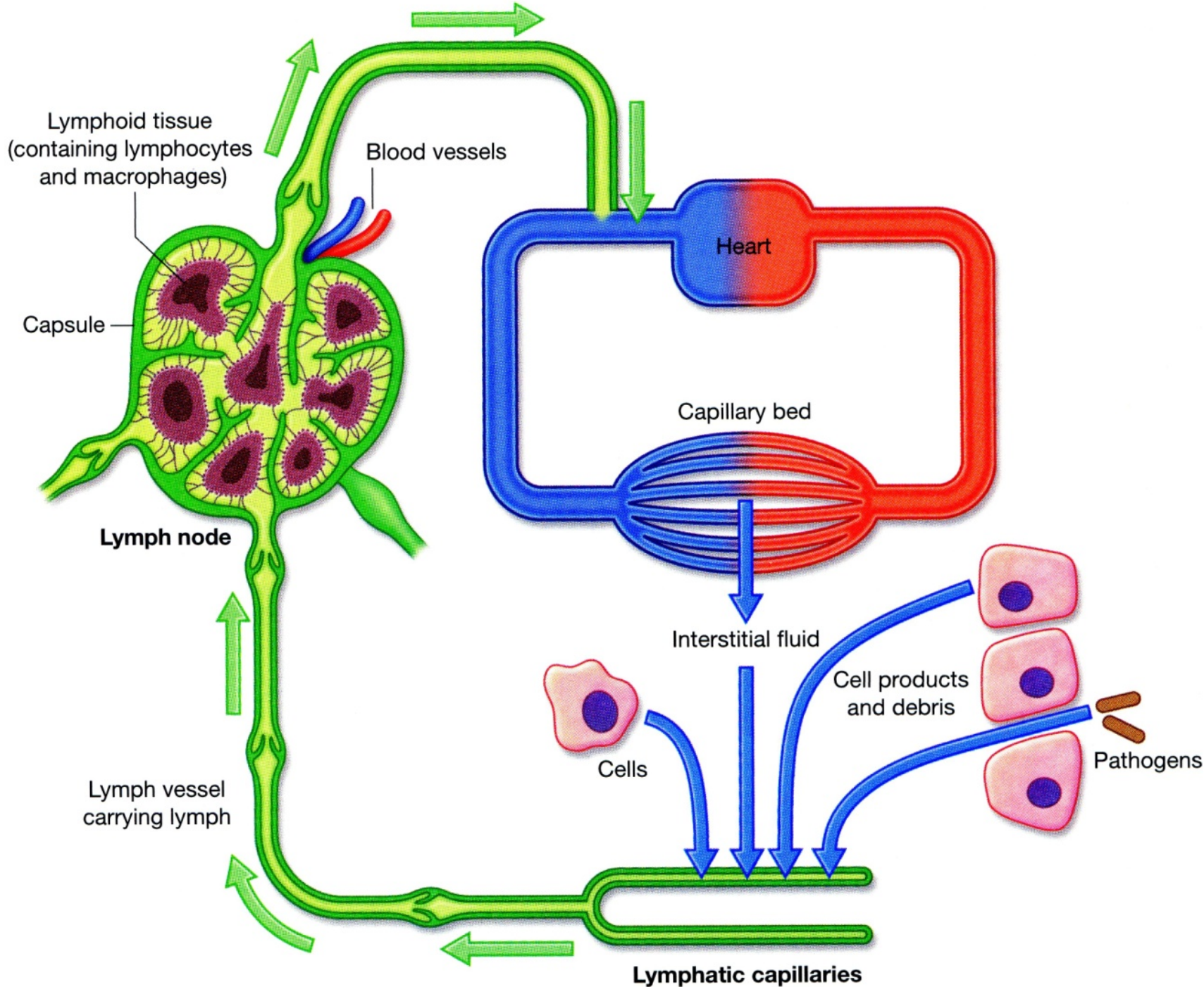
Cell products
and debris

Cells

Pathogens

Lymph vessel
carrying lymph

Lymphatic capillaries



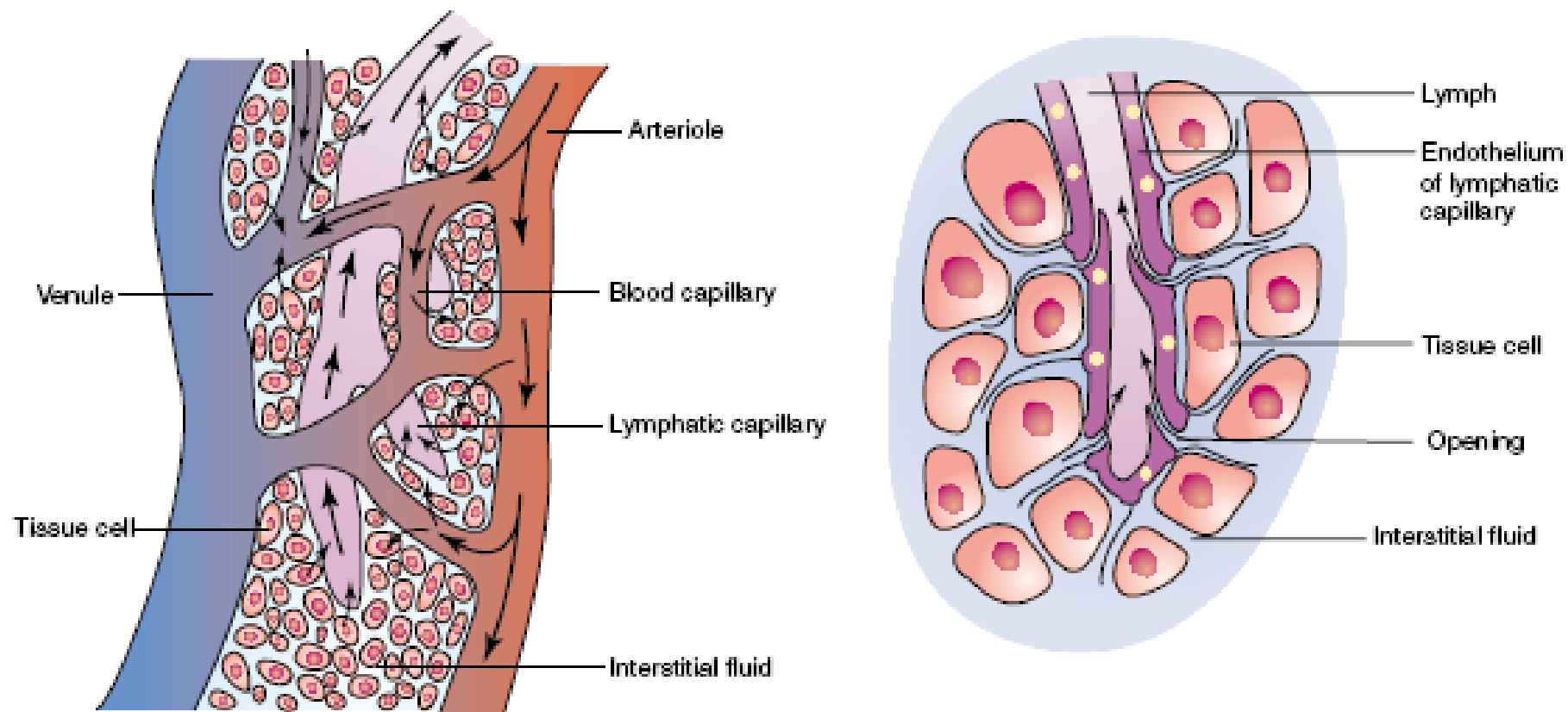
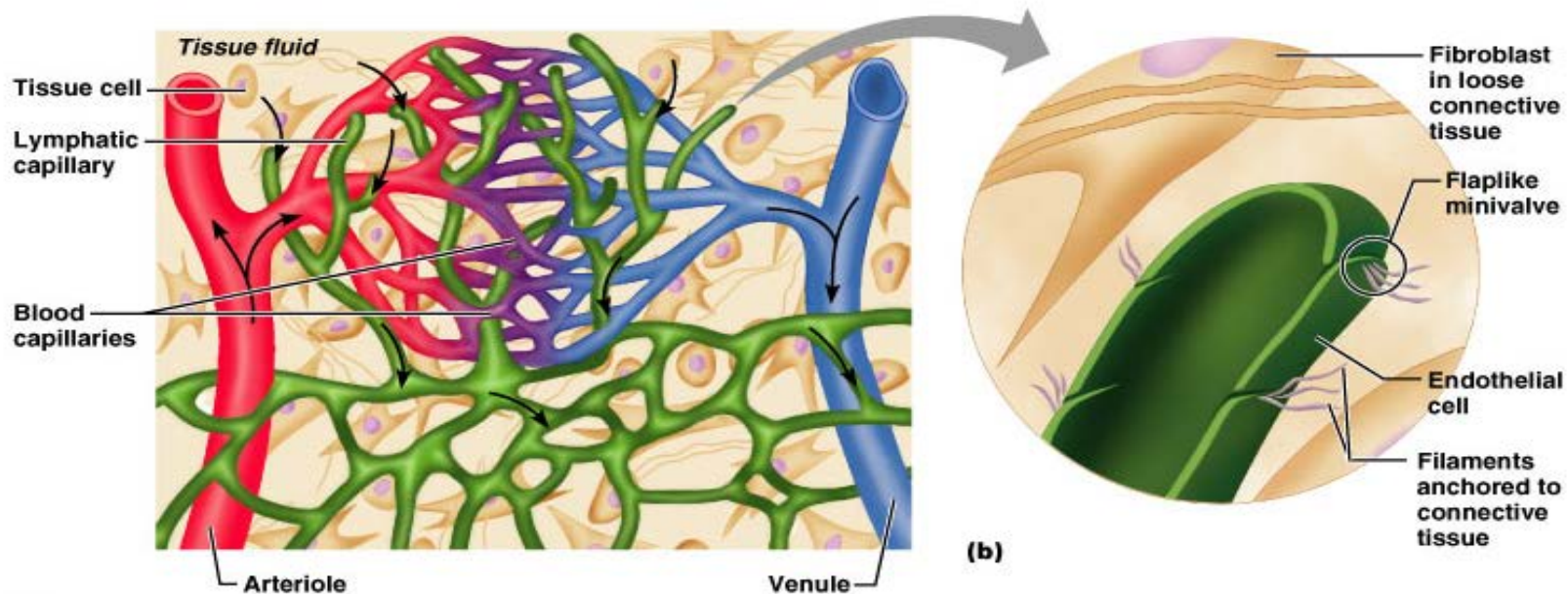


FIGURE 15-3. (A) The relationship between lymph capillaries and tissue cells and blood vessels. (B) Detail of a lymphatic capillary and tissue cells.

GENERAL LYMPHATIC CIRCULATION

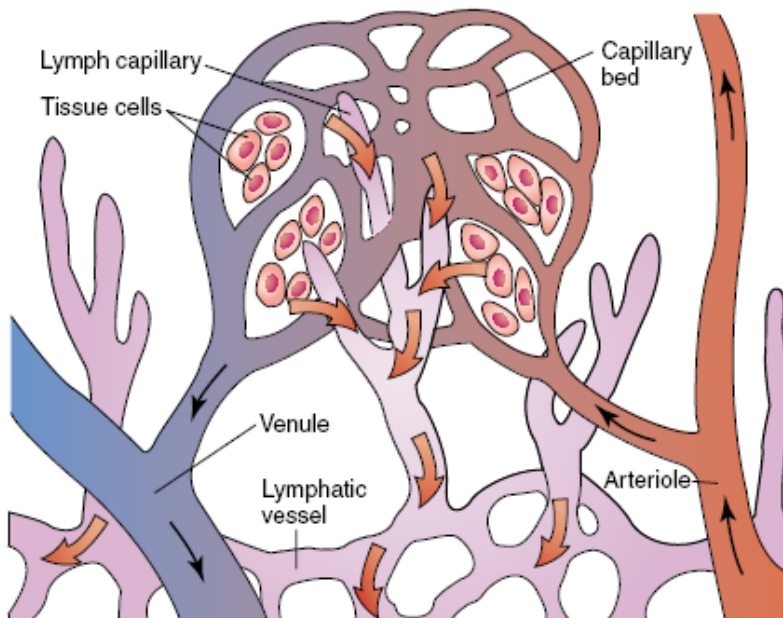
- Thoracic duct
- Rt. Lymphatic duct



Lymphatic Vessels

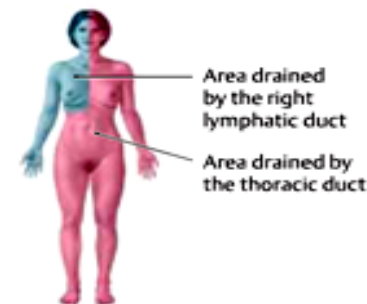
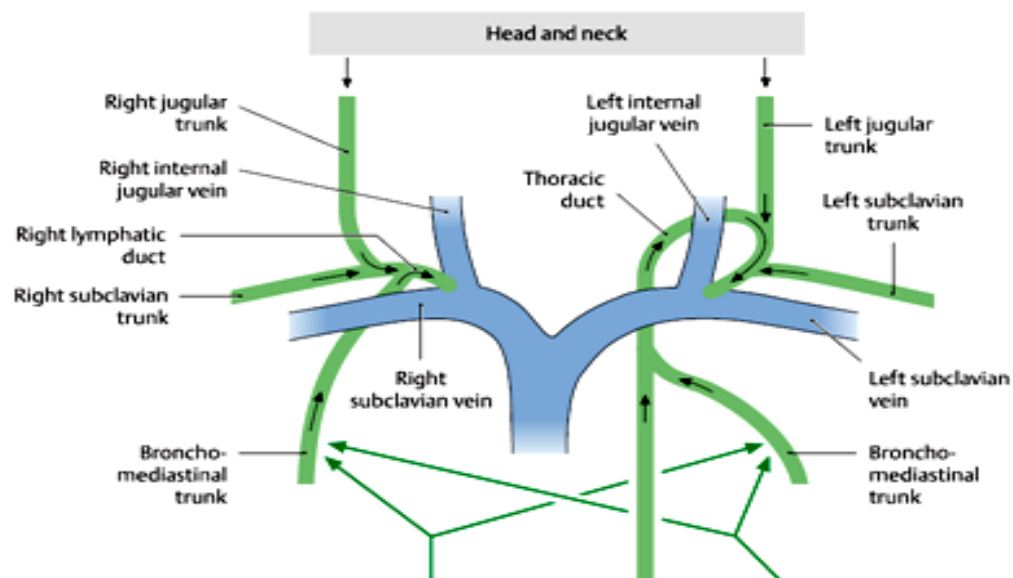
Lymphatic vessels originate as blind-end tubes that begin in spaces between cells in most parts of the body. The tubes, which are closed at one end, occur

singly or in extensive plexuses and are called **lymph capillaries** (Figures 15-2 and 15-3). These vessels are not found in the central nervous system, red bone marrow, vascular tissue, and portions of



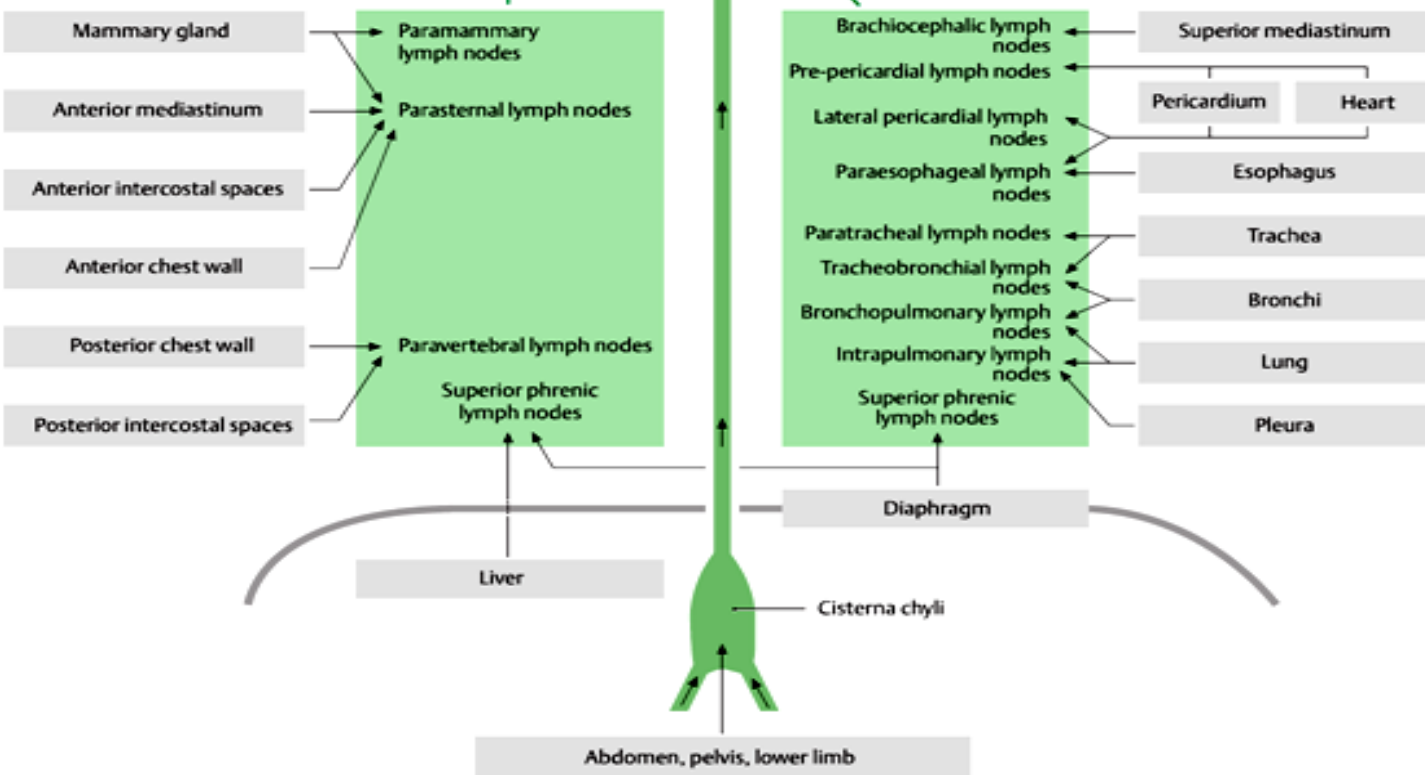
the spleen. Lymph capillaries are much larger and more permeable than blood capillaries. Lymph capillaries will eventually unite to form larger and larger lymph vessels called **lymphatics** (**LIM**-fat-iks). Lymphatics resemble veins in structure but have thinner walls and more valves. The large number of valves helps to ensure that the lymph will not back-flow but go in one direction only. Along lymphatics there are lymph nodes found at various intervals.

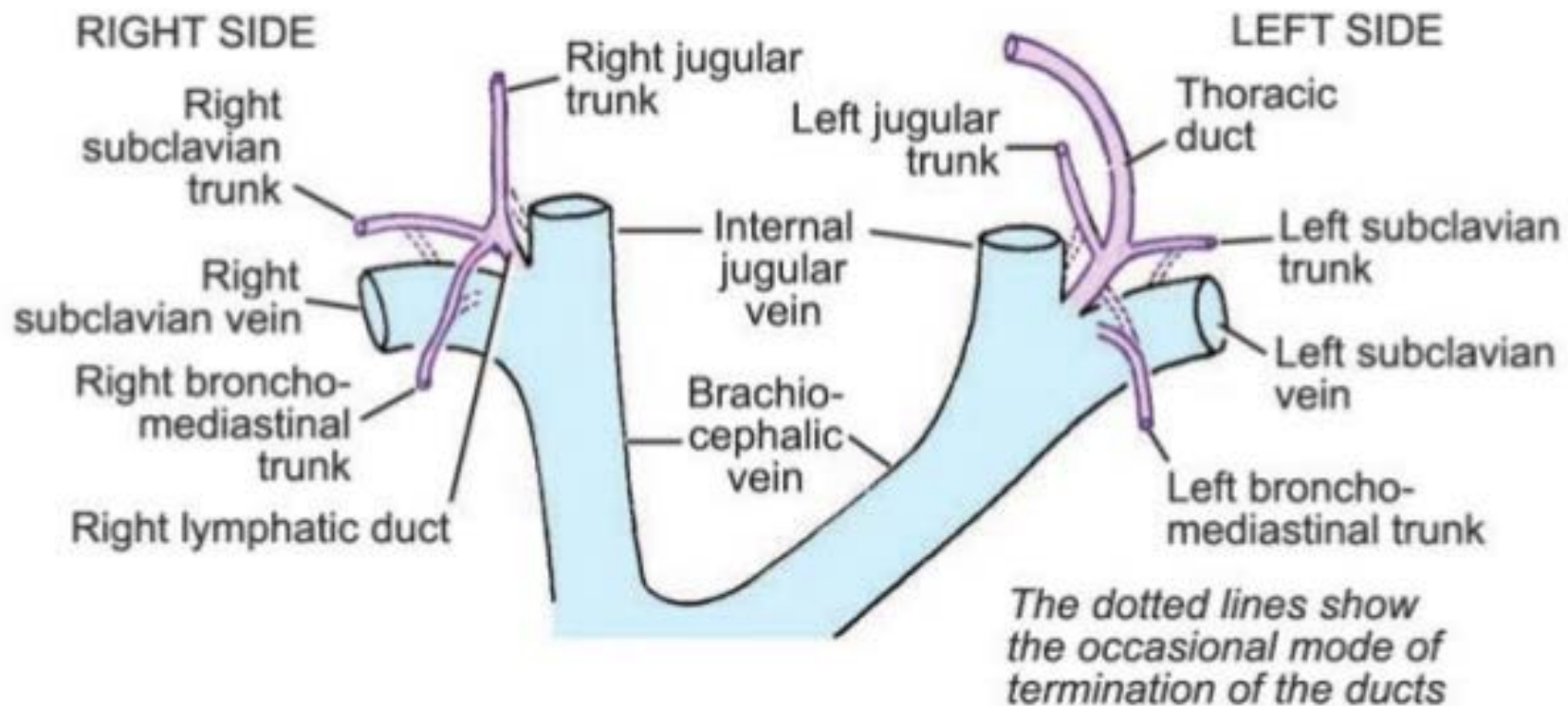
Lymphatics of the skin travel in loose subcutaneous connective tissue and generally follow the routes of veins. Lymphatics of the viscera generally follow the routes of arteries and form plexuses around the arteries. Eventually, all the lymphatics of the body converge into one of two main channels: either the **thoracic duct** (the main collecting channel) or the **right lymphatic duct**.



C Lymphatic drainage by quadrants

Lymphatic drainage follows the "quadrant principle," with three quadrants draining into the thoracic duct and one quadrant draining into the right lymphatic duct (see B for details).





22.7: Scheme to show the main lymphatic ducts

LYMPHATIC NODE

- Filtration of lymph
- Diffused all of the body
- Multiple afferent lymph vessel
- One efferent lymph vessel

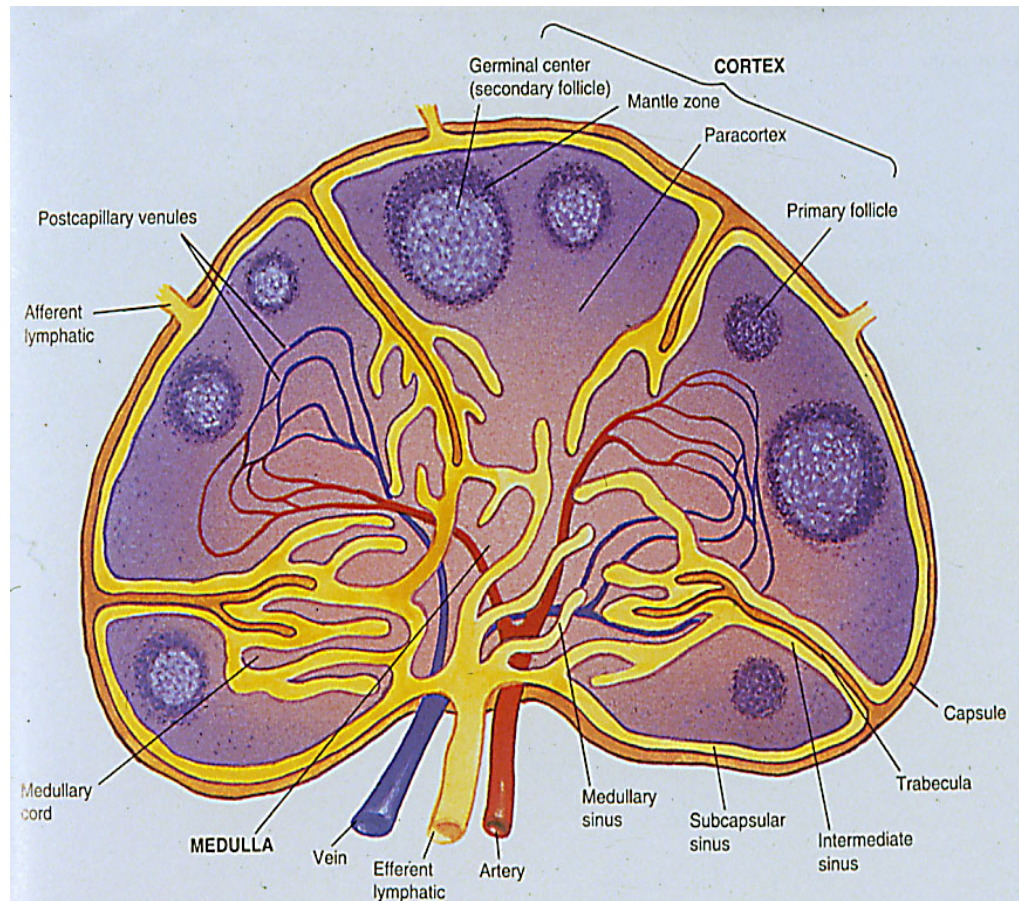
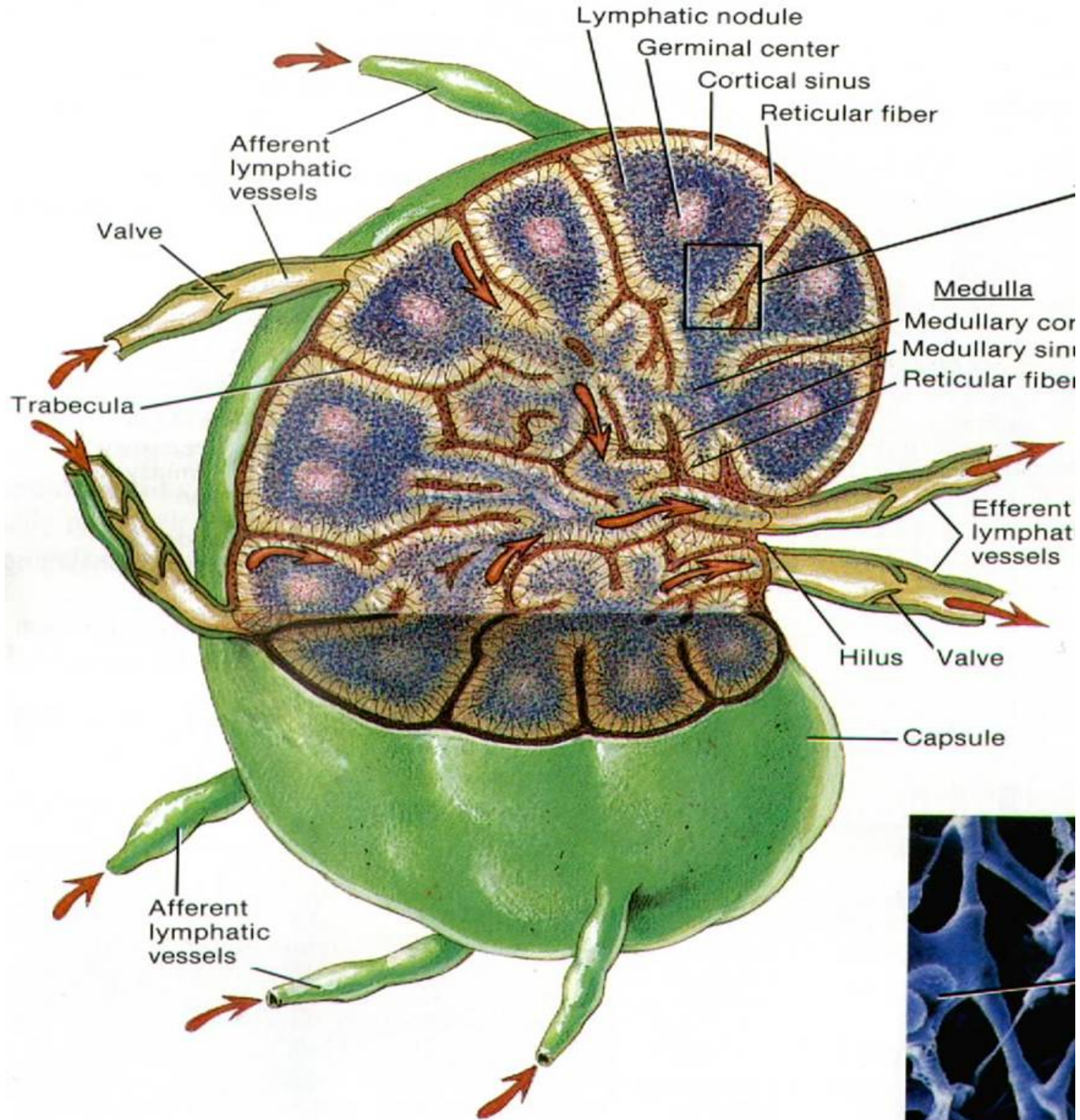
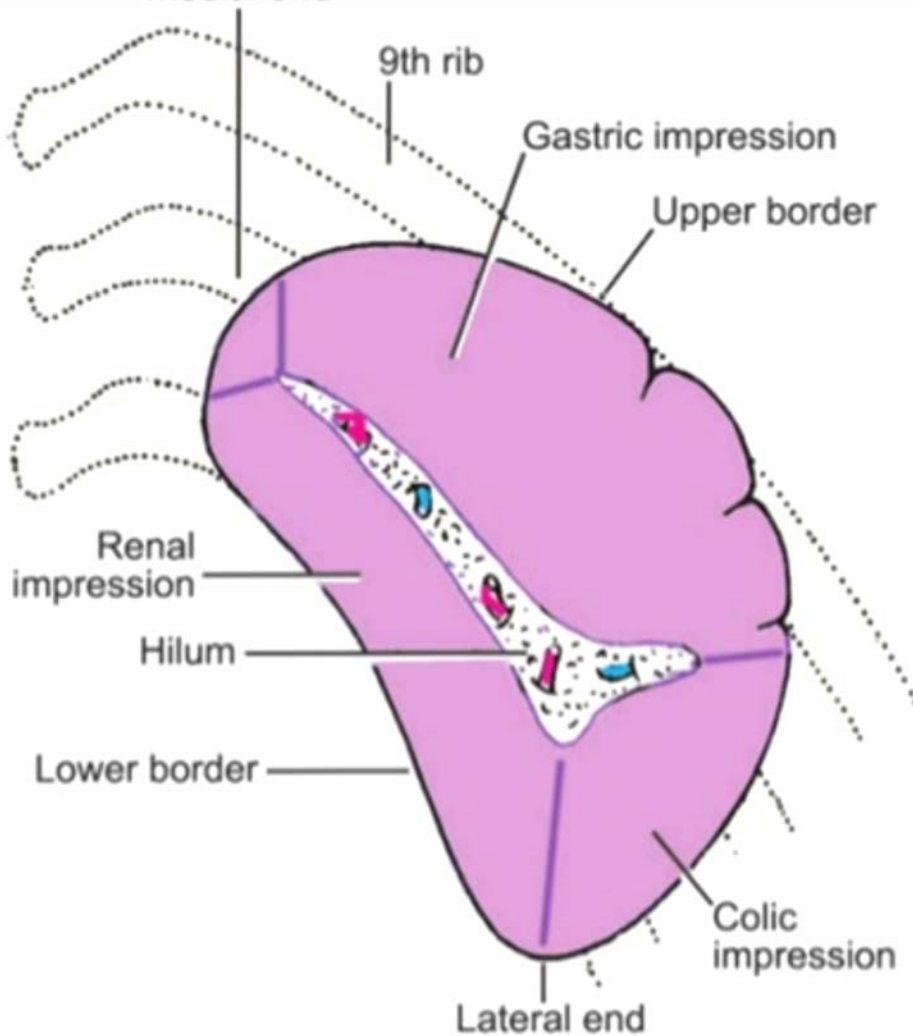


FIGURE 20-12
Structure of a normal lymph node.

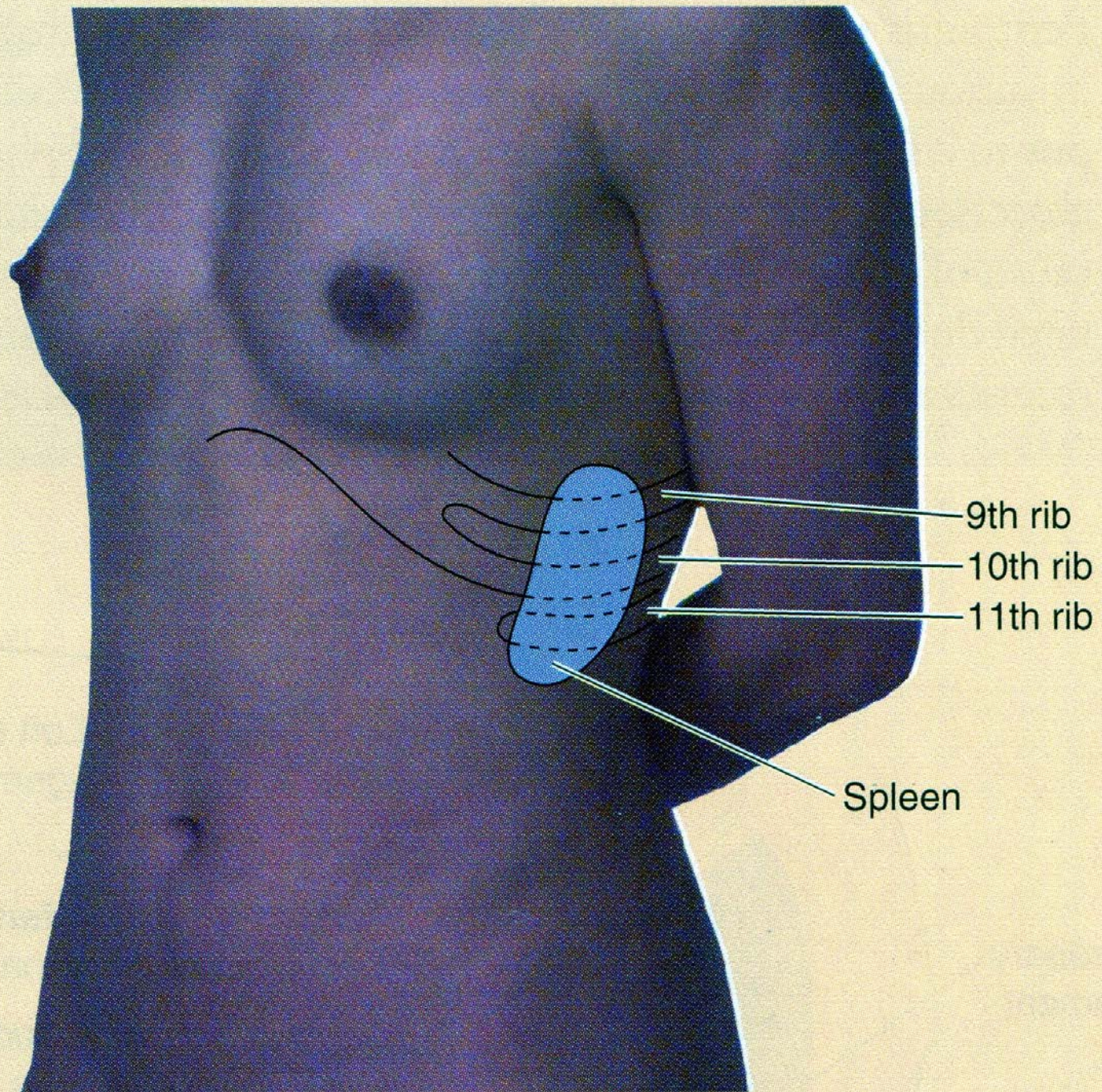


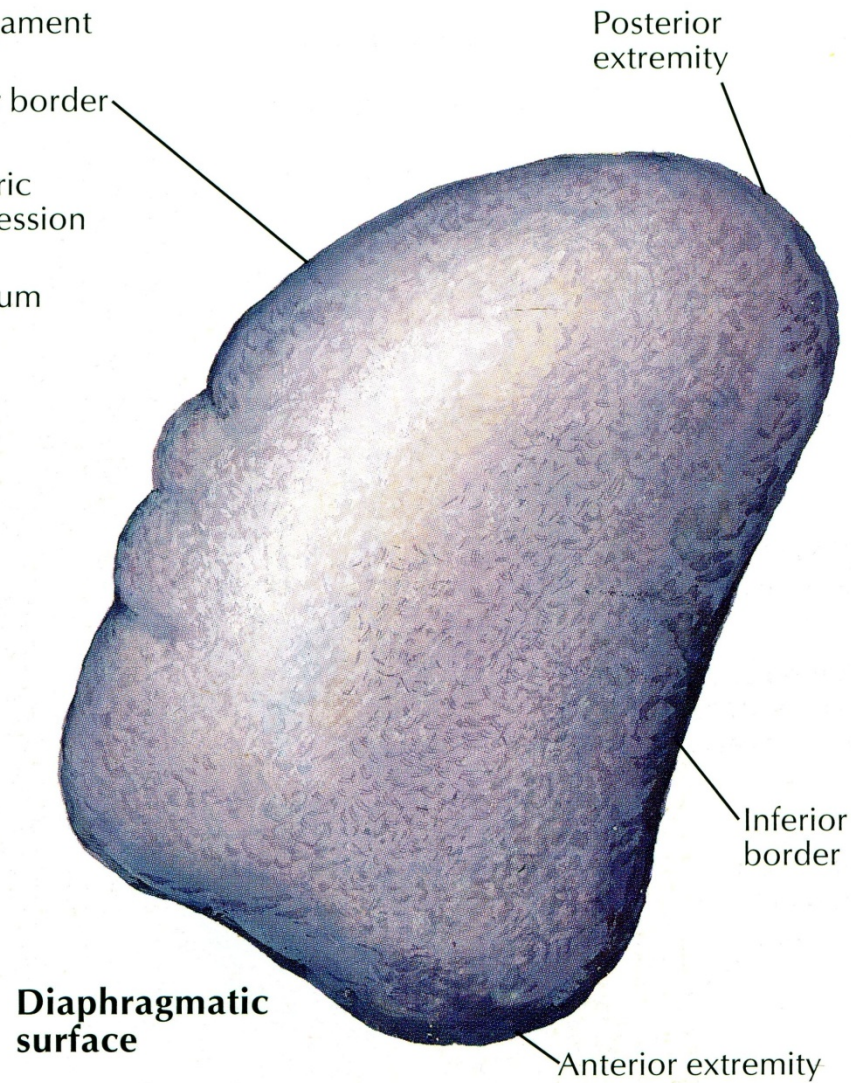
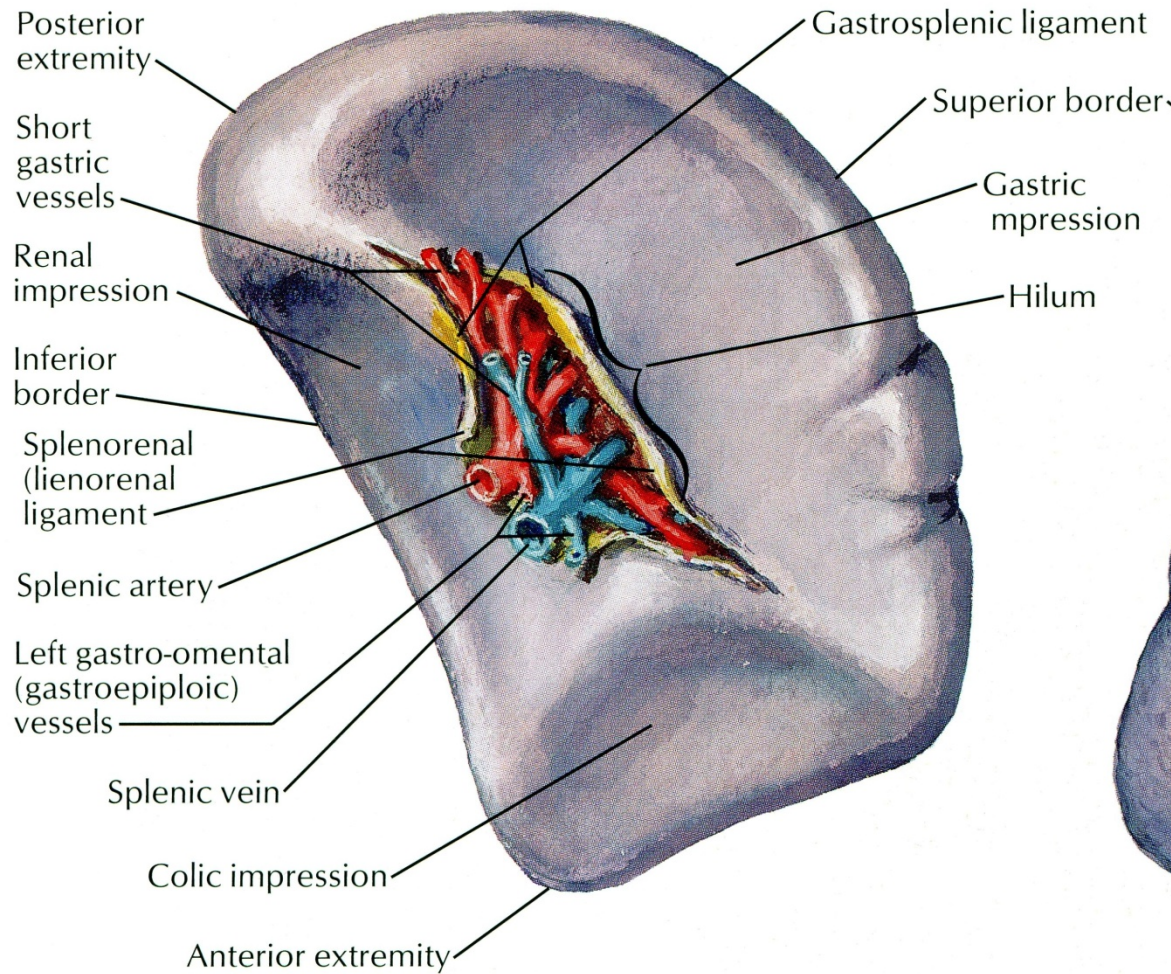
SPLEEN

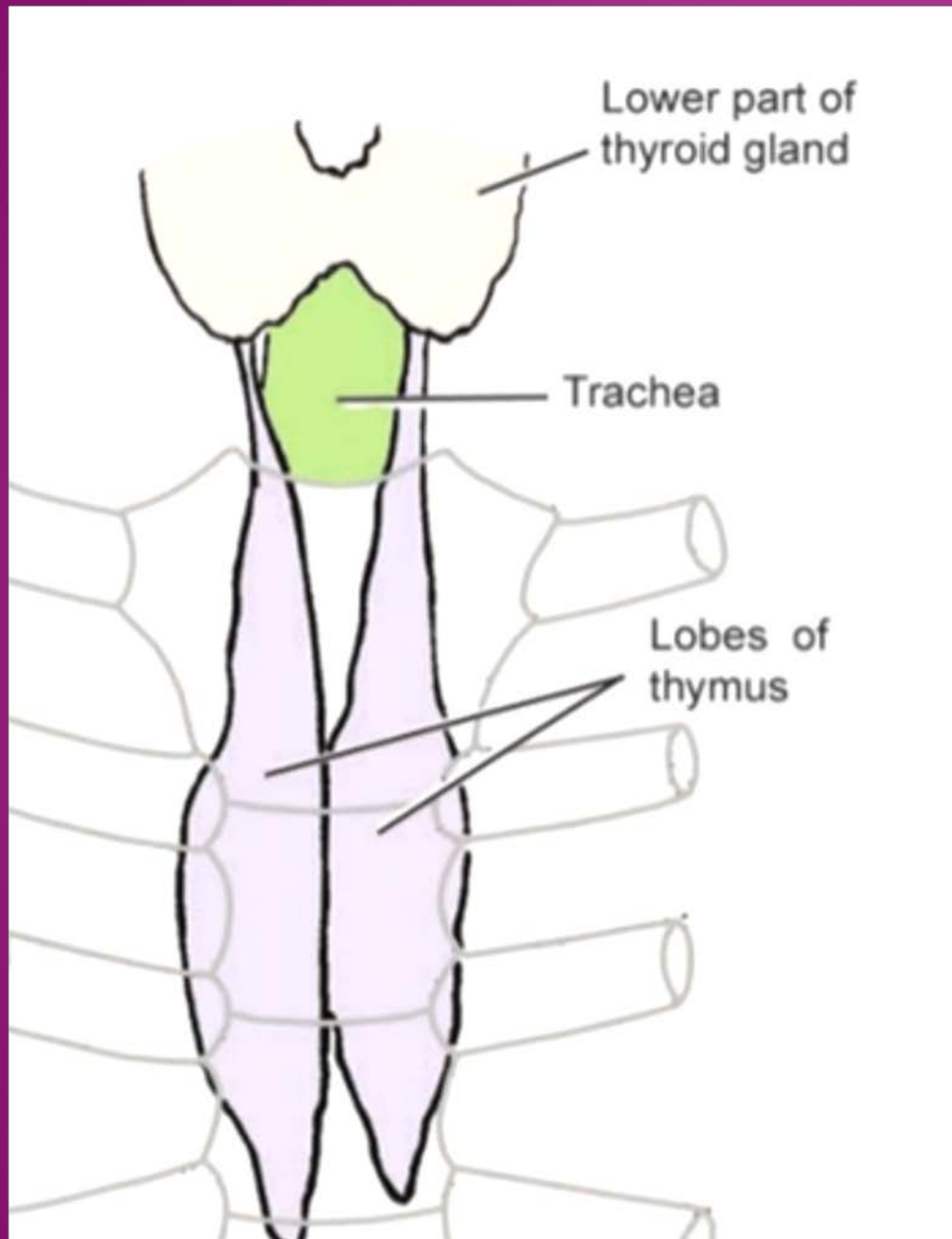


28.23: Spleen as seen from the front

- The greatest lymphatic organ
- Blood filtration
- Position of spleen
- Surfaces



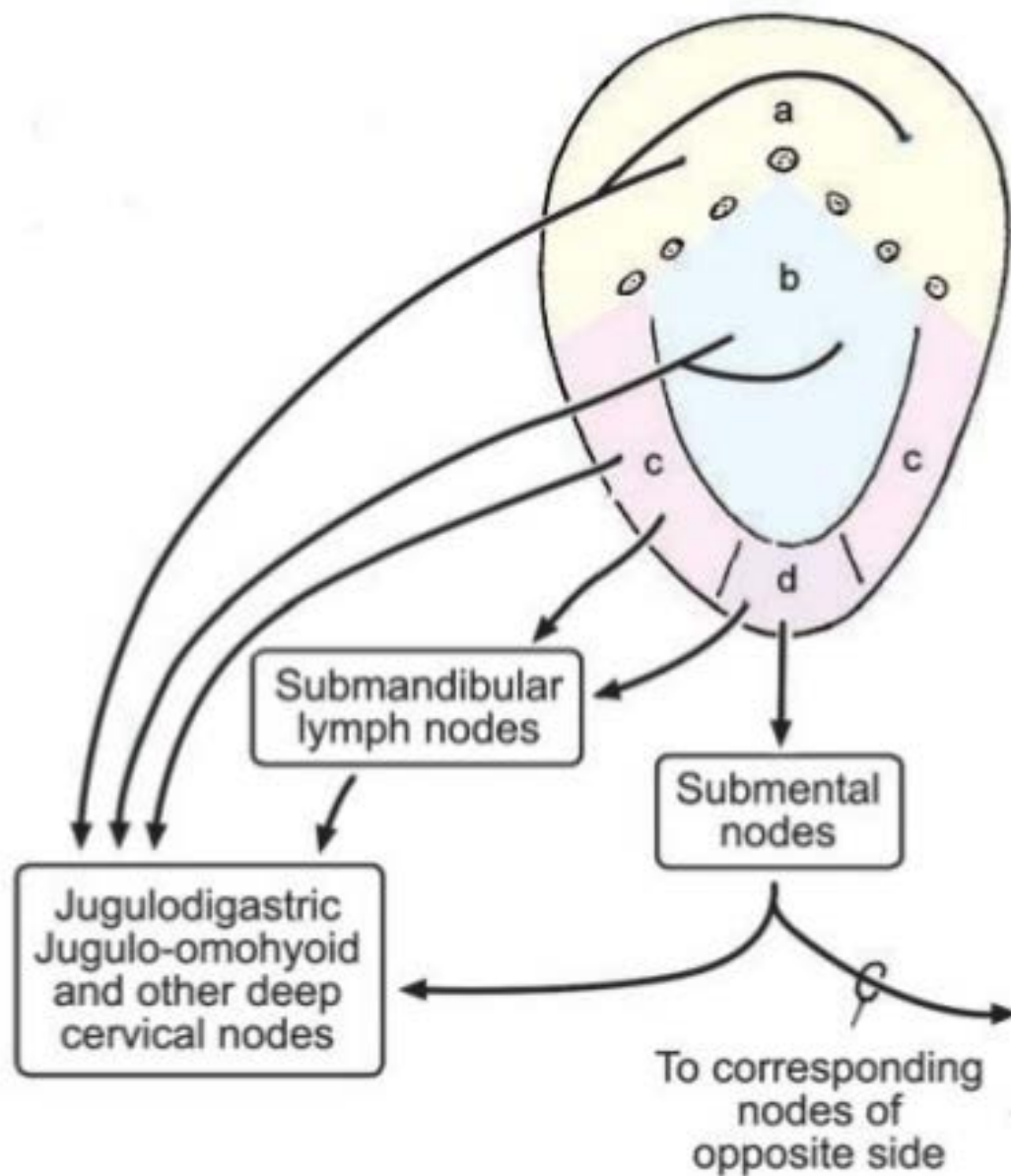




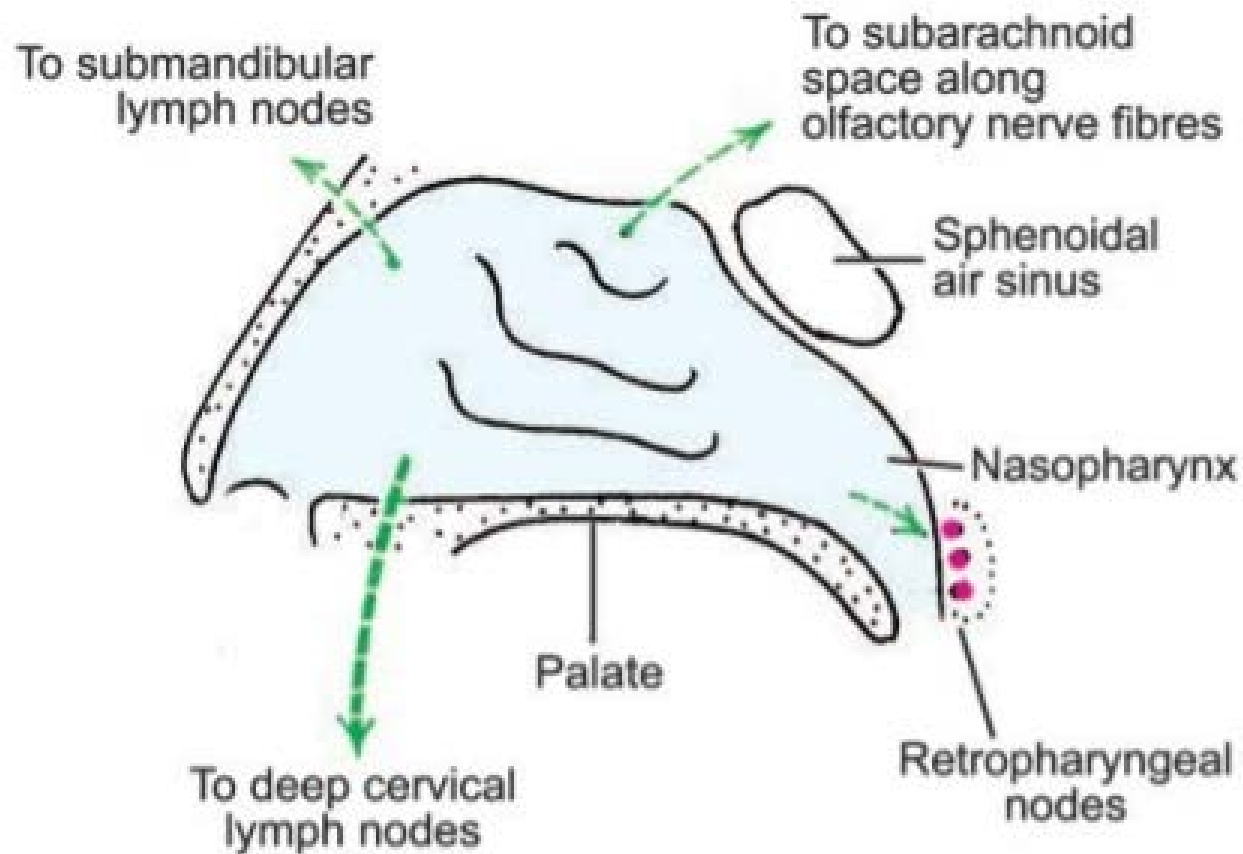
THYMUS

- Located in sup. And ant. Mediastinum
- Located behind the sternum
- Weight = 30-40 gram
- Maximum growth = 5-6 years old
- Degeneration at 14 years old
- 2 lobes & isthmus
- Differentiation of T lymphocyte
- Production of multiple growth factor = thymolin / thymopoitin / thymozin / thymus humeral factor

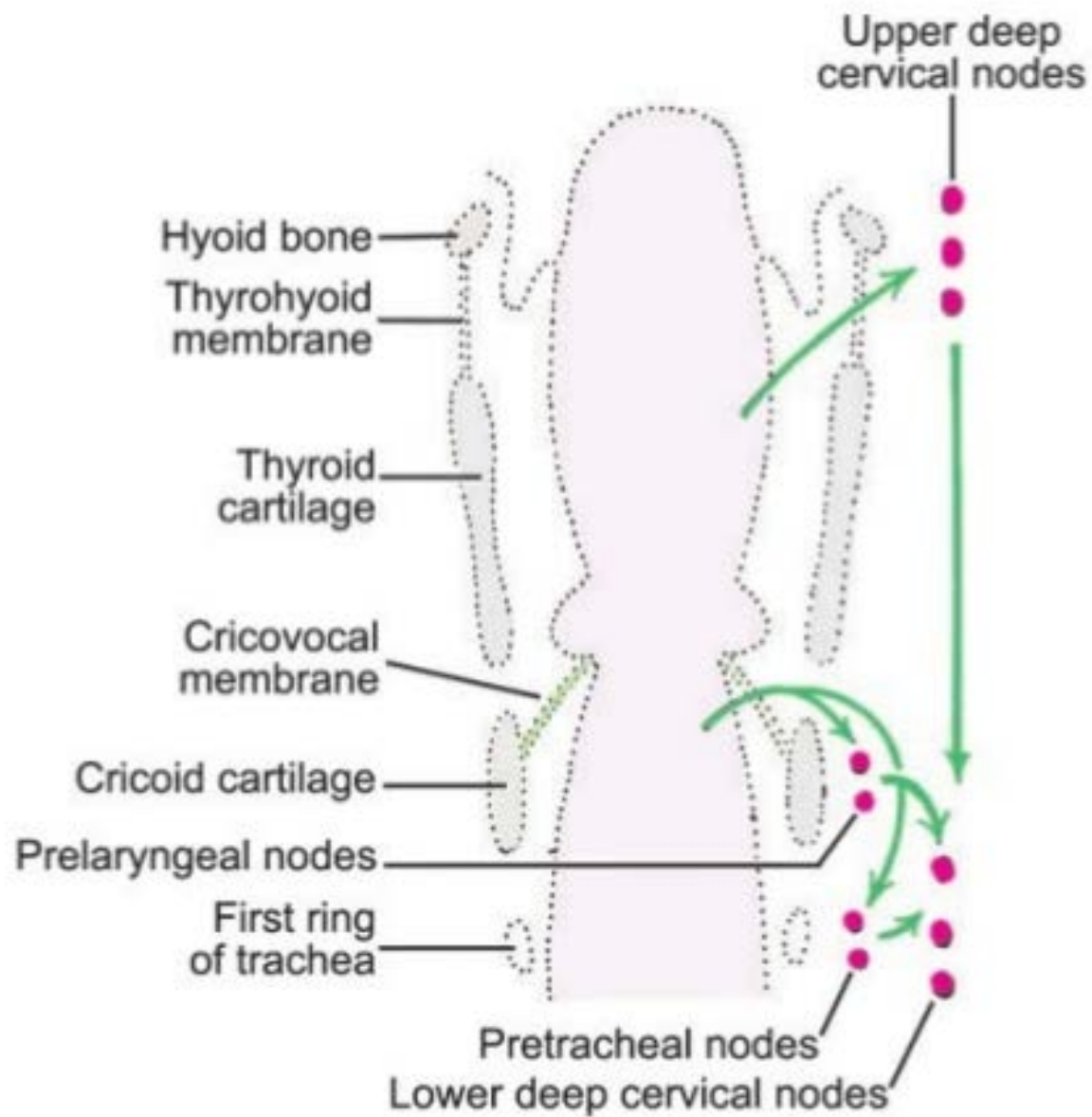




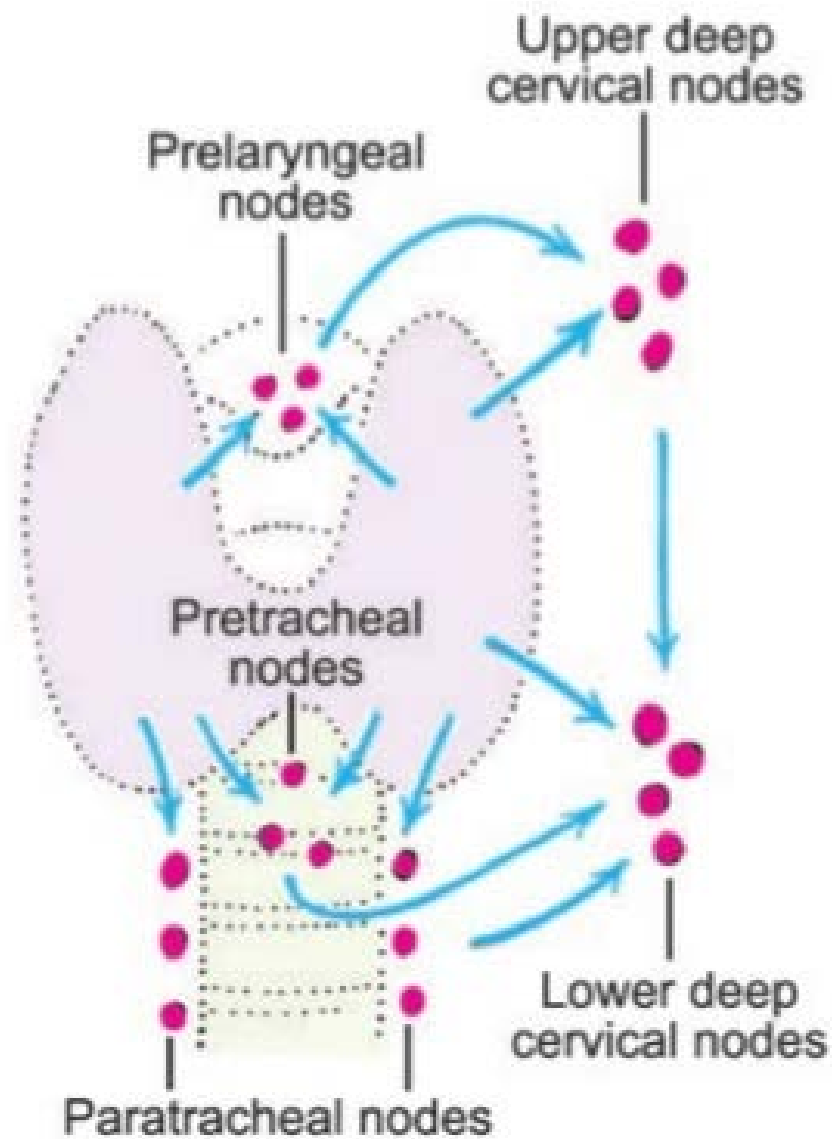
39.21: Lymphatic drainage of the tongue



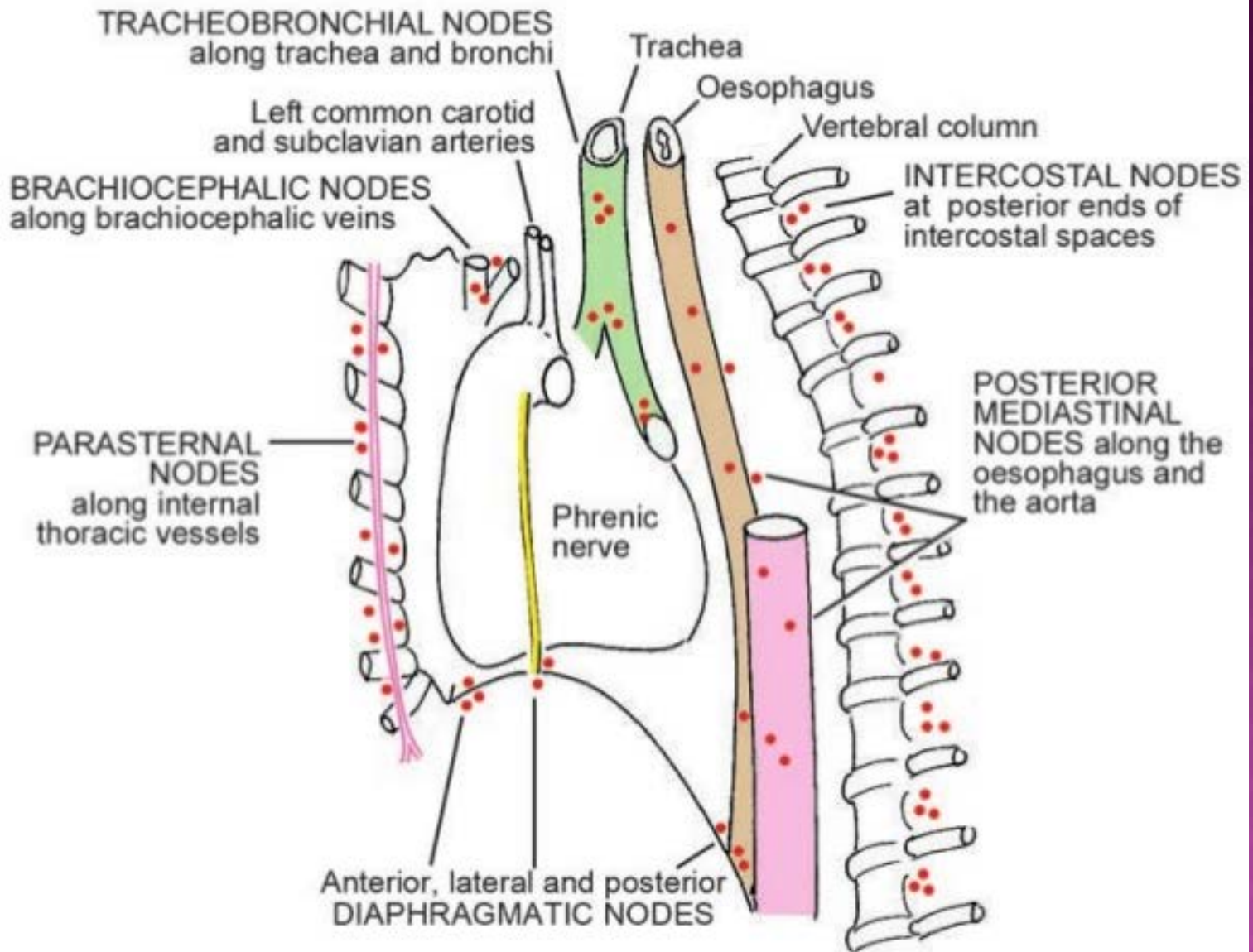
45.8B: Scheme to show the lymphatic drainage of the nasal cavity



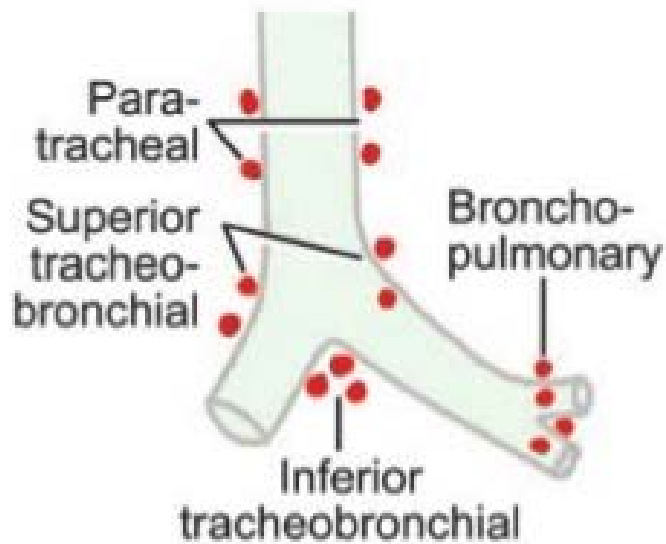
45.20: Scheme to show the lymphatic drainage of the larynx



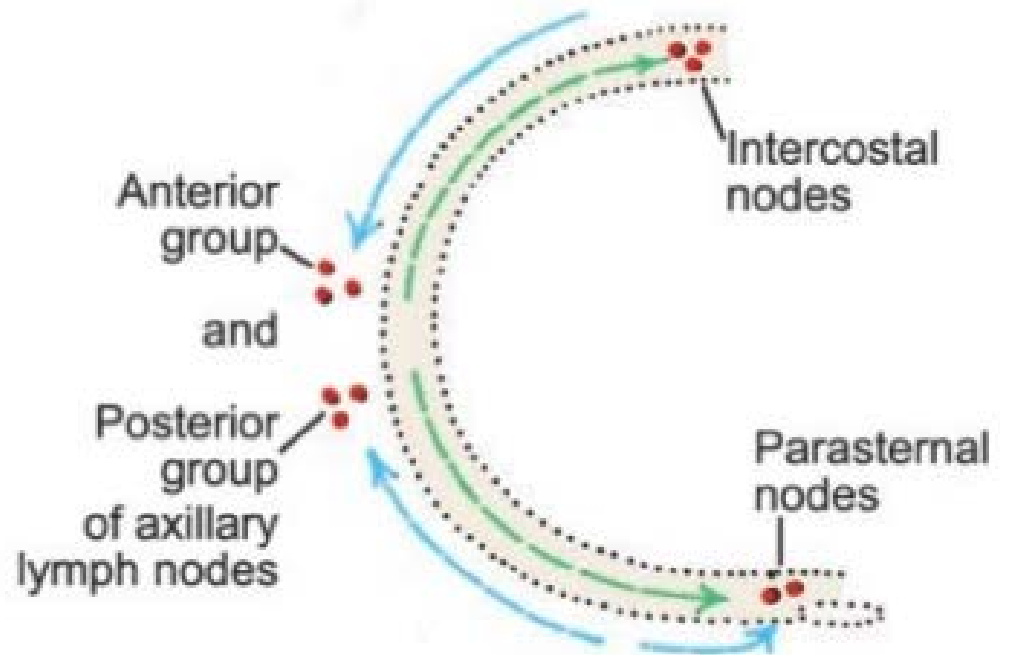
46.9B: Scheme to show the lymphatic drainage of the thyroid gland



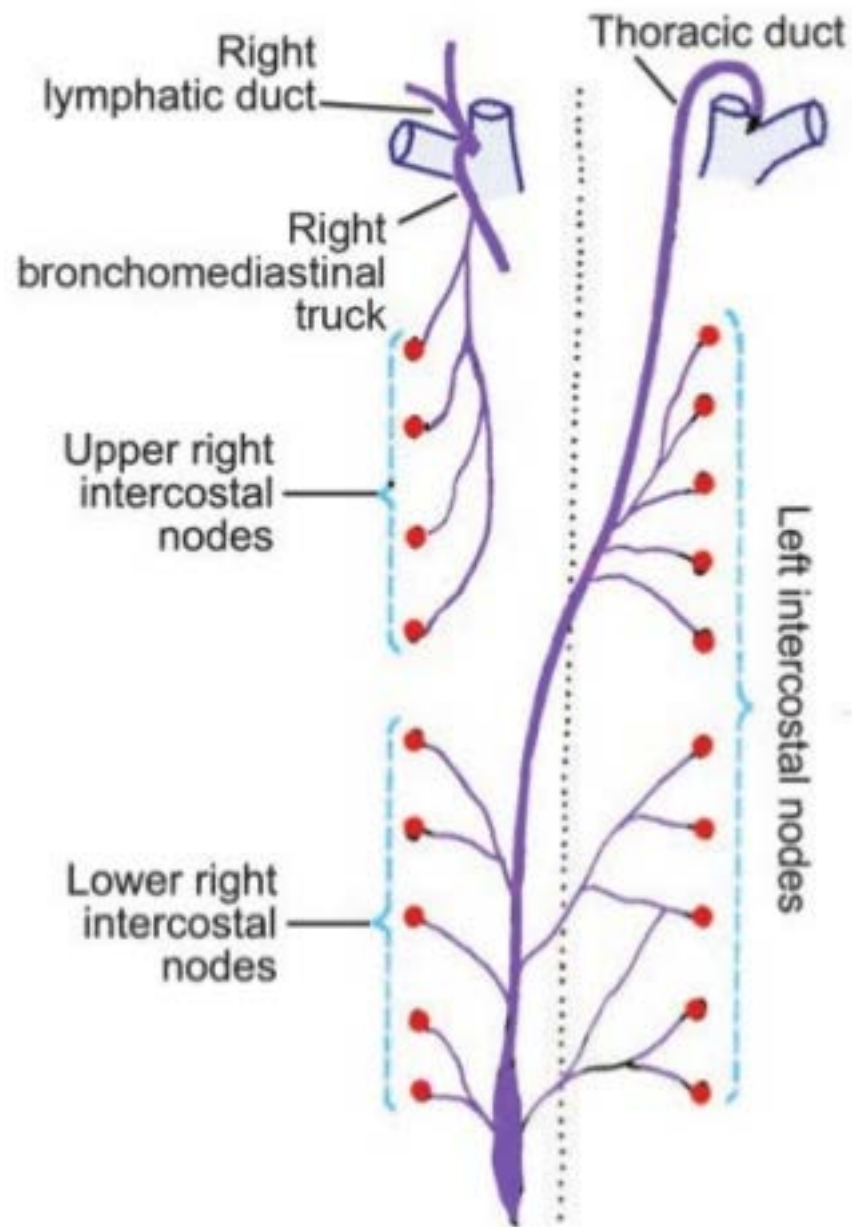
22.8: Scheme to show the lymph nodes of the thorax



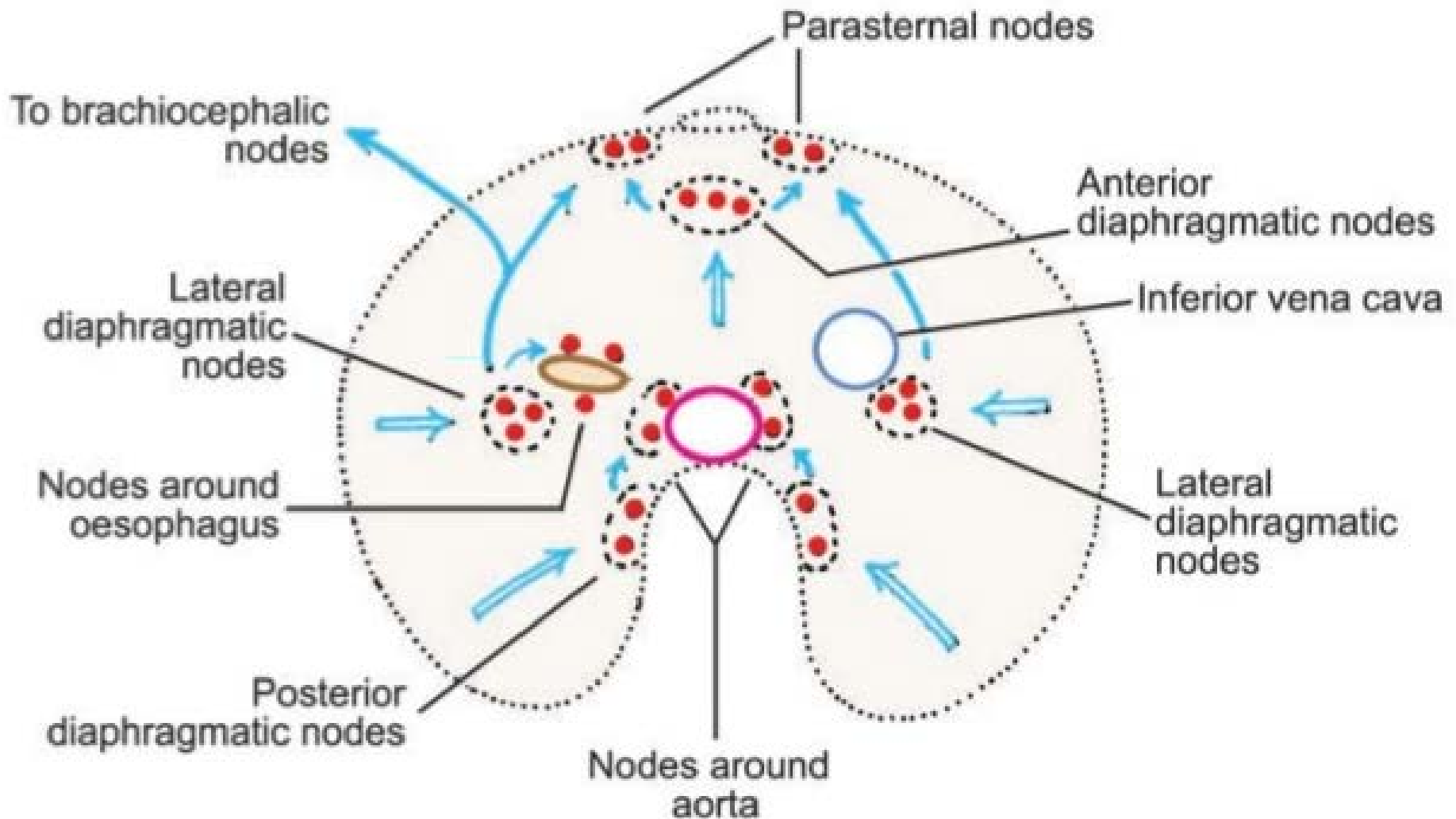
22.9: Tracheobronchial lymph nodes



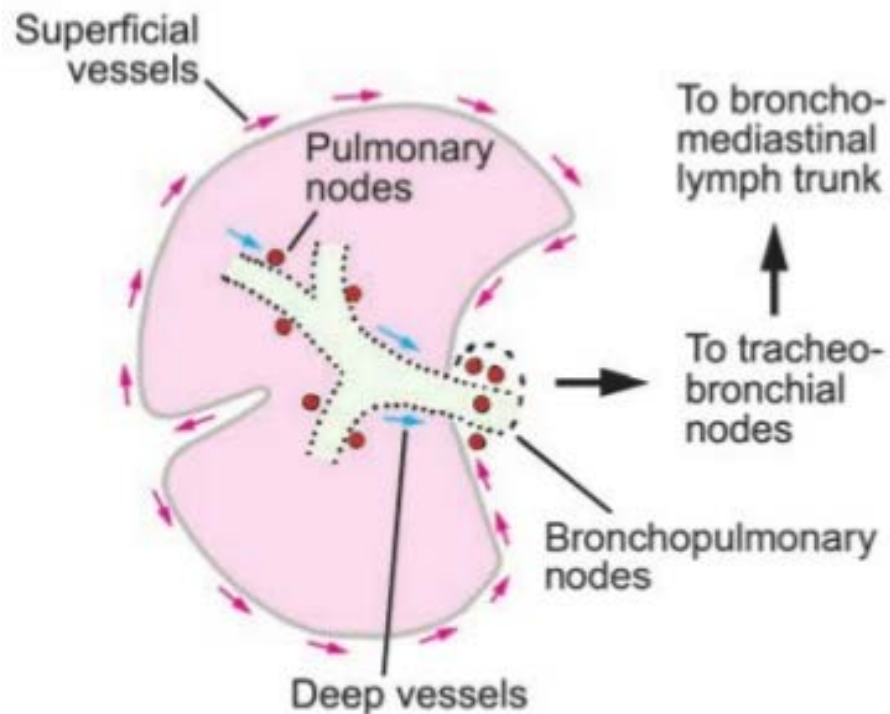
22.10: Scheme to show lymphatic drainage of skin and deeper tissues of thoracic wall



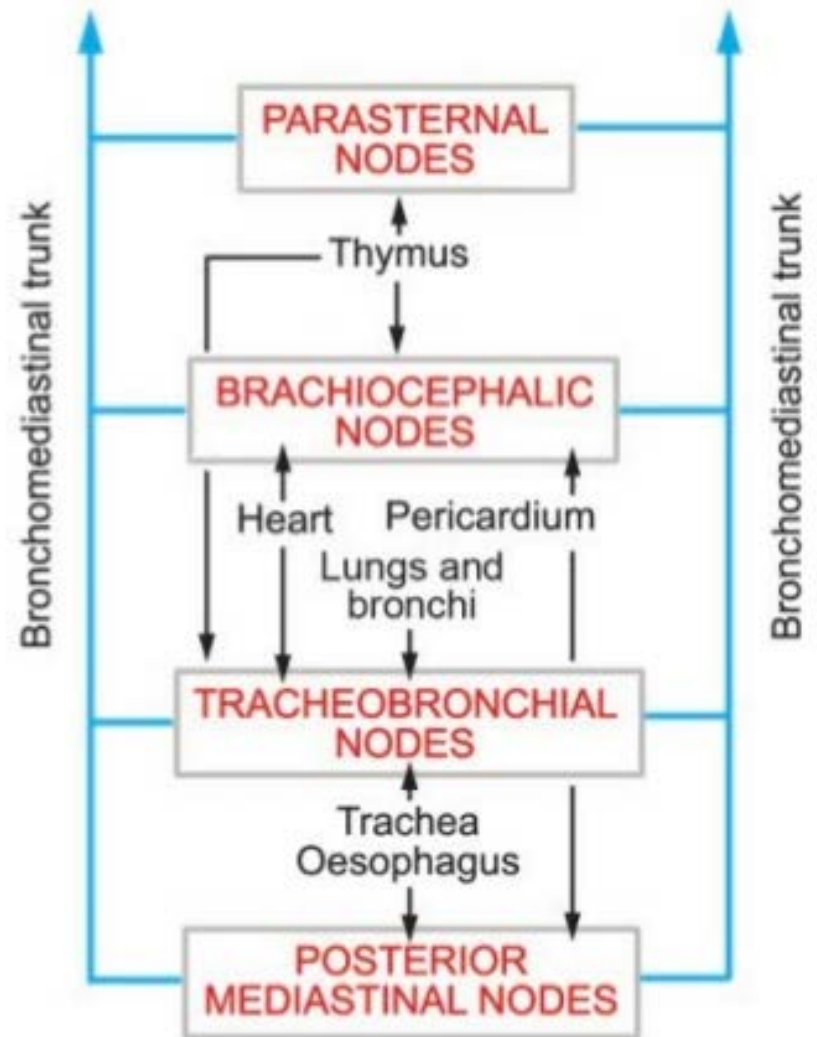
22.11: Scheme to show efferent vessels arising from intercostal lymph nodes phagus.



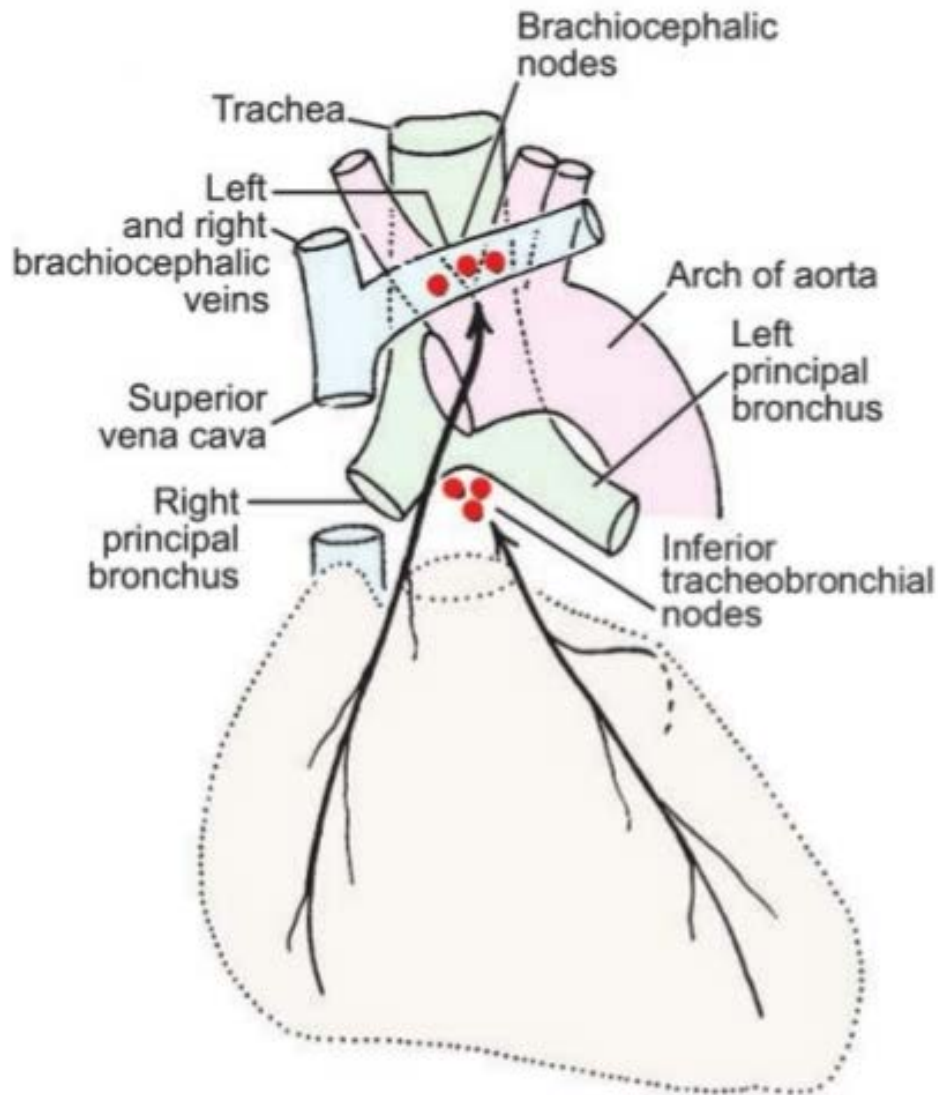
22.12: Scheme to show lymphatic drainage of thoracic surface of diaphragm



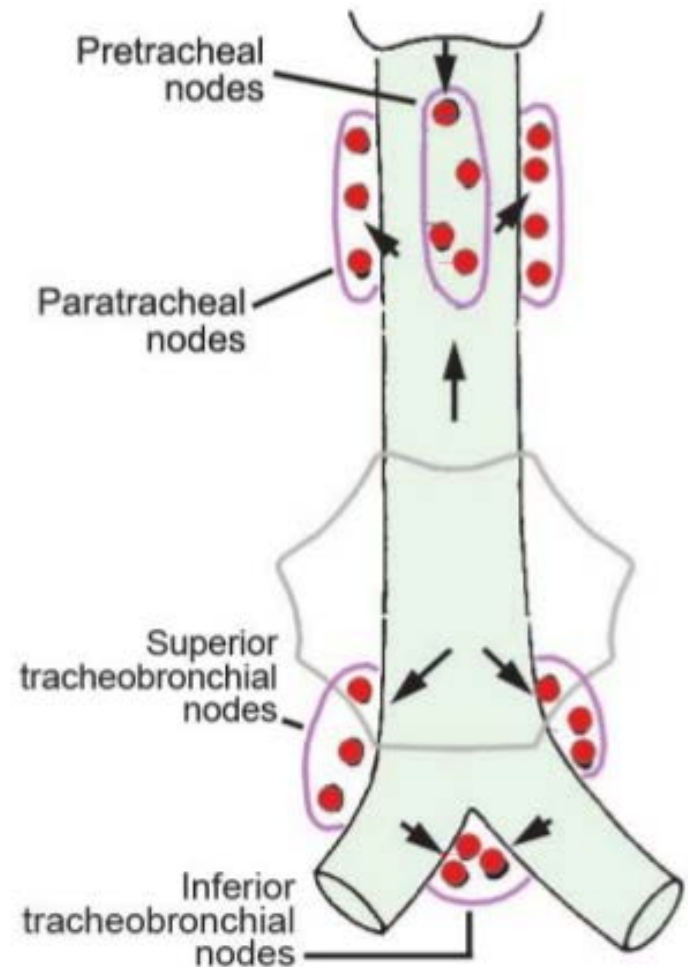
22.13: Lymphatic drainage of the lungs



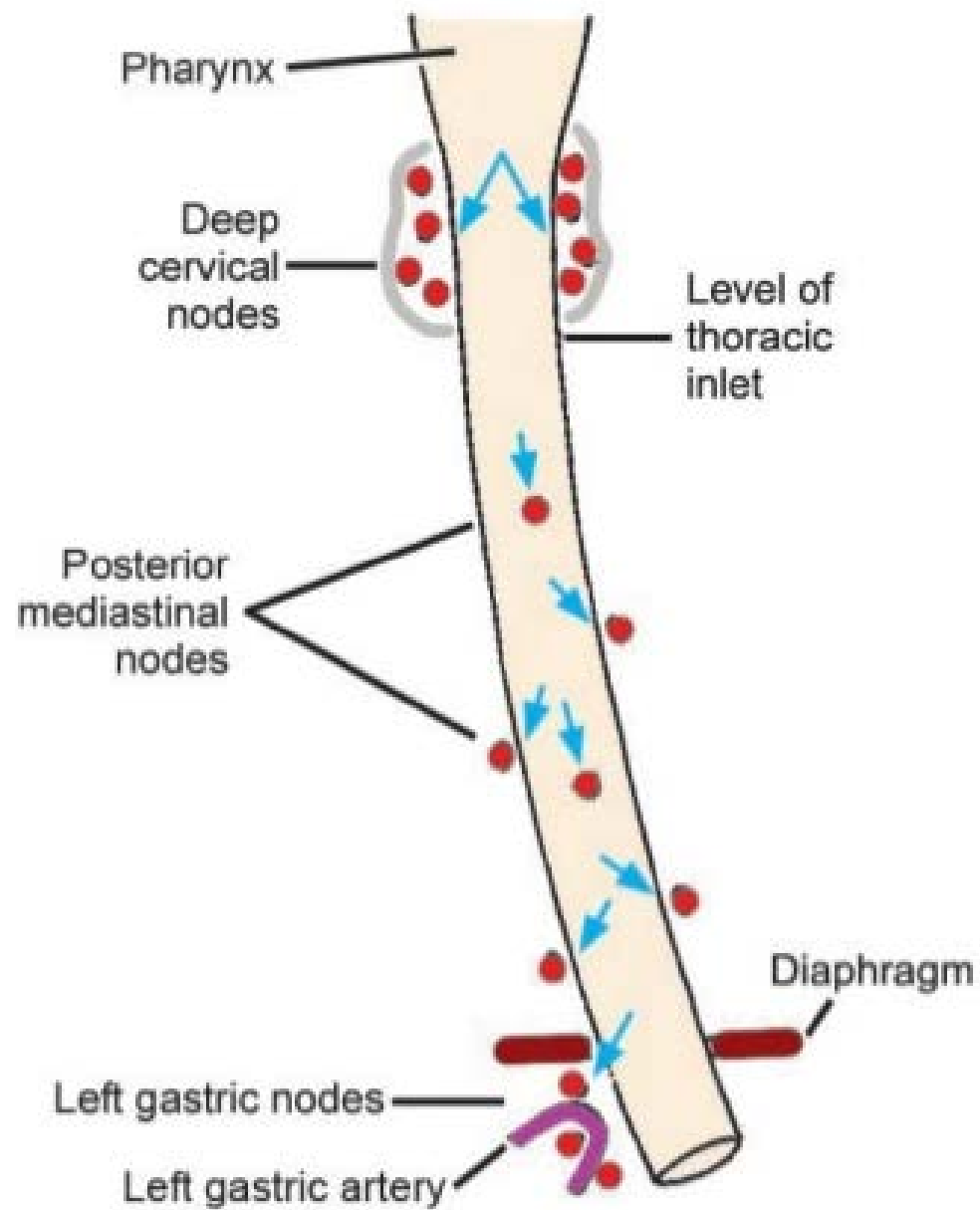
22.14: Scheme to show interconnections of major lymph nodes draining the thoracic viscera



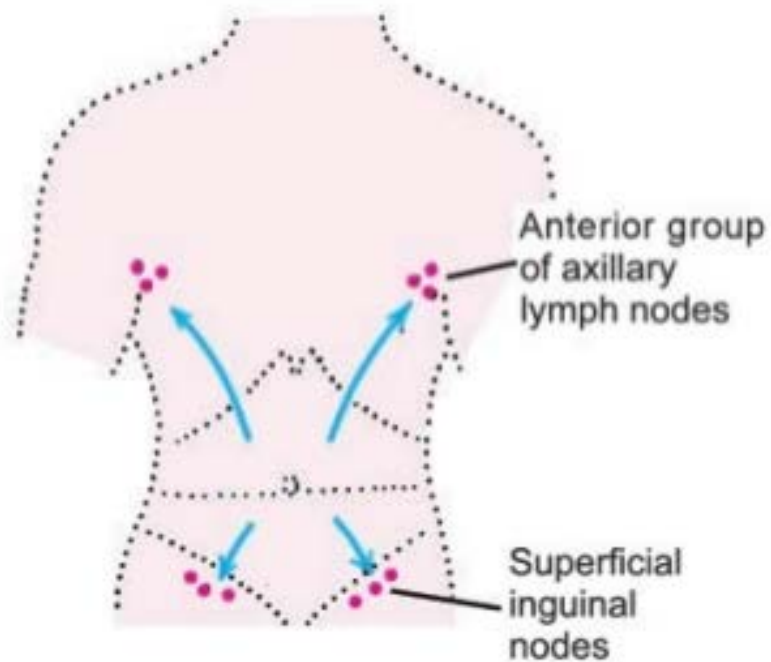
22.15: Scheme to show the lymphatic drainage of the heart



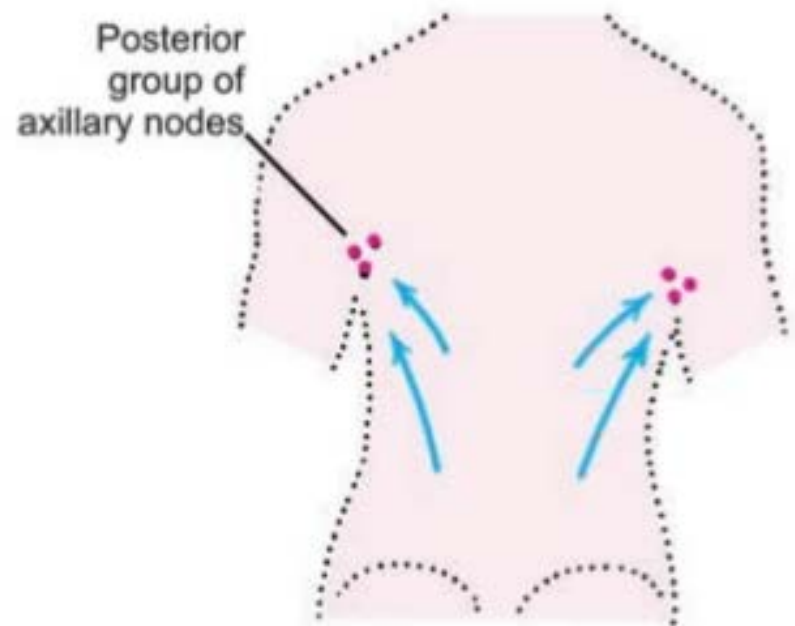
22.16: Lymphatic drainage of trachea



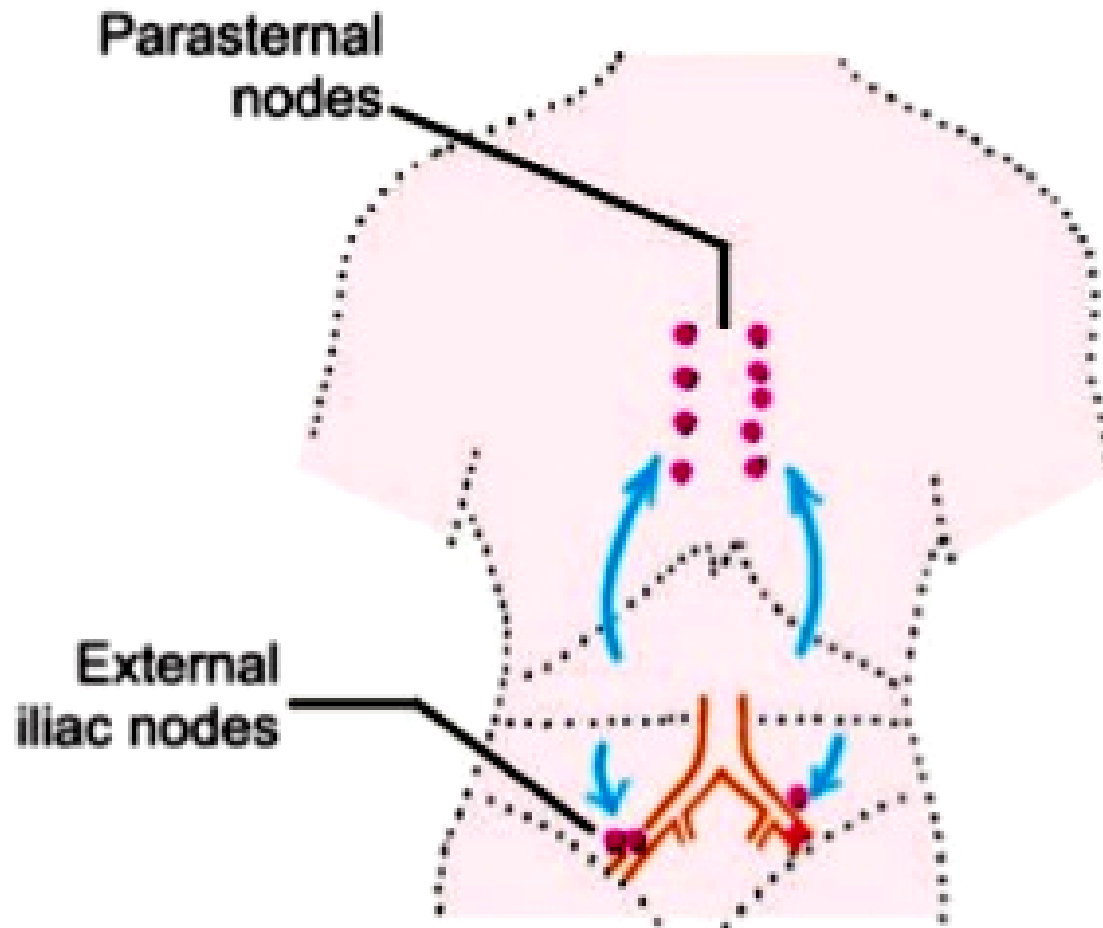
22.17: Lymphatic drainage of oesophagus



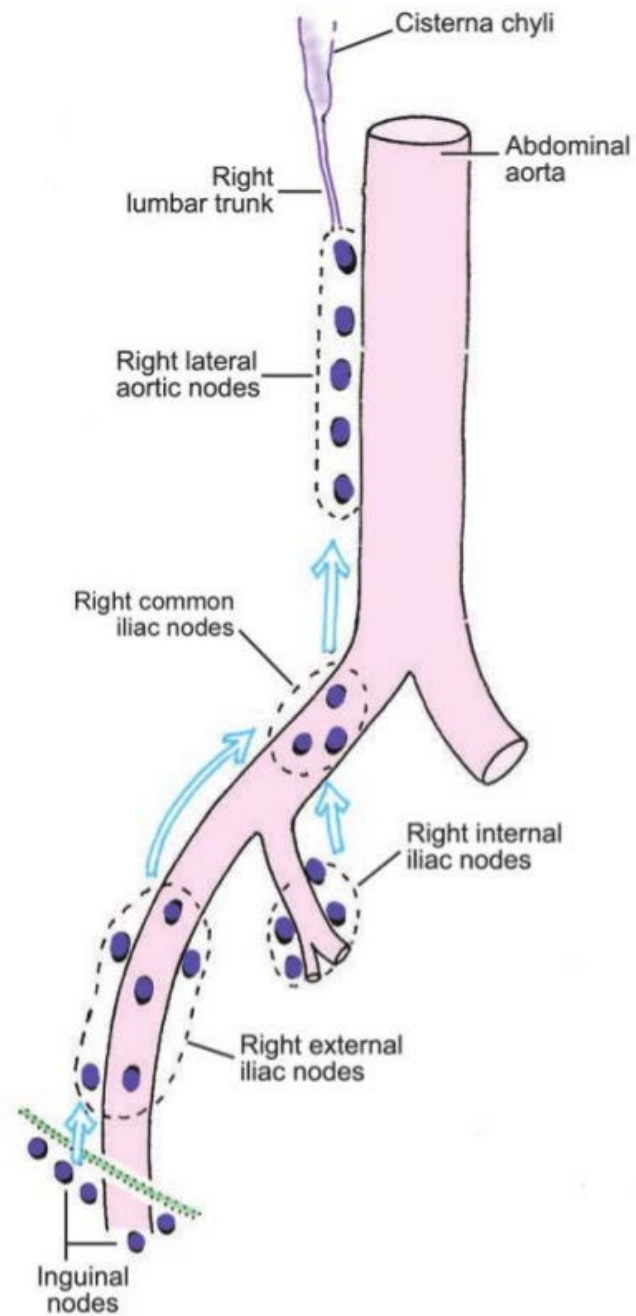
25.28: Lymphatic drainage of anterior aspect of trunk



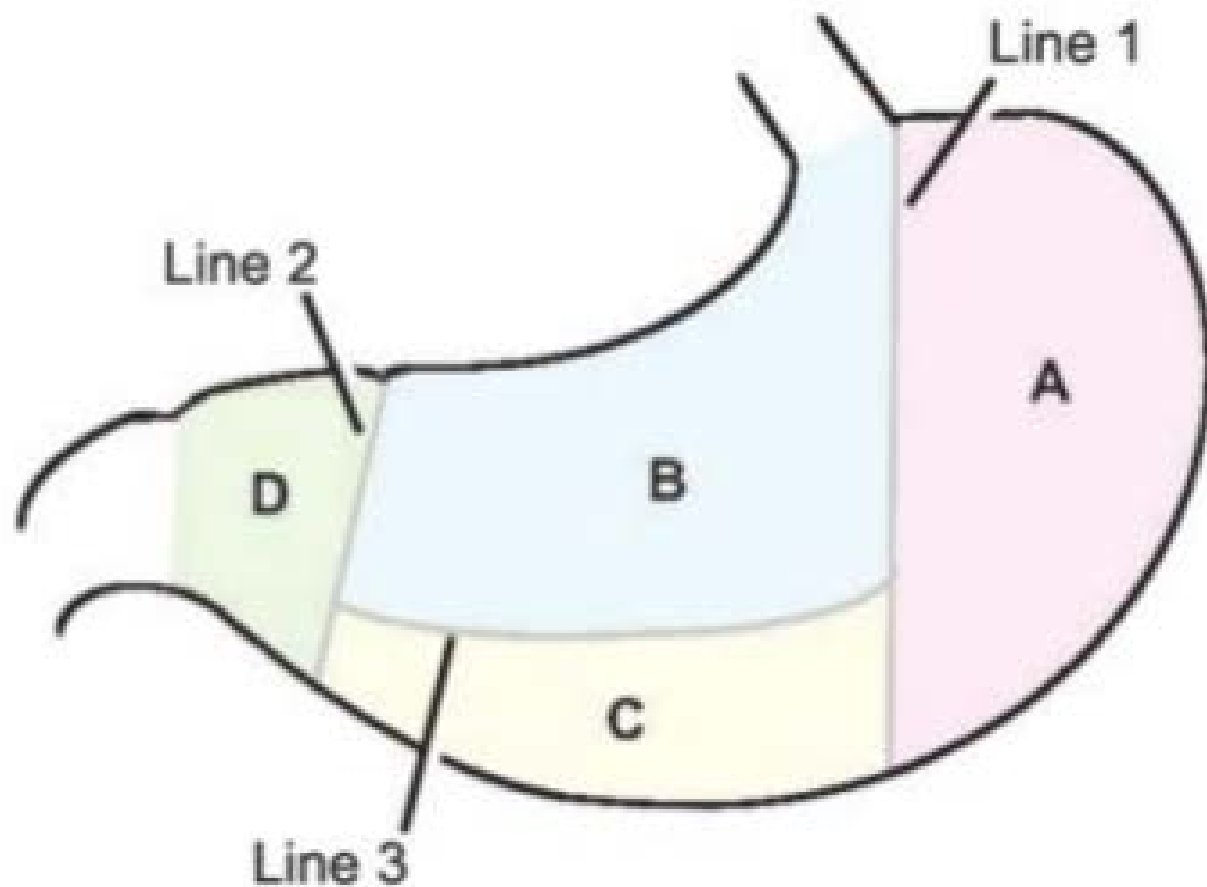
25.29: Posterior aspect of trunk to show its lymphatic drainage.



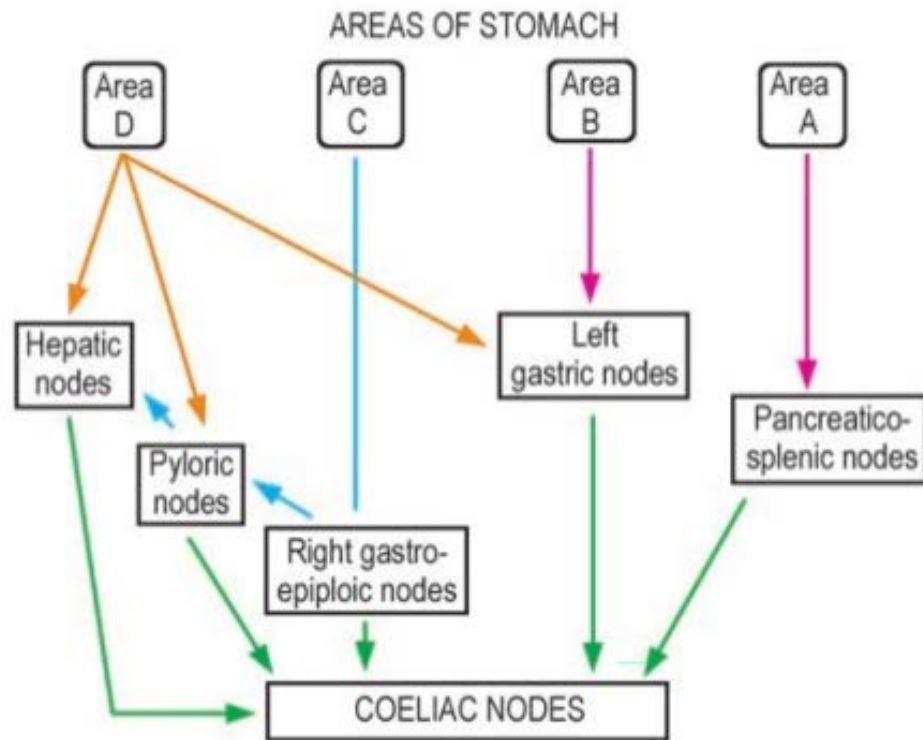
25.30: Lymphatic drainage of deeper tissues of anterior abdominal wall



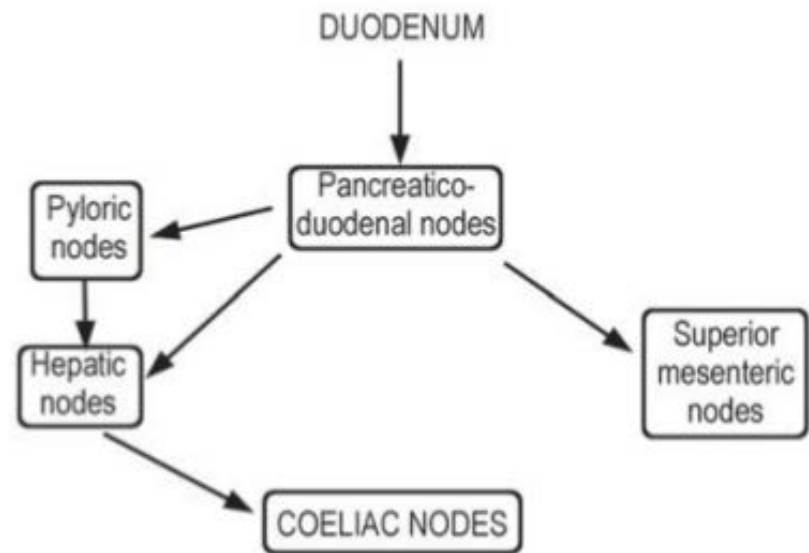
34.3: The lateral aortic lymph nodes



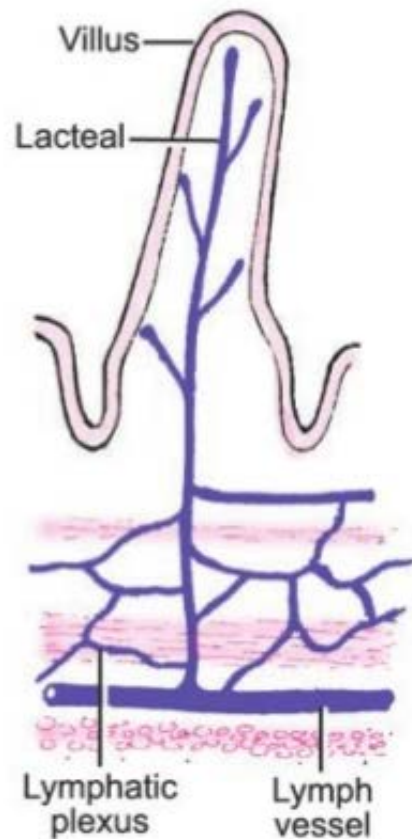
34.4: Areas of stomach having separate lymphatic drainage



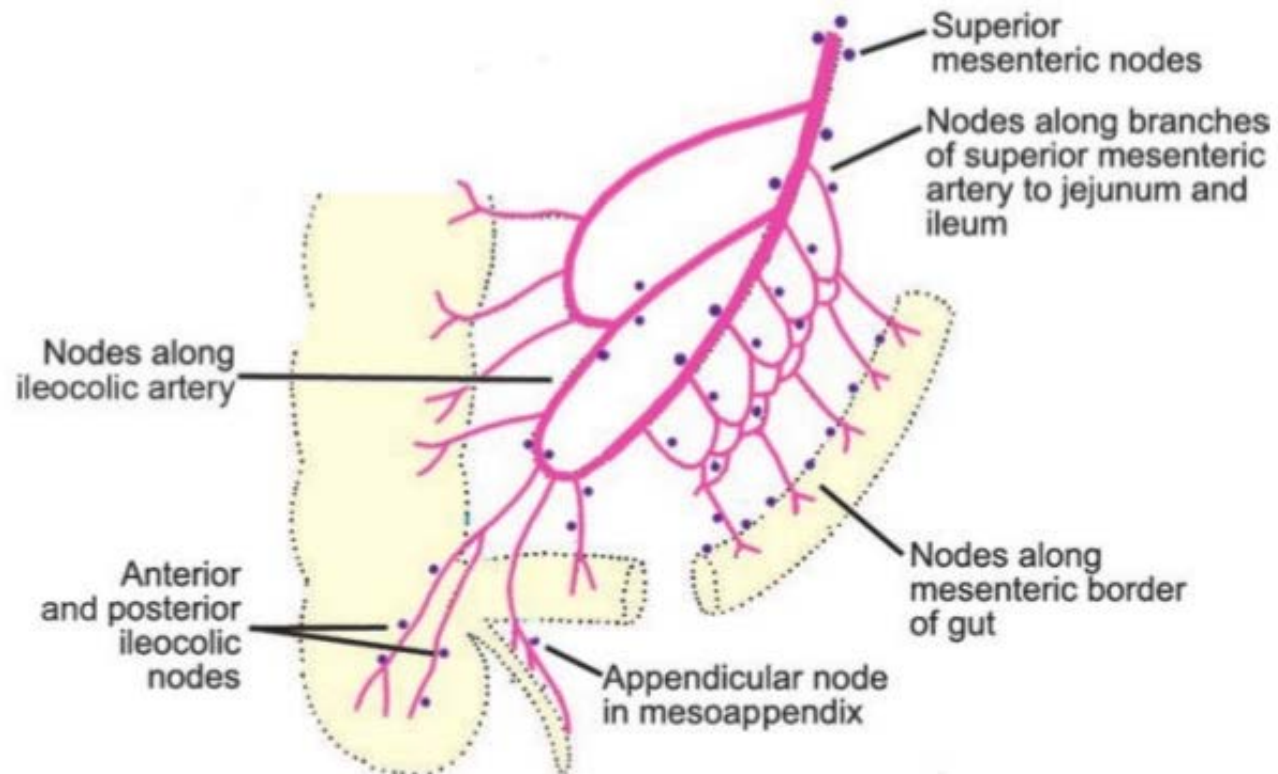
34.5: Scheme to show the lymphatic drainage of the stomach



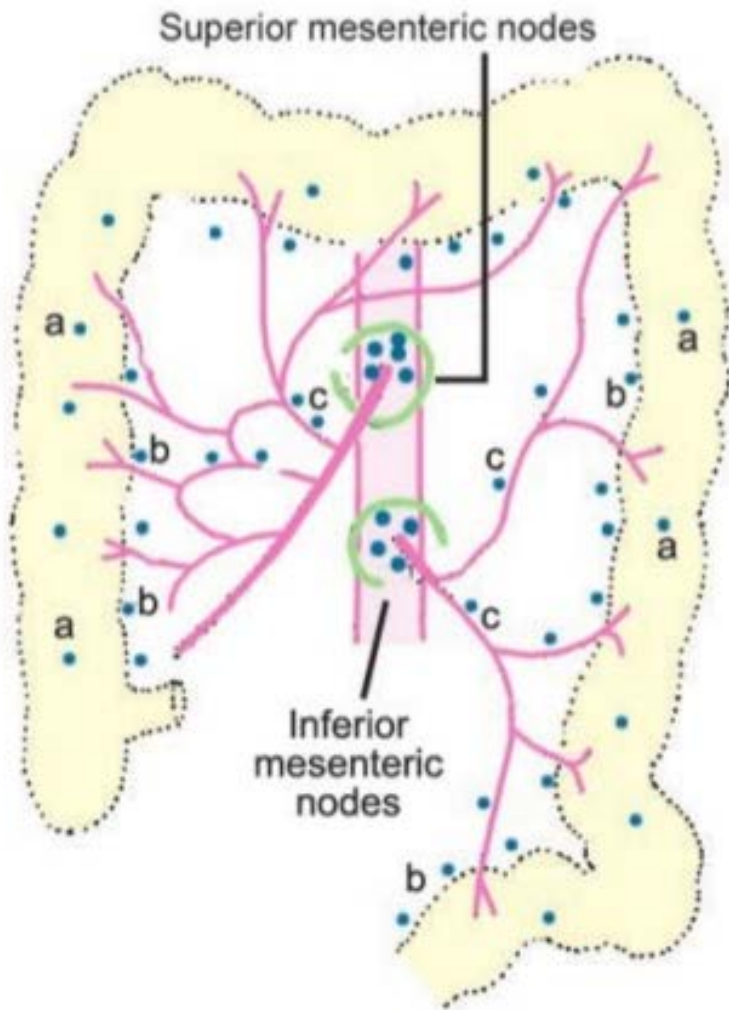
34.6: Scheme to show the lymphatic drainage of the duodenum



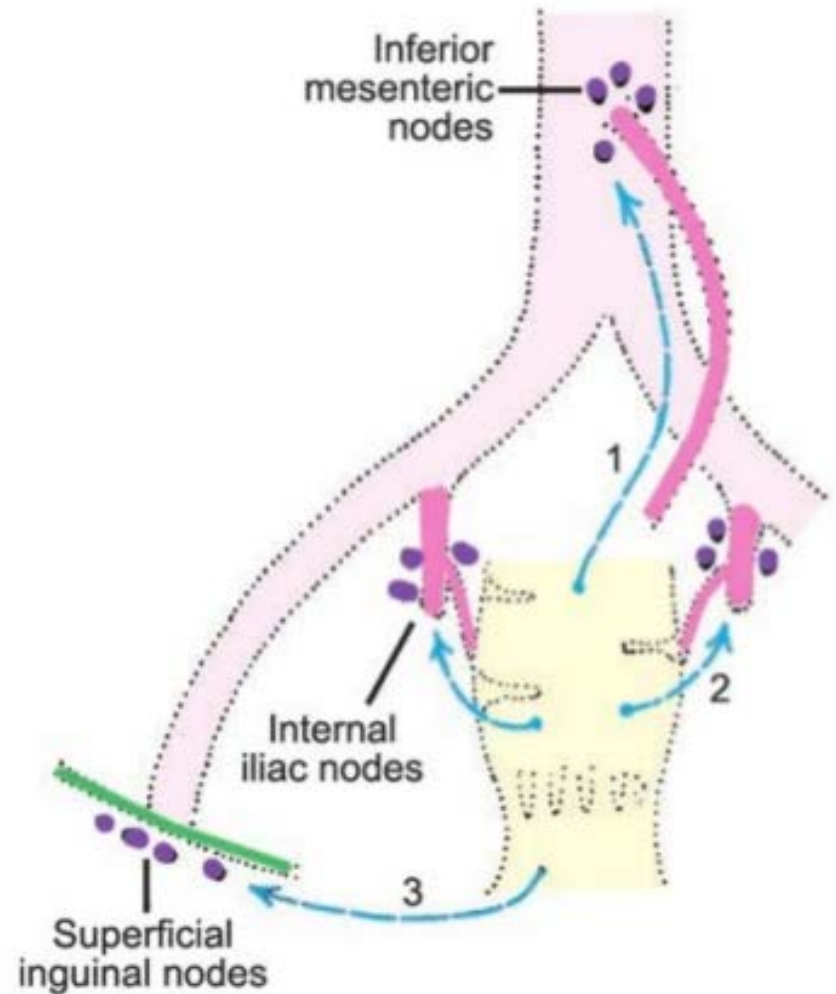
34.7: Scheme to show arrangement of lymph vessels within the gut



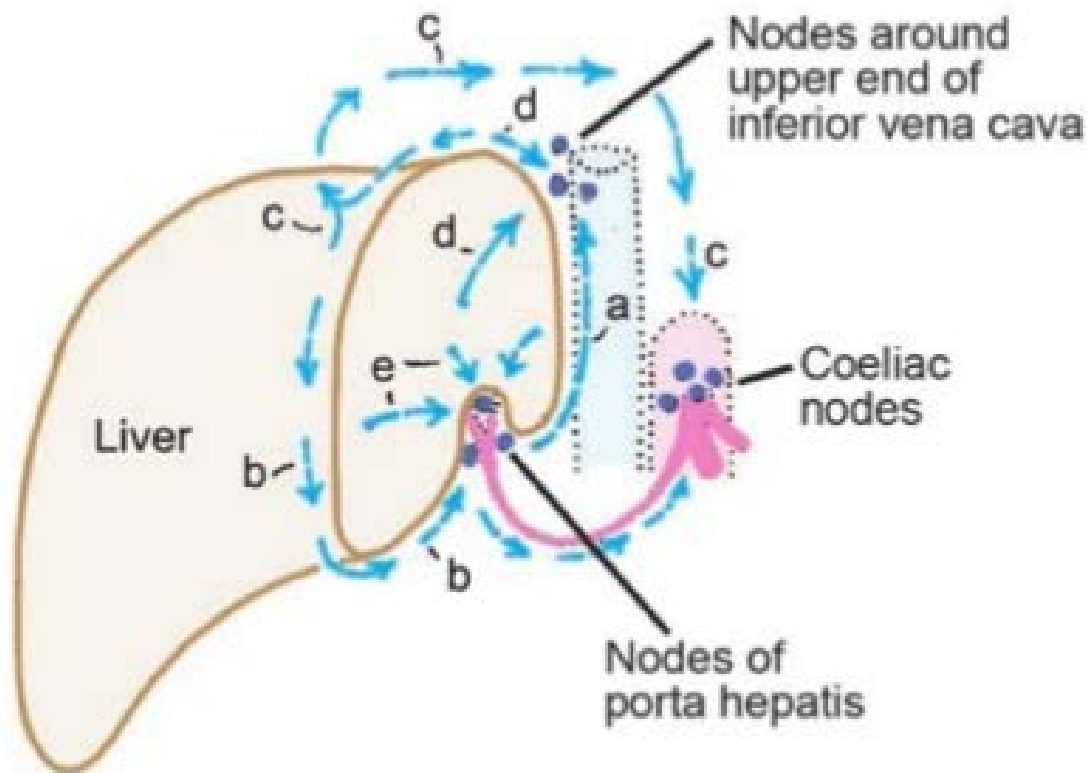
34.8: Lymph nodes draining the jejunum ileum, caecum and appendix



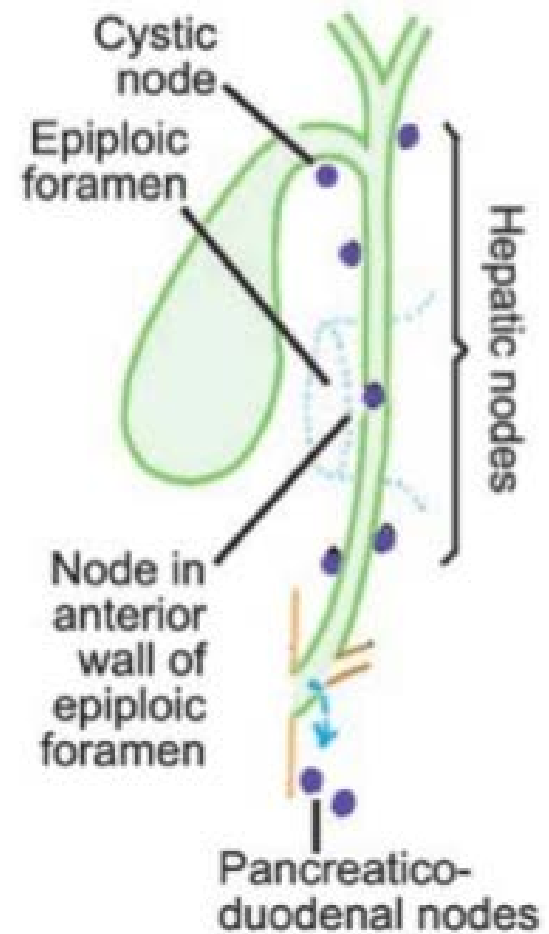
34.9: Lymph nodes draining the colon



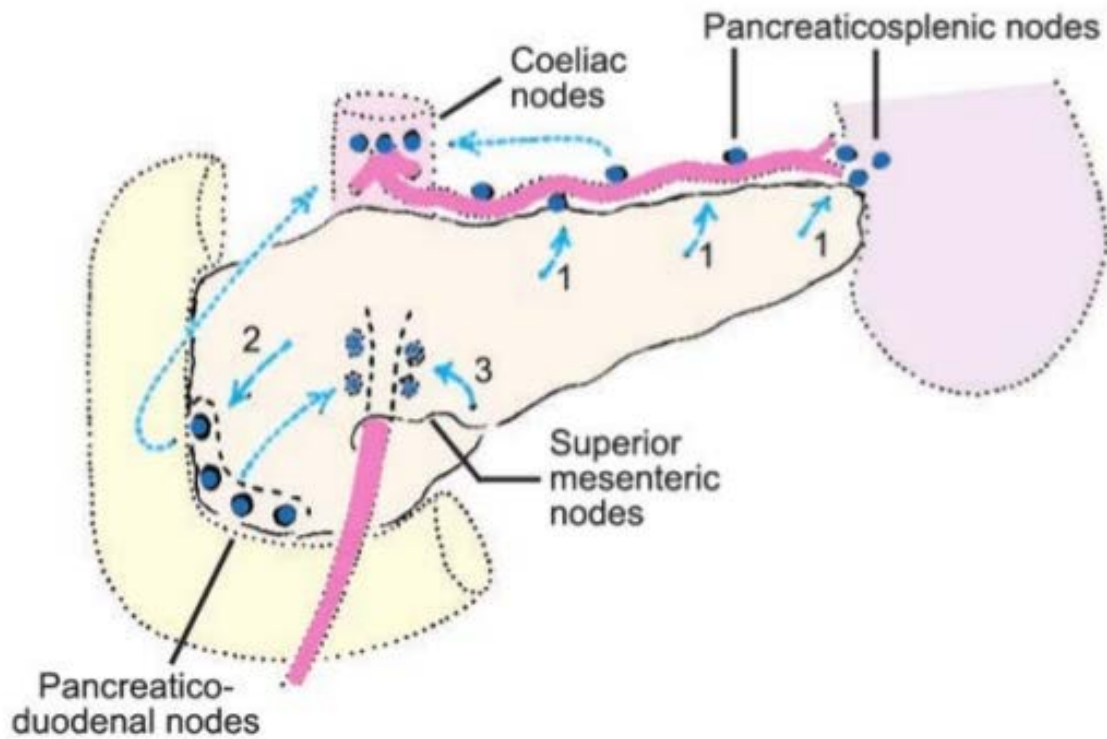
34.10: Scheme to show the lymphatic drainage of the rectum and anal canal



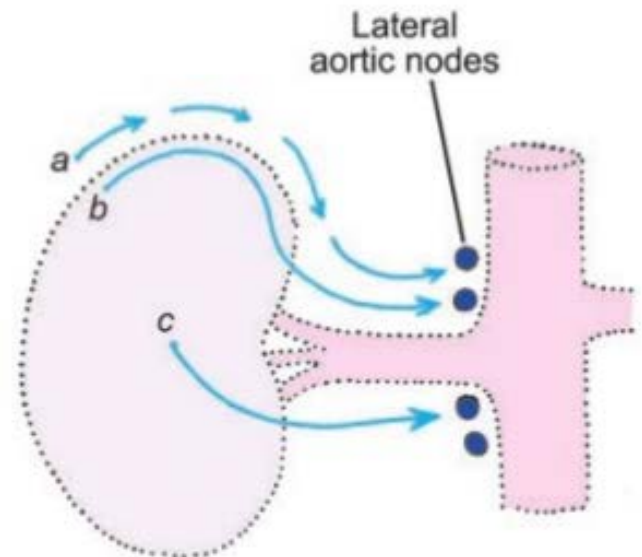
34.11: Lymphatic drainage of the liver



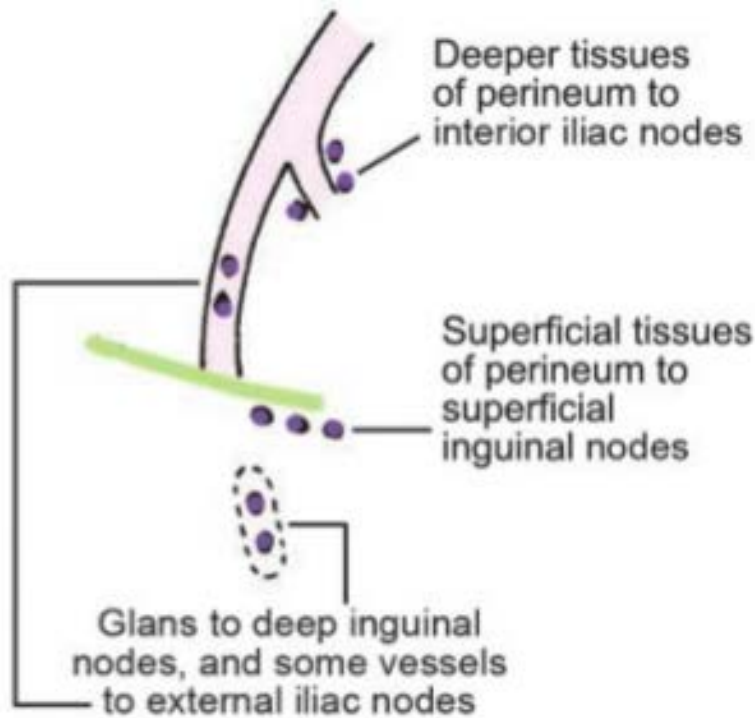
34.12: Lymphatic drainage of gall bladder and bile duct



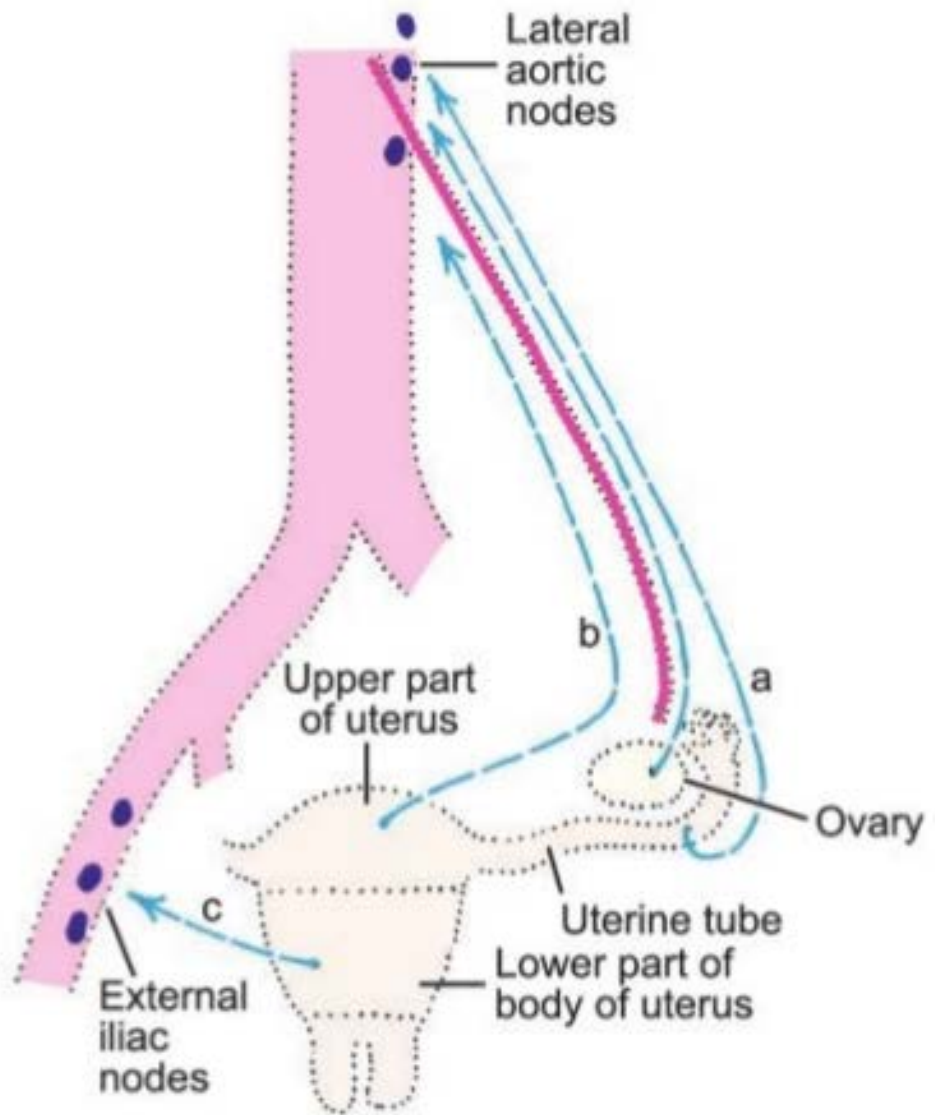
34.13: Lymphatic drainage of the pancreas



34.14: Lymphatic drainage of the kidney



34.15: Lymphatic drainage of the perineum



34.16: Scheme to show the lymphatic drainage of the uterus