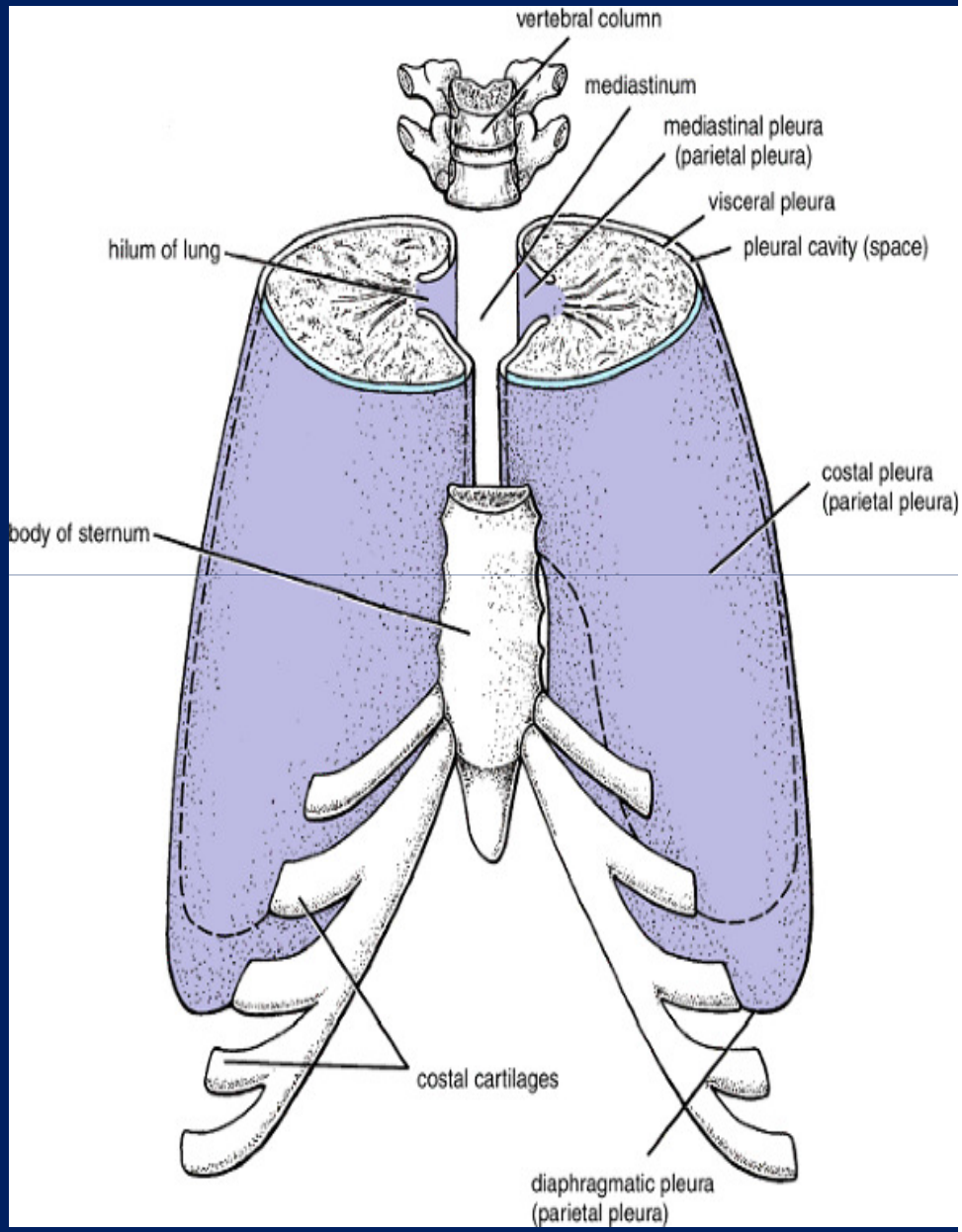
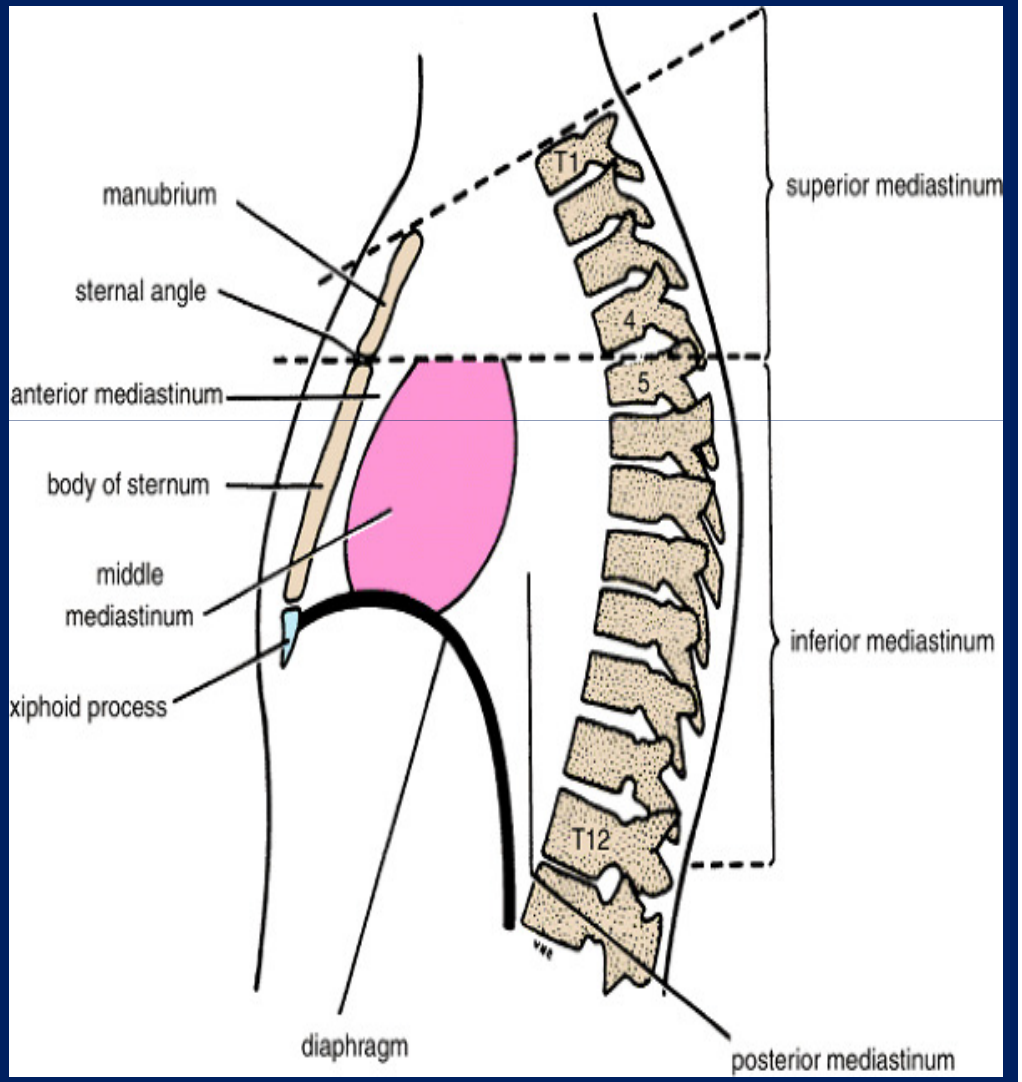
Thoracic Cavity

- The Thoracic cavity is bounded by the **chest wall** and below by the **diaphragm**.
- It extends upward into the root of the neck about one fingerbreadth above the clavicle on each side.
- The diaphragm, which is a very thin muscle, is the only structure (apart from the pleura and peritoneum) that separates the chest from the abdominal viscera.
- The chest cavity can be divided into a median partition, called the **mediastinum**, and the laterally placed **pleurae and lungs**.



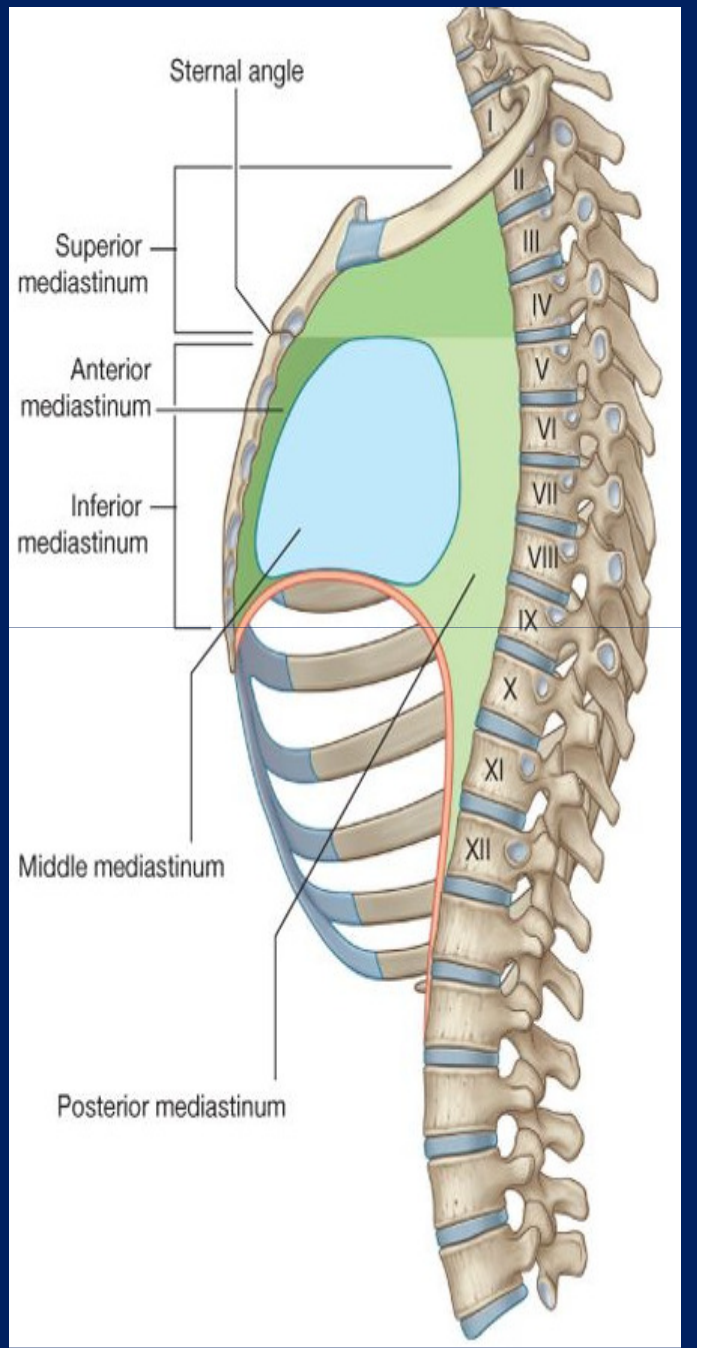
Mediastinum

- The **mediastinum** is a movable partition that extends **superiorly** to the thoracic outlet and the root of the neck and **inferiorly** to the diaphragm.
- It extends **anteriorly** to the sternum and **posteriorly** to the vertebral column.
- It **contains** the thymus, heart and large blood vessels, trachea and esophagus, the thoracic duct and lymph nodes, vagus and phrenic nerves, and sympathetic trunks.
- The mediastinum is **divided** into **superior** and **inferior mediastina** by an imaginary plane passing from the sternal angle **anteriorly** to the lower border of the body of the fourth thoracic vertebra **posteriorly**.
- The **inferior mediastinum** is further *subdivided* into the **middle mediastinum**, consists (the pericardium and heart); the **anterior mediastinum** and the **posterior mediastinum**.



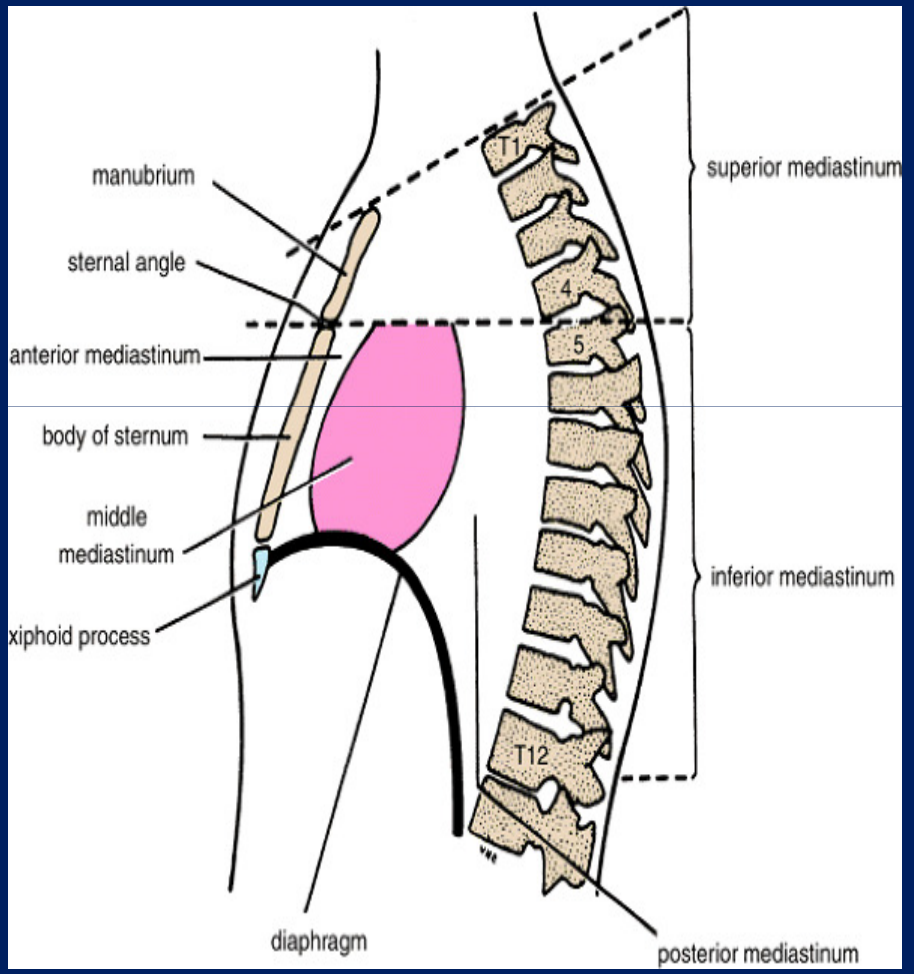
Superior Mediastinum

- (a) Thymus, (b) large veins, (c) large arteries, (d) trachea, (e) esophagus and thoracic duct (f) sympathetic trunks
- The superior mediastinum is bounded in **front** by the manubrium sterni and **behind** by the first four thoracic vertebrae.



Inferior Mediastinum

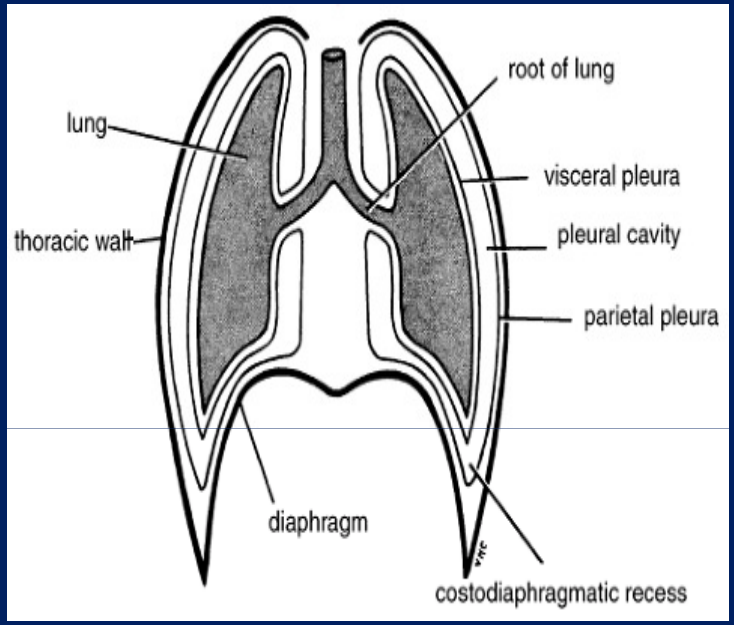
- (a) Thymus, (b) heart within the pericardium with the phrenic nerves on each side, (c) esophagus and thoracic duct, (d) descending aorta, and (e) sympathetic trunks.
- The inferior mediastinum is bounded in **front** by the body of the sternum and **behind** by the lower eight thoracic vertebrae.



Pleura

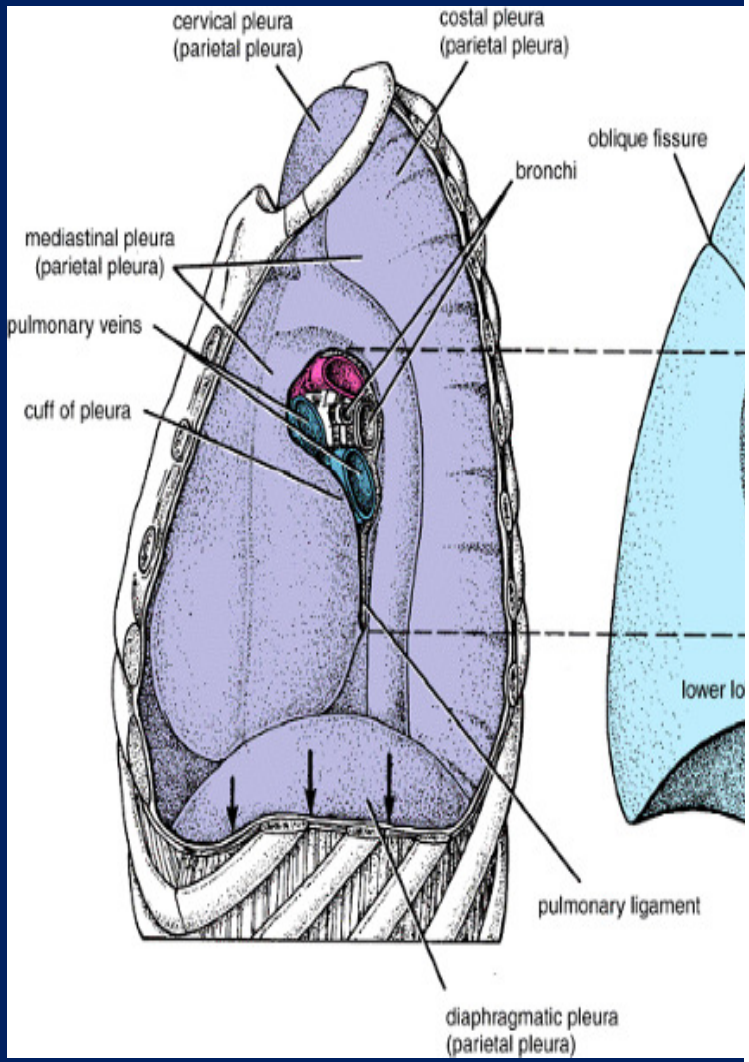
Each pleura has two parts:

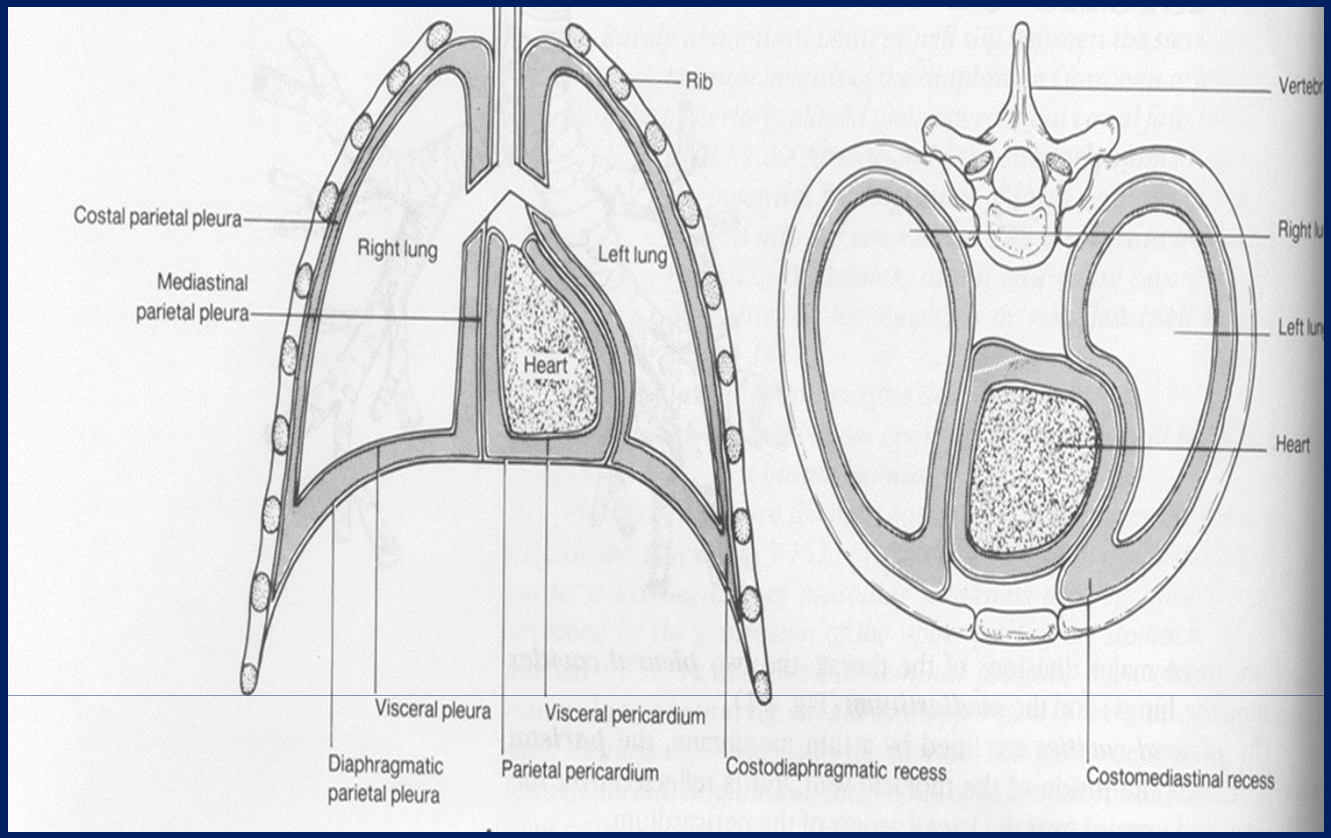
- a **parietal layer**, which lines the thoracic wall, covers the thoracic surface of the diaphragm and the lateral aspect of the mediastinum, and extends into the root of the neck to line the undersurface of the suprapleural membrane at the thoracic outlet.
- A **visceral layer**, which completely covers the outer surfaces of the lungs and extends into the depths of the interlobar fissures.
- The two layers become continuous with one another by means of a cuff of pleura that surrounds the structures entering and leaving the lung at the hilum of each lung.
- The parietal and visceral layers of pleura are separated from one another by a slit like space, the **pleural cavity**
- The pleural cavity normally contains a small amount of tissue fluid, the **pleural fluid**, which covers the surfaces of the pleura as a thin film and permits the two layers to move on each other with the minimum of friction.



The parietal pleura is divide according to the region:-

- The **cervical pleura** extends up into the neck, lining the undersurface of the suprapleural membrane.
- The **costal pleura** lines the inner surfaces of the ribs, the costal cartilages, the intercostal spaces, the sides of the vertebral bodies, and the back of the sternum.
- The **diaphragmatic pleura** covers the thoracic surface of the diaphragm.
- The **mediastinal pleura** covers and forms the lateral boundary of the mediastinum. At the hilum of the lung, it is reflected as a cuff around the vessels and bronchi and here becomes continuous with the visceral pleura. To allow for movement of the pulmonary vessels and large bronchi during respiration, the pleural cuff hangs down as a loose fold called the **pulmonary ligament**.
- It is thus seen that each lung lies free except at its hilum, where it is attached to the blood vessels and bronchi that constitute the lung root.





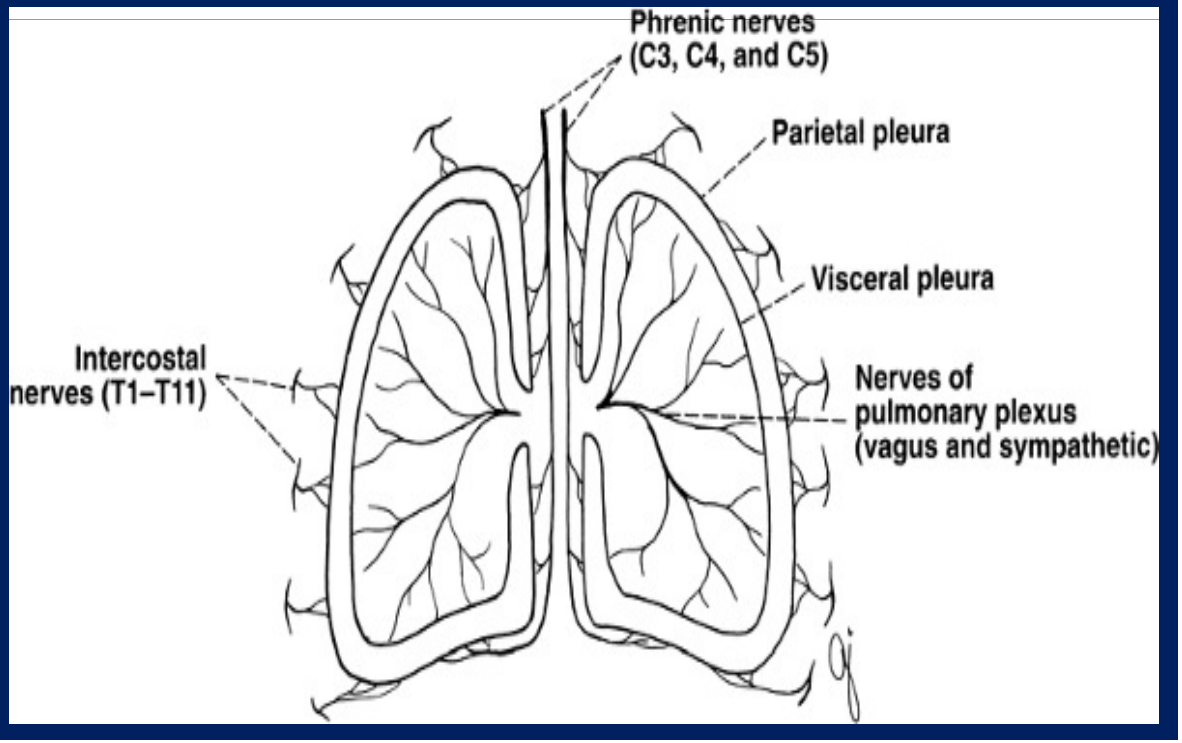
- The **costodiaphragmatic recesses** are slitlike spaces between the costal and diaphragmatic parietal pleurae that are separated only by a capillary layer of pleural fluid.
- The **costomediastinal recesses** are situated along the anterior margins of the pleura. They are slitlike spaces between the costal and the mediastinal parietal pleurae, which are separated by a capillary layer of pleural fluid.

Nerve Supply of the Pleura

The **parietal pleura** is sensitive to pain, temperature, touch, and pressure and is supplied as follows:-

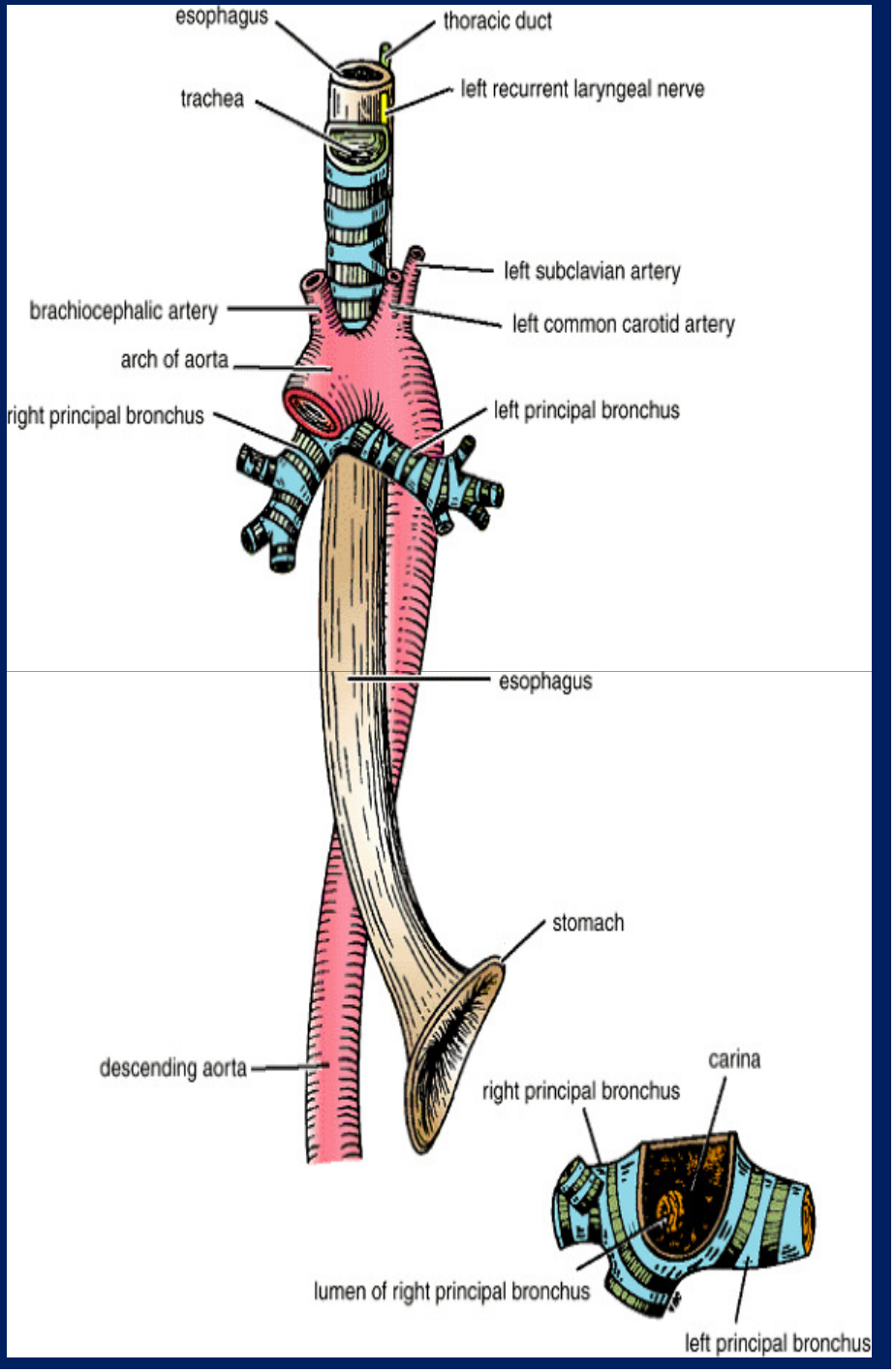
- The costal pleura is segmentally supplied by the intercostal nerves.
- The mediastinal pleura is supplied by the phrenic nerve.
- The diaphragmatic pleura is supplied over the domes by the phrenic nerve and around the periphery by the lower six intercostal nerves.

The **visceral pleura** covering the lungs is sensitive to stretch but is insensitive to common sensations such as pain and touch. It receives an autonomic nerve supply from pulmonary plexus.



Trachea

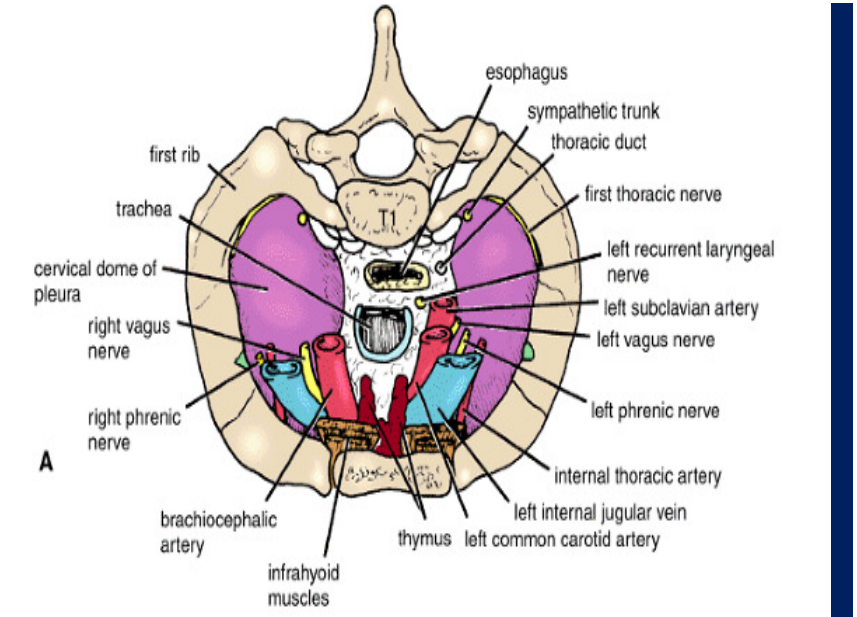
- The trachea is a mobile cartilaginous and membranous tube.
- It **begins** in the neck as continuation of larynx at lower border of cricoid cartilage at level(sixth cervical vertebra) It descends in the midline of the neck.
- In **thorax** the trachea **ends** below at the carina by dividing into right and left principal (main) bronchi at the level of sternal angle (opposite disc between the fourth and fifth thoracic vertebrae).
- In **adults** the trachea is about 11.25 cm long and 2.5 cm in diameter.
- The fibroelastic tube is kept patent by the presence of U-shaped bars (rings) of hyaline cartilage embedded in its wall.
- The posterior free ends of the cartilage are connected by smooth muscle, the **trachealis muscle**.

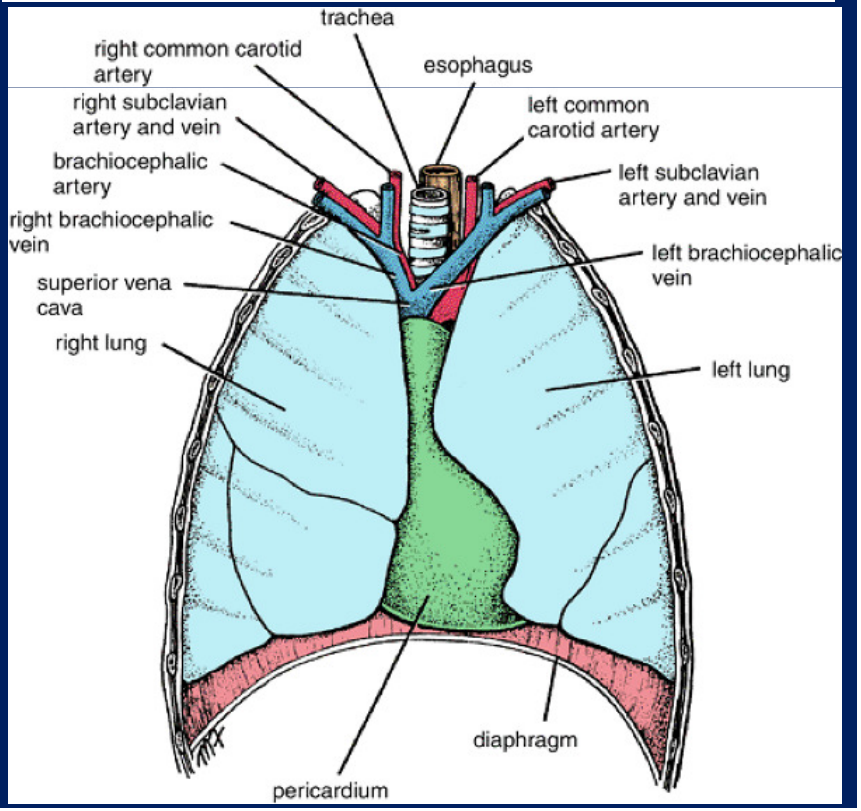


Relations of the Trachea

The relations of the trachea in the superior mediastinum of the thorax are as follows:

- **Anteriorly**: The sternum, the thymus, the left brachiocephalic vein, the origins of the brachiocephalic and left common carotid arteries, and the arch of the aorta.
- **Posteriorly**: The esophagus and the left recurrent laryngeal nerve.
- **Right side**: The azygos vein, the right vagus nerve, and the pleura.
- **Left side**: The arch of the aorta, the left common carotid and left subclavian arteries, the left vagus and left phrenic nerves, and the pleura.





Blood Supply of the Trachea

The upper two thirds are supplied by the inferior thyroid arteries and the lower third is supplied by the bronchial arteries.

Lymph Drainage of the Trachea

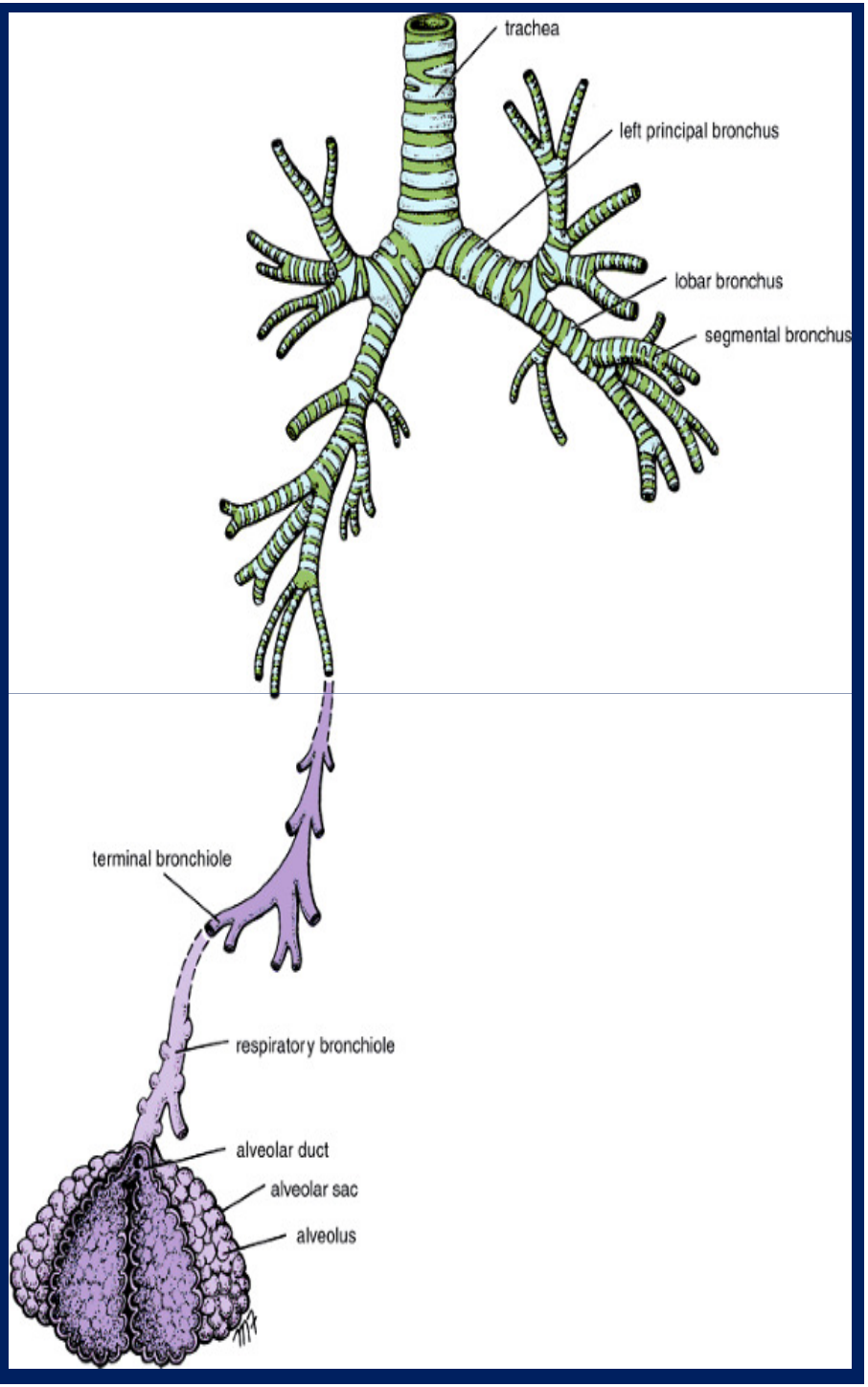
The lymph drains into the pretracheal and paratracheal lymph nodes and the deep cervical nodes.

Nerve Supply of the Trachea

The **sensory** nerve supply is from the vagi and the recurrent laryngeal nerves. **Sympathetic** nerves supply the trachealis muscle.

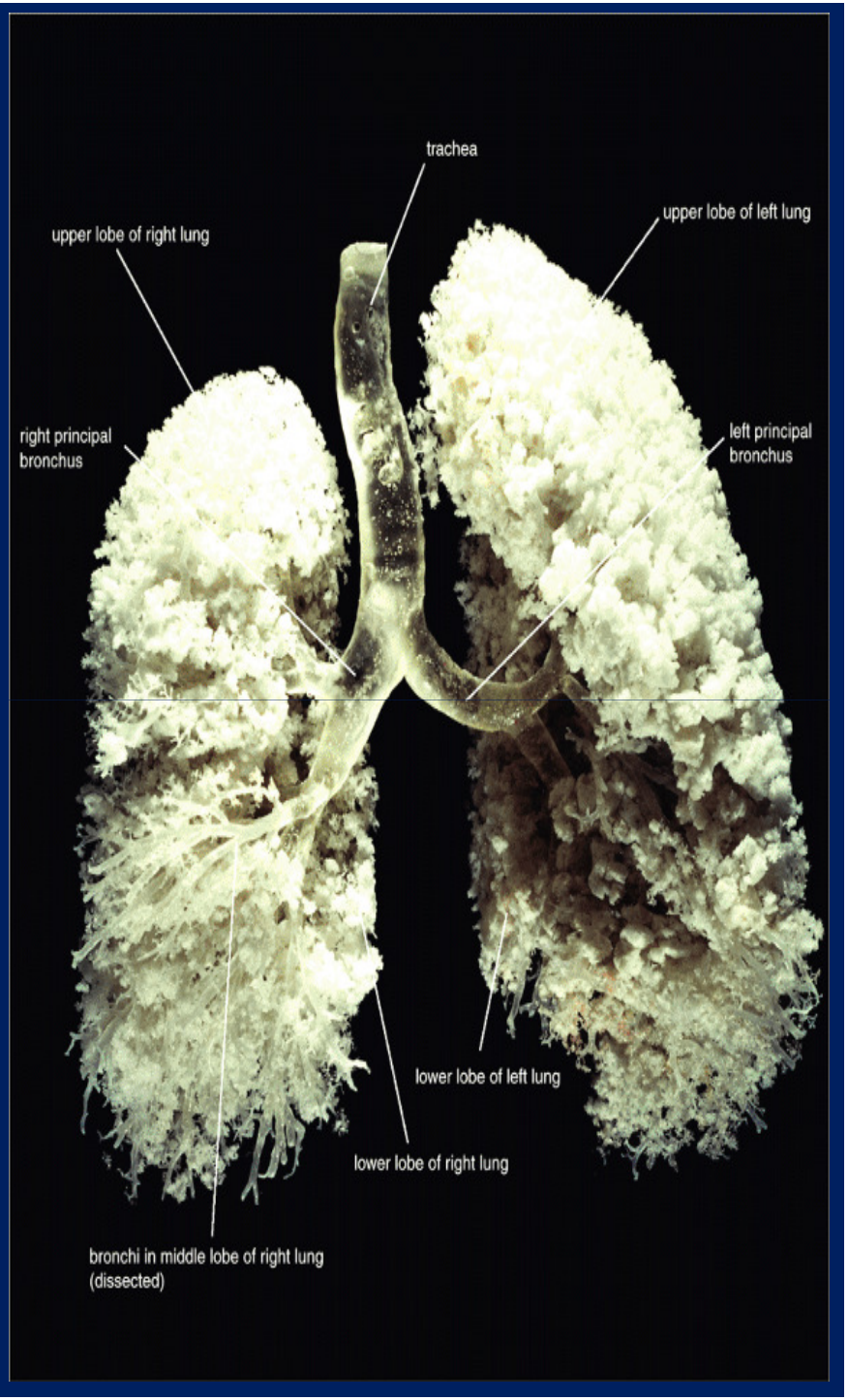
The Bronchi

- The trachea bifurcates behind the arch of the aorta into the right and left **principal** (primary, or main) **bronchi**.
- The bronchi divide repeaditly, giving rise to several million **terminal bronchioles** that terminate in one or more **respiratory bronchioles**.
- Each respiratory bronchiole divides into 2 to 11 **alveolar ducts** that enter the **alveolar sacs**. The alveoli arise from the walls of the sacs as diverticula.



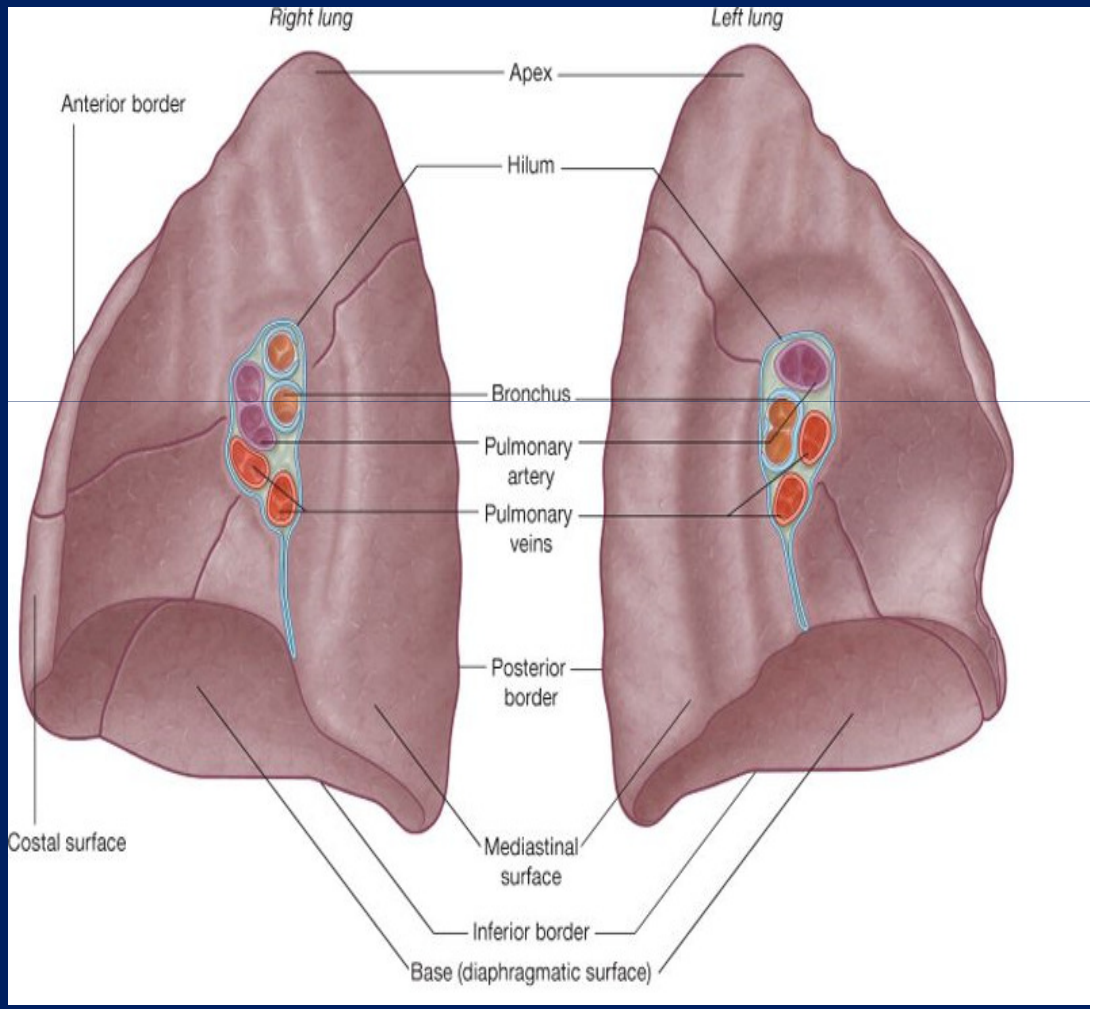
Principal Bronchi

- The **right principal** (main) **bronchus** is wider, shorter, and more vertical than the left and is about **2.5** cm long.
- Before entering the hilum of the right lung, the principal bronchus gives off the **superior lobar bronchus**. On entering the hilum, it divides into a **middle** and an **inferior lobar bronchus**.
- The **left principal** (main) **bronchus** is narrower, longer, and more horizontal than the right and is about **5** cm long.
- It passes to the left below the **arch of the aorta** and in front of the **esophagus**.
- On entering the hilum of the left lung, the principal bronchus divides into a **superior** and an **inferior lobar bronchus**.



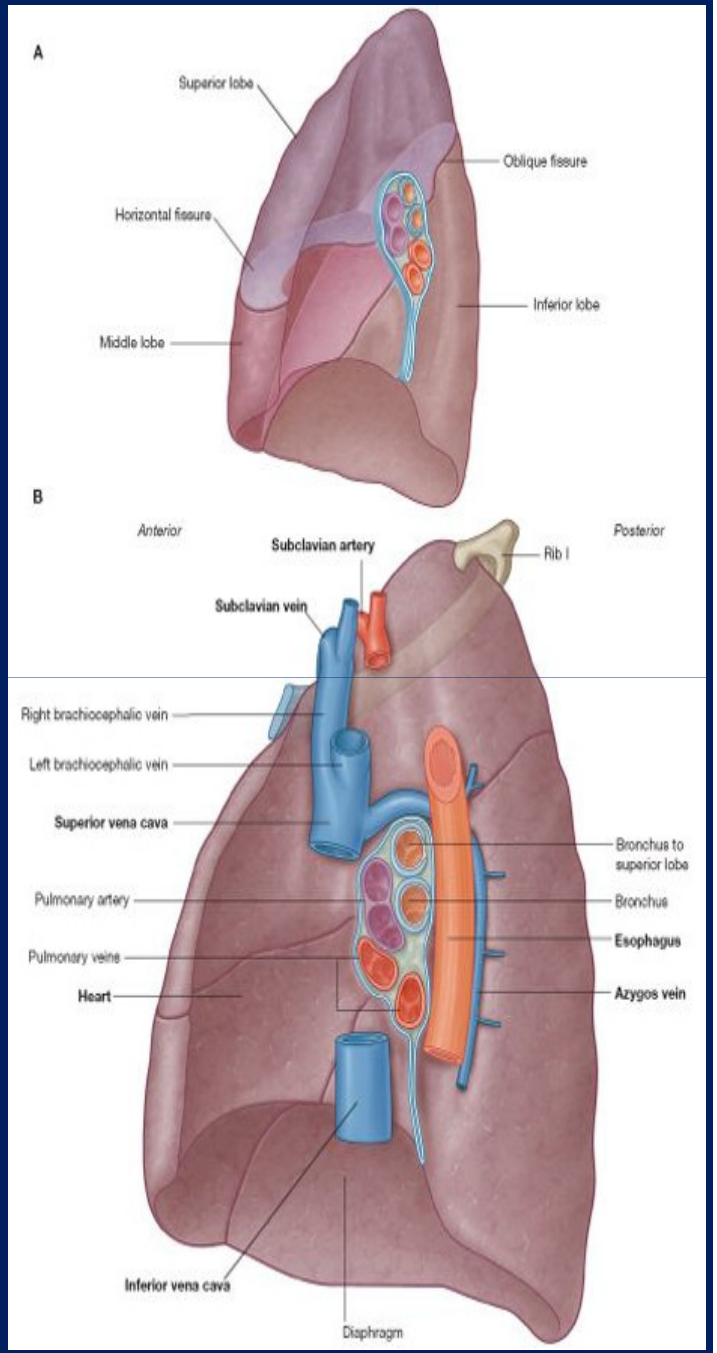
Lungs

- The **two lungs** are organs of respiration and lie on either side of the mediastinum surrounded by right and left pleural cavities.
- The **pulmonary arteries** deliver deoxygenated blood to lungs from the right ventricle of heart. Oxygenated blood returns to left atrium via **pulmonary veins**.
- Each lung has a **half-cone** shape, with a base, apex, two surfaces, and three borders.
- The **base** sits on the diaphragm.
- The **apex** projects above first rib and into the root of the neck.
- The **costal surface** lies immediately adjacent to the ribs and intercostal spaces of the thoracic wall.
- The **mediastinal surface** lies against the mediastinum anteriorly and the vertebral column posteriorly and contains the hilum of the lung through which structures enter and leave.
- The **inferior border** of the lung is sharp and separates base from the costal surface.
- The **anterior** and **posterior borders** separate costal surface from medial surface.
- Unlike the **anterior** and **inferior** borders, which are **sharp**, the **posterior** border is **smooth** and **rounded**.



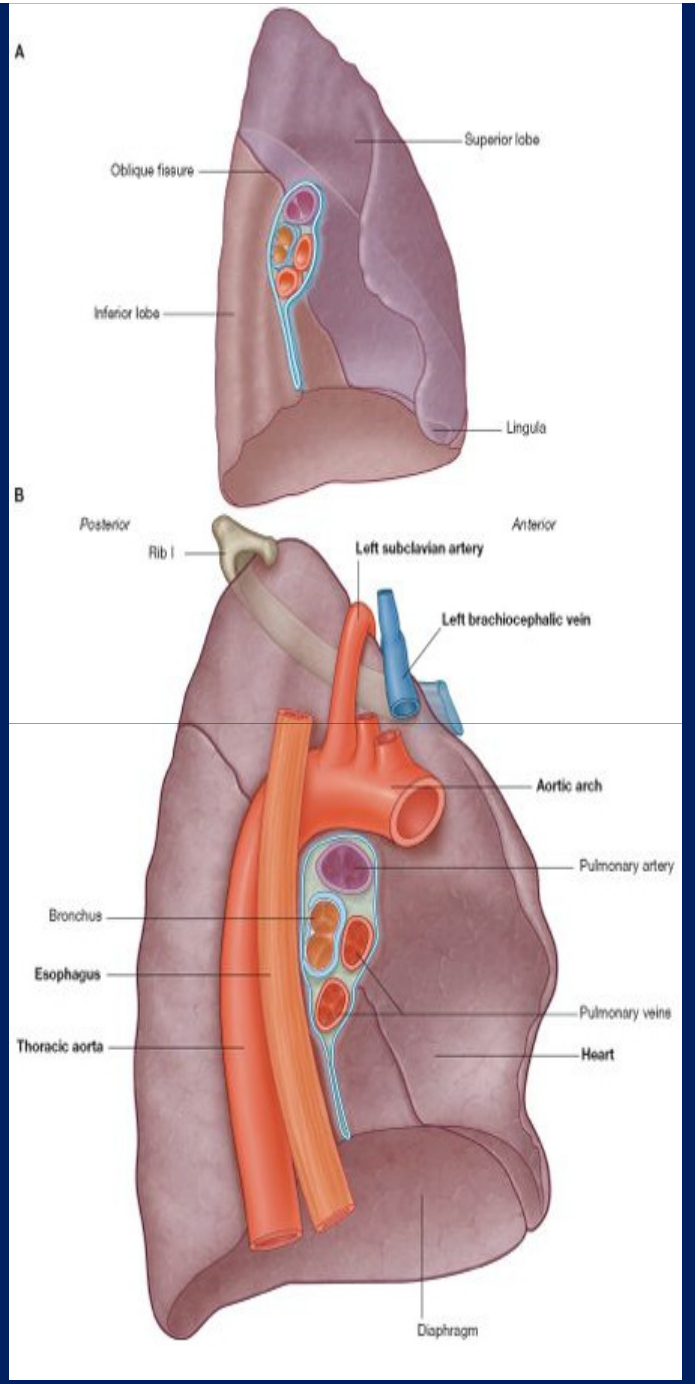
Right Lung

- The **right lung** is slightly **larger** than the left and is divided by the oblique and horizontal fissures into three lobes: **upper**, **middle**, and **lower** lobes.
- The **oblique fissure** runs from the **inferior** border upward and backward across the medial and costal surfaces until it cuts the **posterior** border about 6.25 cm below the apex.
- The **horizontal fissure** runs **horizontally** across the costal surface at the level of the fourth costal cartilage to meet the oblique fissure in the midaxillary line.
- The **middle lobe** is thus a **small triangular** lobe bounded by the horizontal and oblique fissures.
- The **medial surface** of the right lung lies adjacent to a number of important structures in the mediastinum and the root of the neck.
- These **include** the: heart, inferior vena cava, superior vena cava, azygos vein and esophagus.



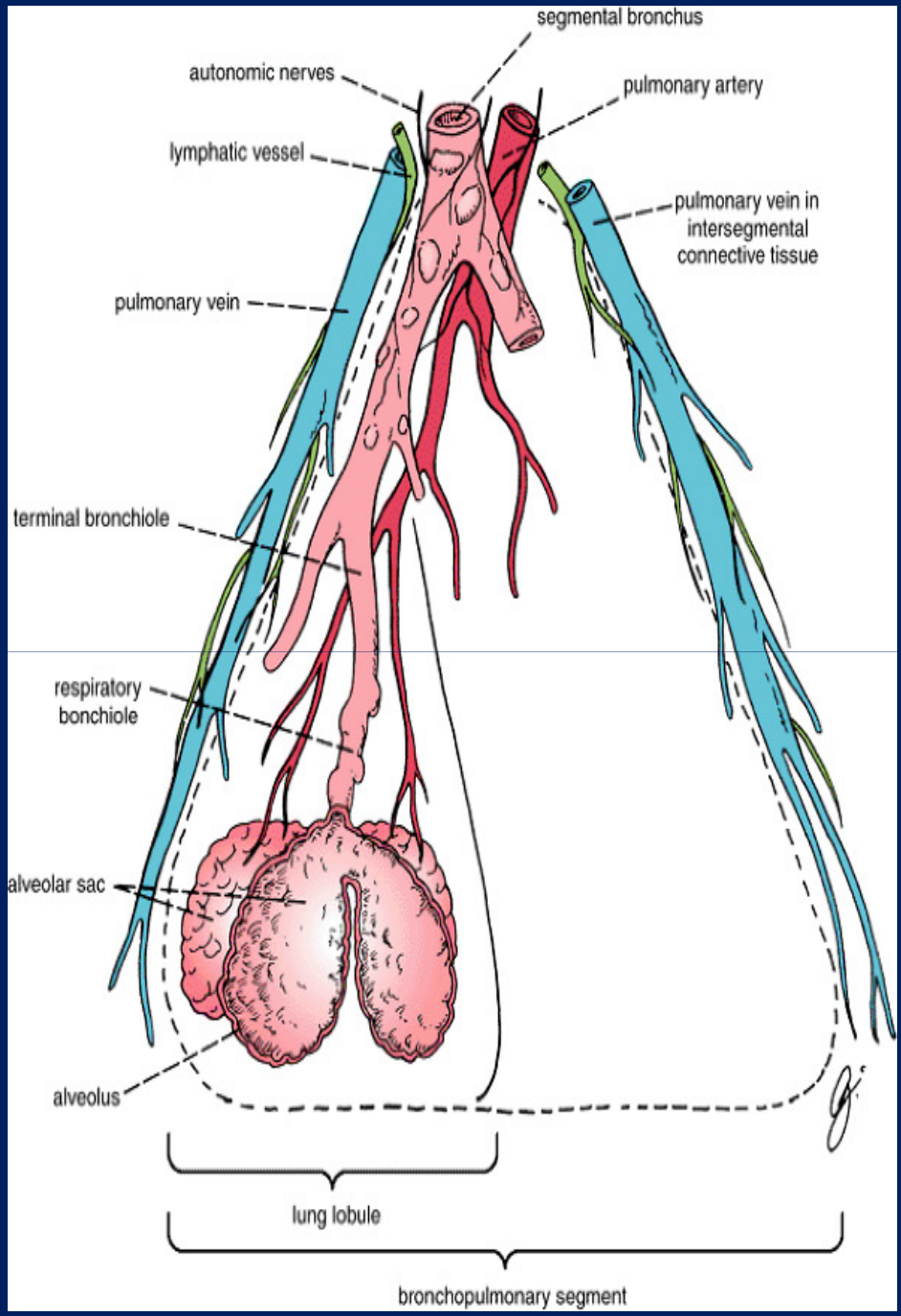
Left Lung

- The **left lung** is divided by a similar oblique fissure into two lobes: the **upper** and **lower lobes**.
- There is no horizontal fissure in the left lung.
- The medial surface of the left lung lies adjacent to a number of important structures in the mediastinum and root of the neck.
- These **include** the: heart, aortic arch, thoracic aorta, and esophagus.



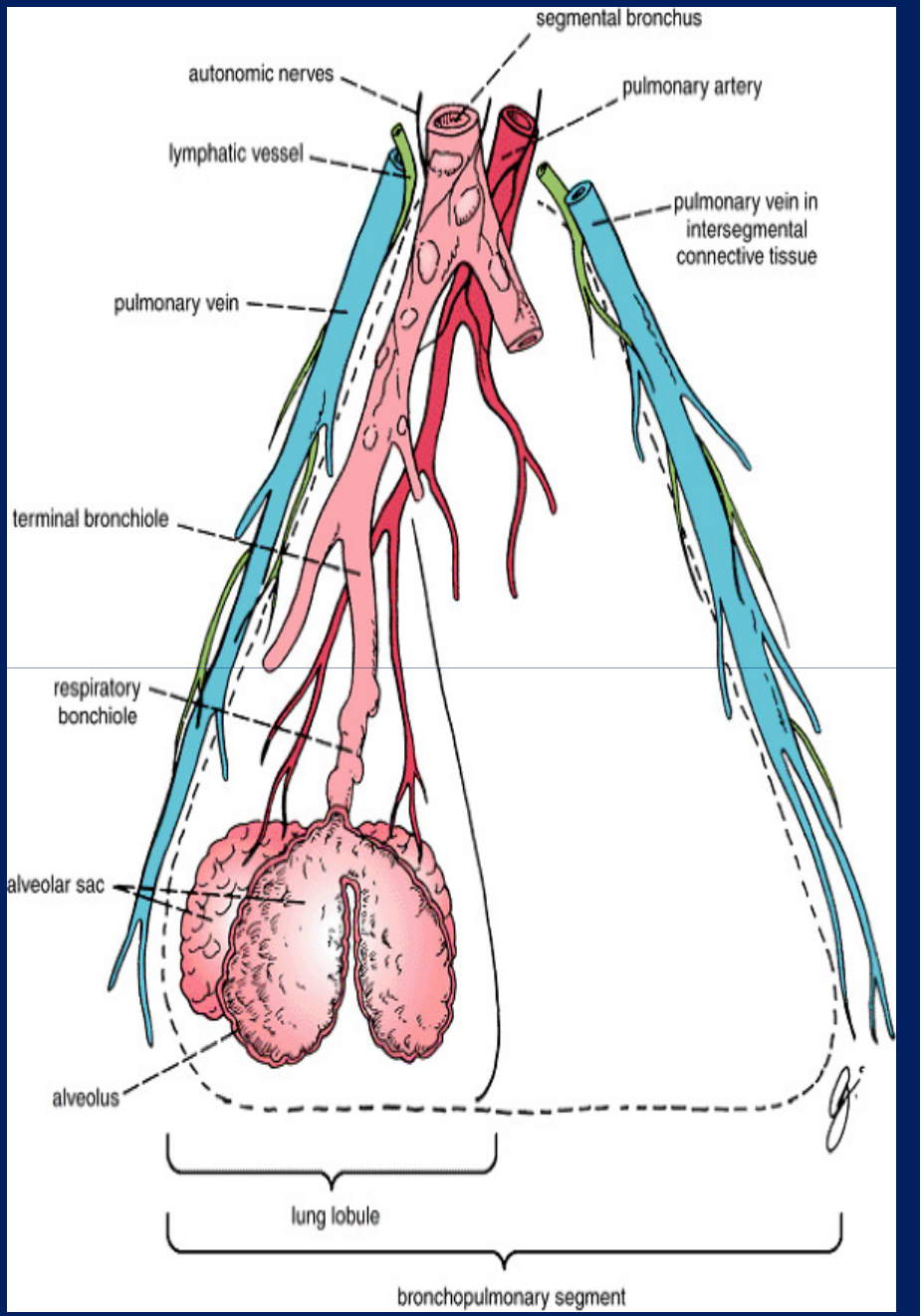
Bronchopulmonary Segments

- The **bronchopulmonary** segments are the **anatomic**, **functional**, and **surgical units** of the lungs.
- Each **lobar** (**secondary**) **bronchus**, which passes to a lobe of the lung, gives off branches called **segmental** (**tertiary**) bronchi.
- Each **segmental** bronchus passes to a structurally and functionally independent unit of a lung lobe called a **bronchopulmonary segment**, which is surrounded by connective tissue.
- The **segmental bronchus** is accompanied by a (branch of the **pulmonary** artery, **lymphatic** vessels and **autonomic** nerve supply) but the **tributaries** of the pulmonary veins run in the connective tissue between adjacent bronchopulmonary segments.



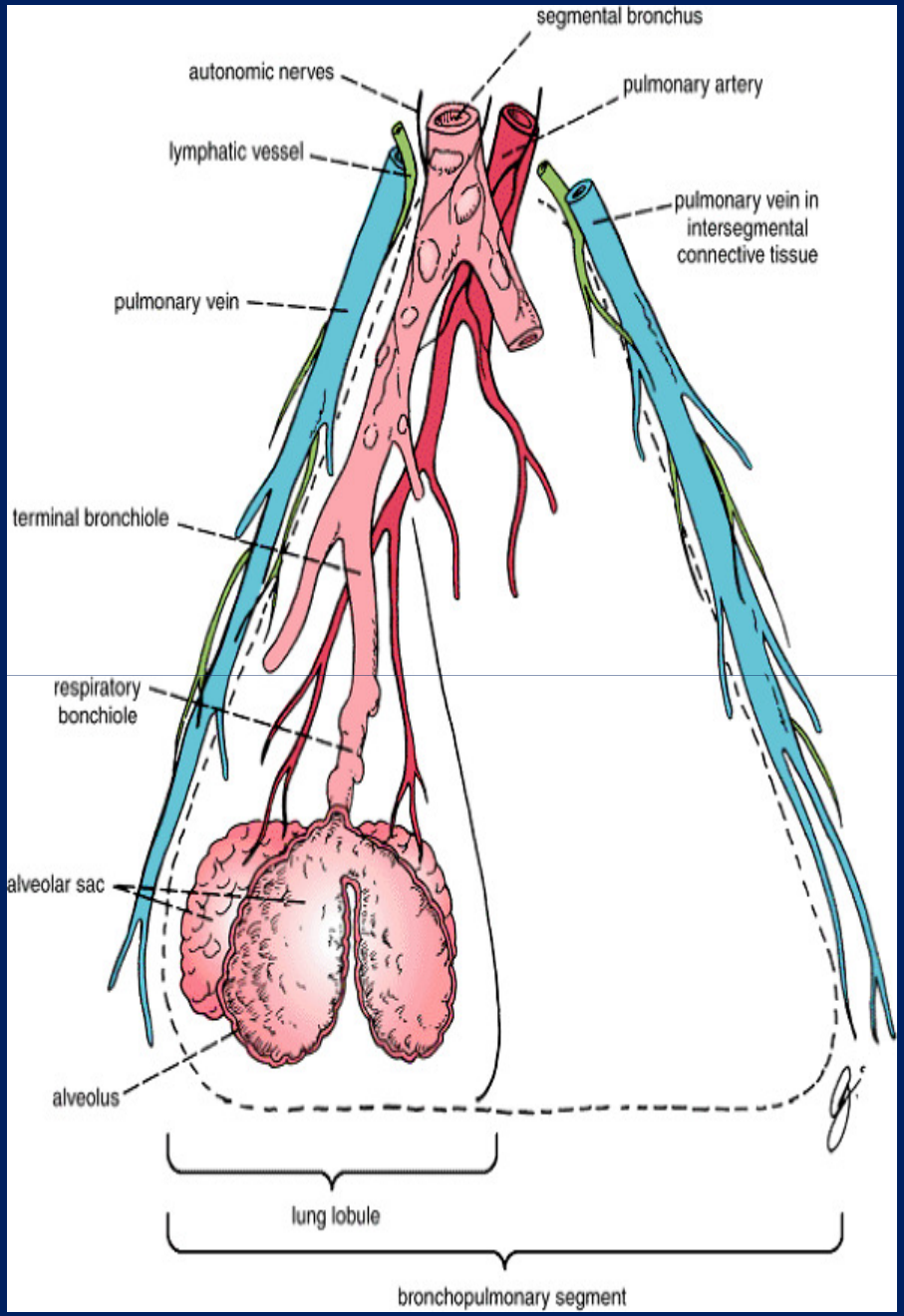
Bronchopulmonary Segment

- On entering a bronchopulmonary segment, each segmental bronchus divides repeatedly.
- The walls of the **bronchi** are held open by discontinuous elongated plates of **cartilage**,.
- The smallest bronchi divide and give rise to **bronchioles**, which are less than **1** mm in diameter.
- Bronchioles possess **no cartilage** in their walls and are lined with columnar ciliated epithelium.



Bronchopulmonary Segment

- The bronchioles then divide and give rise to **terminal bronchioles**, which show delicate outpouchings from their walls.
- The diameter of a **respiratory bronchiole** is about **0.5** mm.
- The respiratory bronchioles end by branching into **alveolar ducts**, which lead into tubular passages with numerous thin-walled outpouchings called **alveolar sacs**.
- The alveolar sacs consist of several **alveoli opening** into a single chamber.
- Each **alveolus** is surrounded by a rich network of blood capillaries.



The Tracheobronchial Tree

right and left

primary or main bronchi

↓

lobar or secondary bronchi

(supplies a lobe)

↓

segmental or tertiary bronchi,

(bronchopulmonary segments)

↓

terminal bronchioles

↓

respiratory bronchioles

(alveoli)

↓

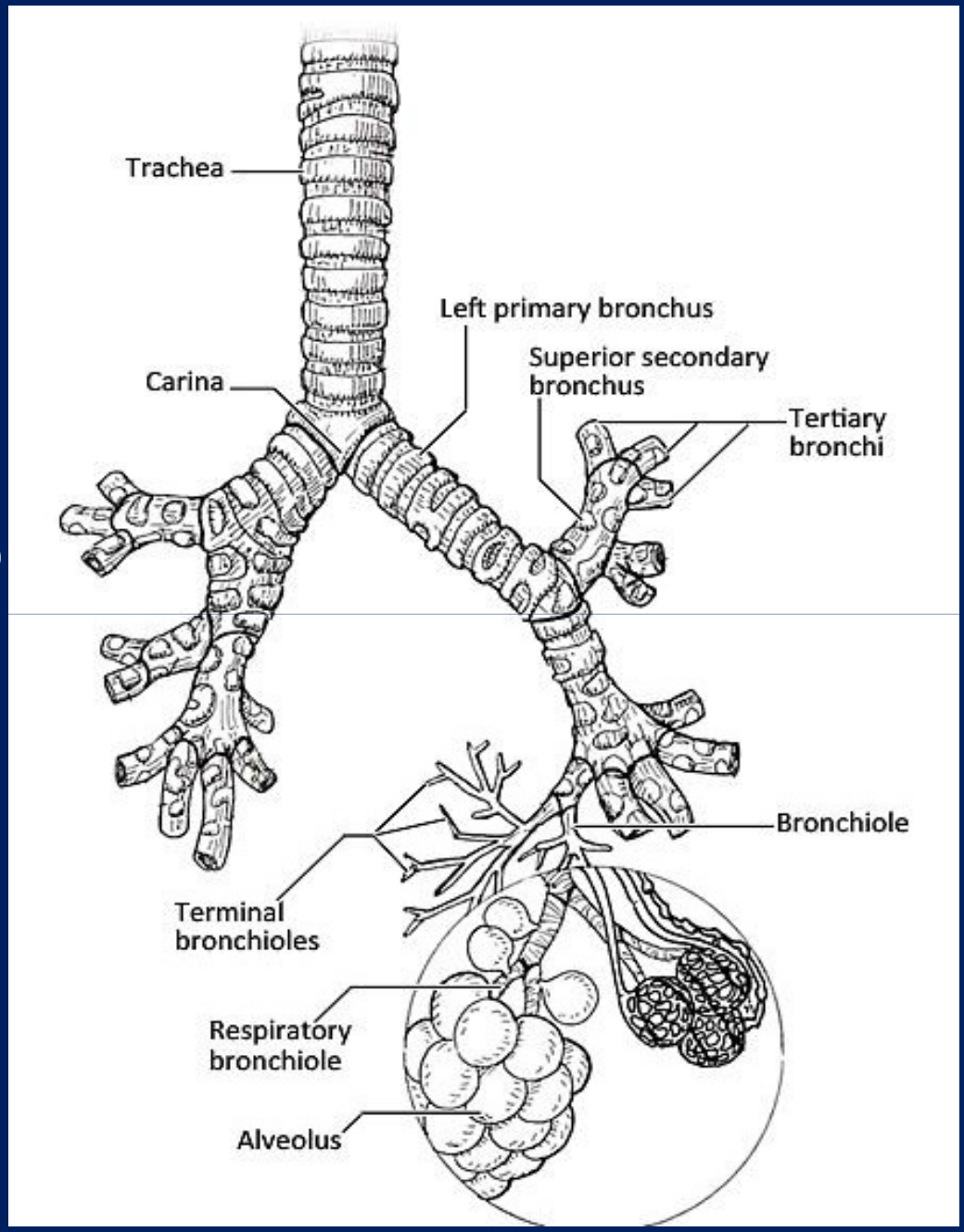
2-11 alveolar ducts

↓

5-6 alveolar sacs

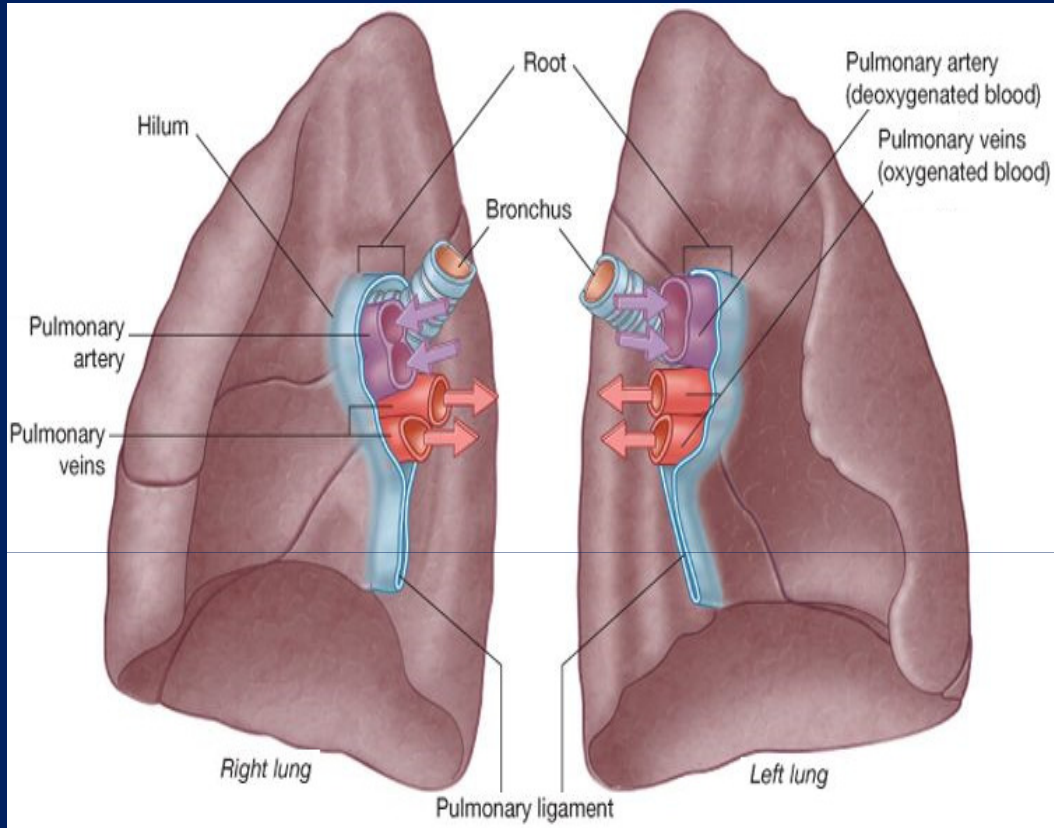
↓

alveoli open



The Root and Hilum of the Lung

- The **root of each lung** is a short tubular collection of structures that is covered by a sleeve of **mediastinal pleura** that reflects onto the surface of the lung as **visceral pleura**
- A thin blade-like fold of pleura projects inferiorly from the root of the lung and extends from the hilum to the mediastinum. This structure is **pulmonary ligament**.
- In the mediastinum, the **vagus** nerves pass immediately **posterior** to the roots of the lungs, while the **phrenic** nerves pass immediately **anterior** to them.



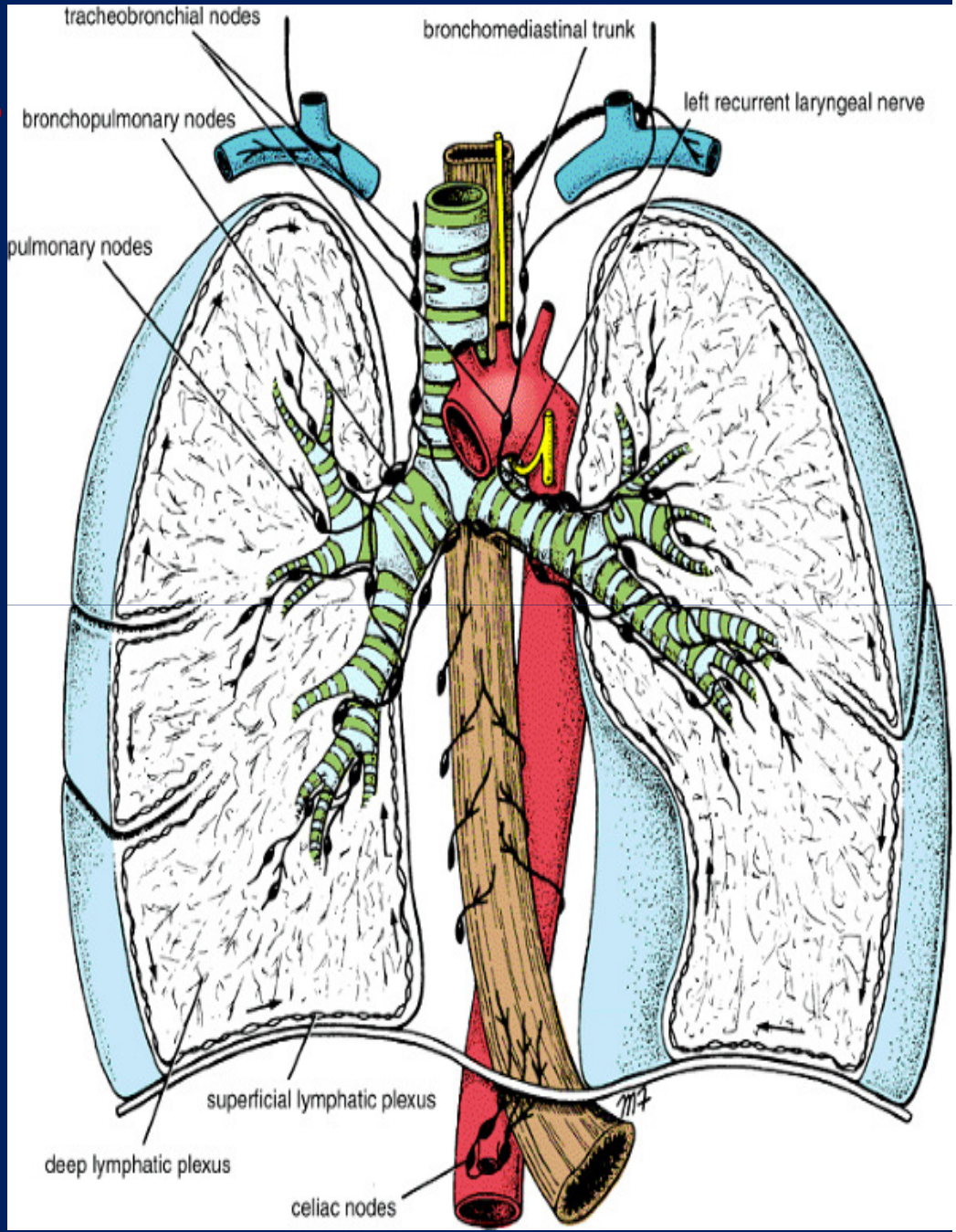
- Within **each root** and located in the hilum are: a **pulmonary artery**; **two pulmonary veins**; a main **bronchus**; **bronchial vessels**; **nerves**; and **lymphatics**.

Blood Supply of the Lungs

- The **bronchi**, the **connective tissue** of the lung, and the **visceral pleura** receive their blood supply from the **bronchial arteries**, which are branches of the **descending aorta**.
- The **bronchial veins** (which communicate with the pulmonary veins) drain into the **azygos** and **hemiazygos veins**.
- The **alveoli** receive deoxygenated blood from the terminal branches of the **pulmonary arteries**.
- The oxygenated blood leaving the alveolar capillaries drains into the tributaries of the **pulmonary veins**.
- **Two pulmonary veins** leave each lung root to empty into the **left atrium** of the **heart**.

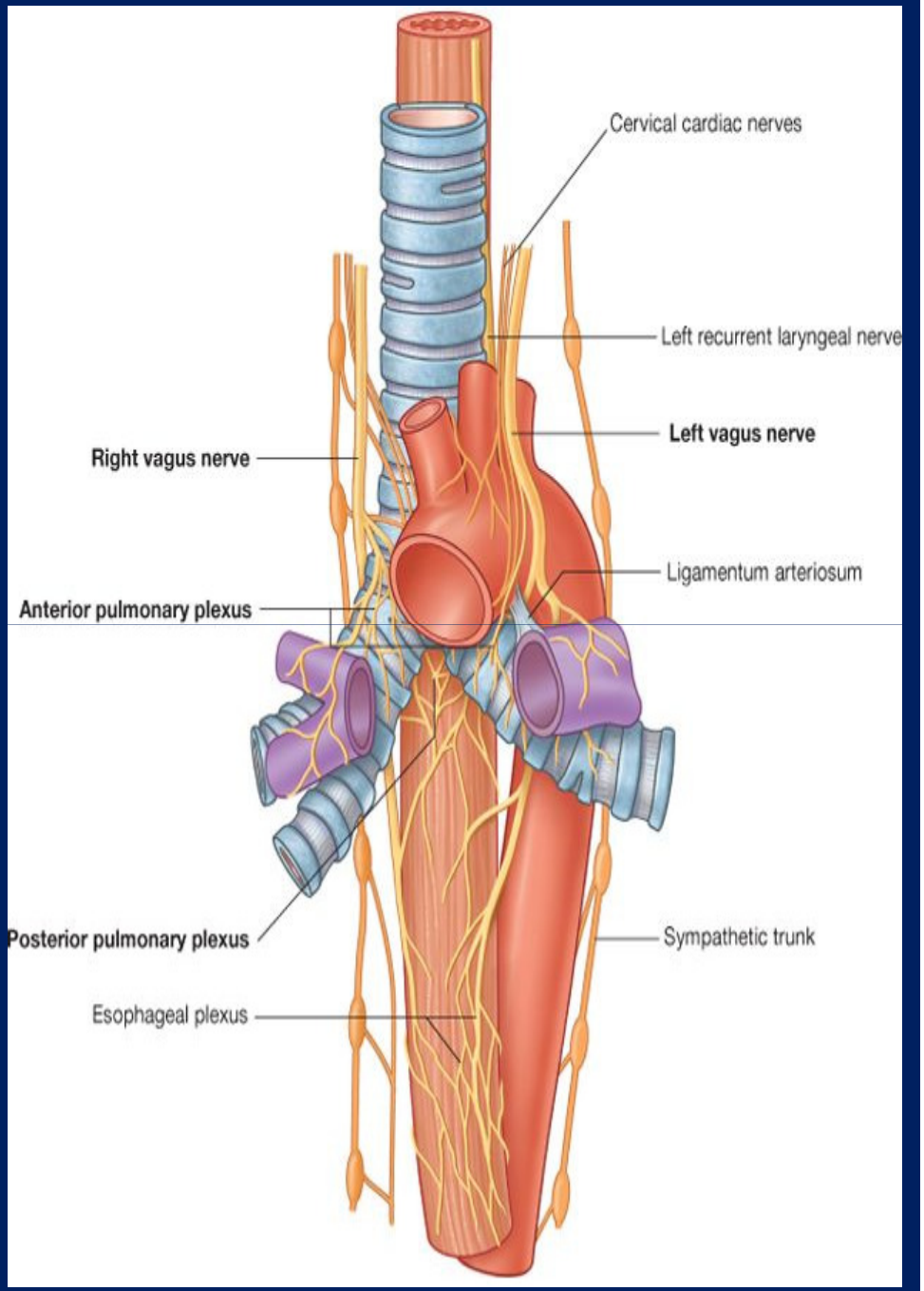
Lymph Drainage of the Lungs

- **Superficial**, or **subpleural**, and **deep lymphatics** of the lung drain into lymph nodes called **tracheobronchial nodes** around the roots of lobar and main bronchi and along the sides of the.
- Efferent vessels from these nodes pass superiorly along the trachea to unite with similar vessels from **parasternal nodes** and **brachiocephalic nodes** to form the right and left **bronchomediastinal trunks**.
- These trunks drain directly into **deep veins** at the base of the neck, or may drain into the **right lymphatic trunk or thoracic duct**.



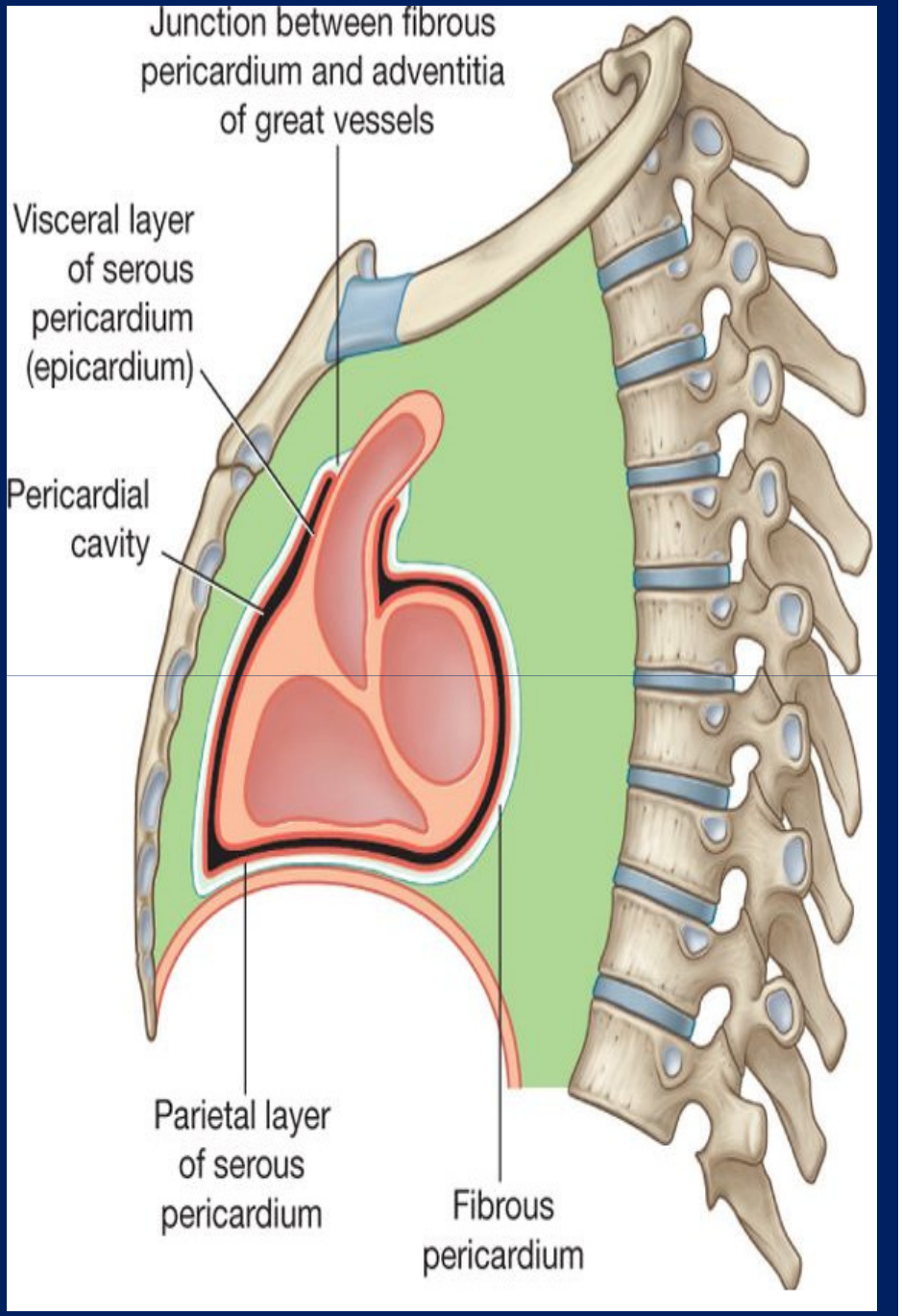
Nerve Supply of the Lungs

- At the root of each lung is a pulmonary plexus , which is formed from branches of the sympathetic trunk and receives parasympathetic fibers from the **vagus** nerve.
- The ***sympathetic*** efferent fibers produce bronchodilatation and vasoconstriction.
- The ***parasympathetic*** efferent fibers produce bronchoconstriction, vasodilatation, and increased glandular secretion.



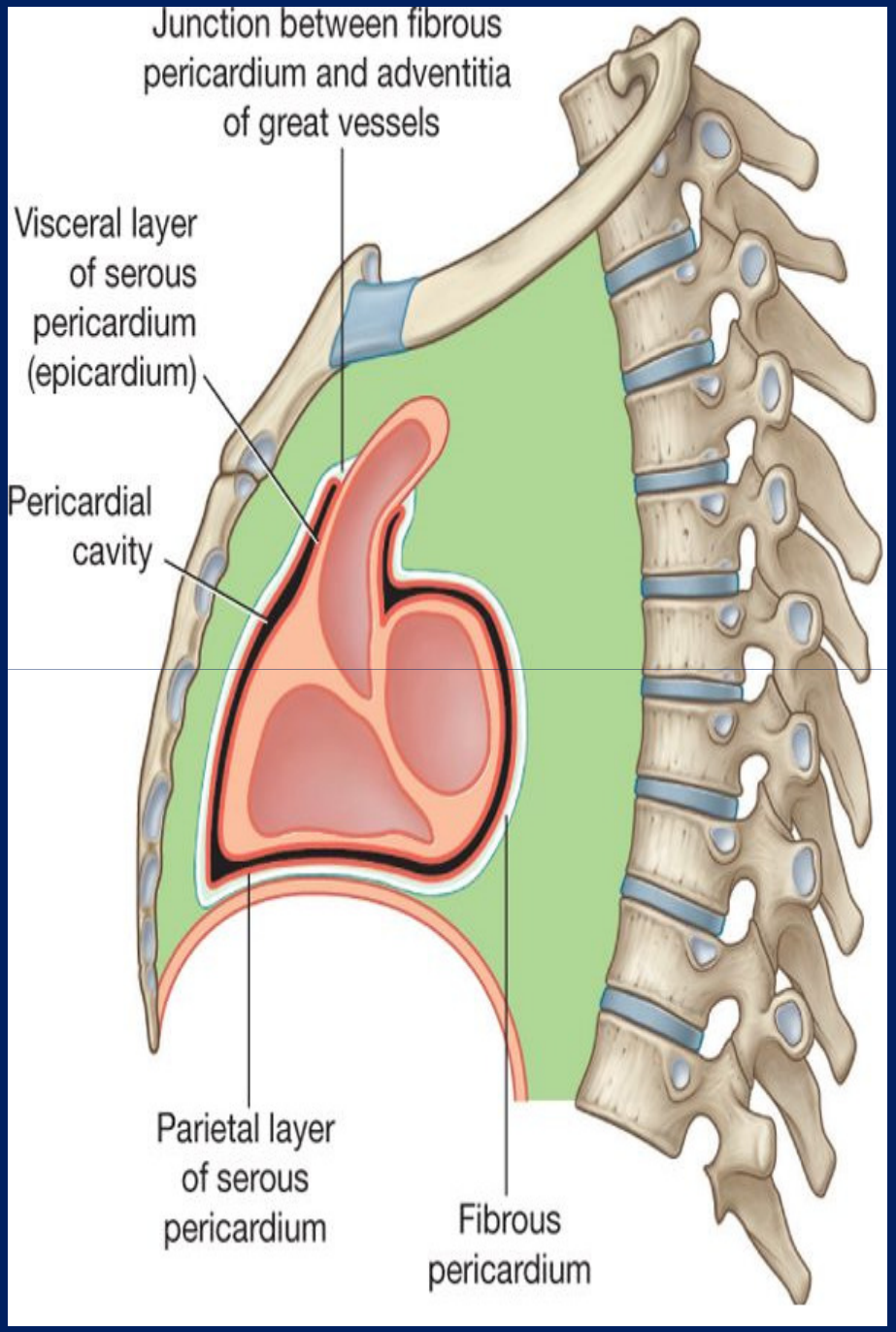
Pericardium

- The **pericardium** is a **fibroserous sac** that encloses the heart and the roots of the great vessels.
- Its **function** is to restrict excessive movements of the **heart** as a whole and to serve as a lubricated container in which the different parts of the heart can contract.
- The pericardium lies within the **middle mediastinum**, posterior to the body of the sternum and the 2^{ed} to 6th costal cartilages and anterior to the 5th to 8th thoracic vertebrae.



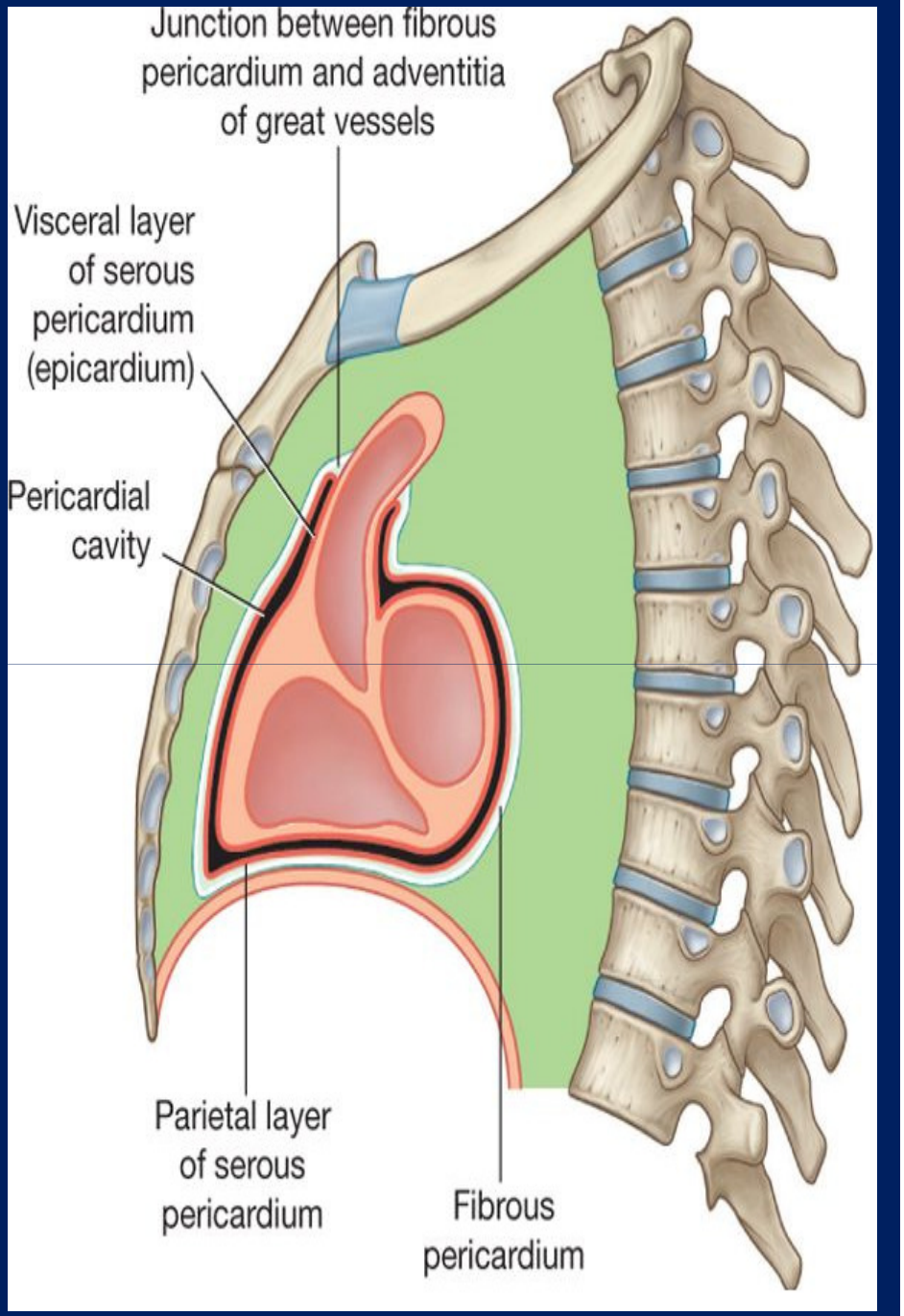
Fibrous Pericardium

- The **fibrous pericardium** is the strong fibrous part of the **sac**.
- It is firmly attached **below** to the **central tendon** of diaphragm.
- It fuses with the outer coats of the great blood vessels passing through it, namely, the **aorta**, the **pulmonary trunk**, the **superior** and **inferior venae cavae**, and the **pulmonary veins**.
- The fibrous pericardium is attached in **front** to the sternum by the **sternopericardial ligaments**.



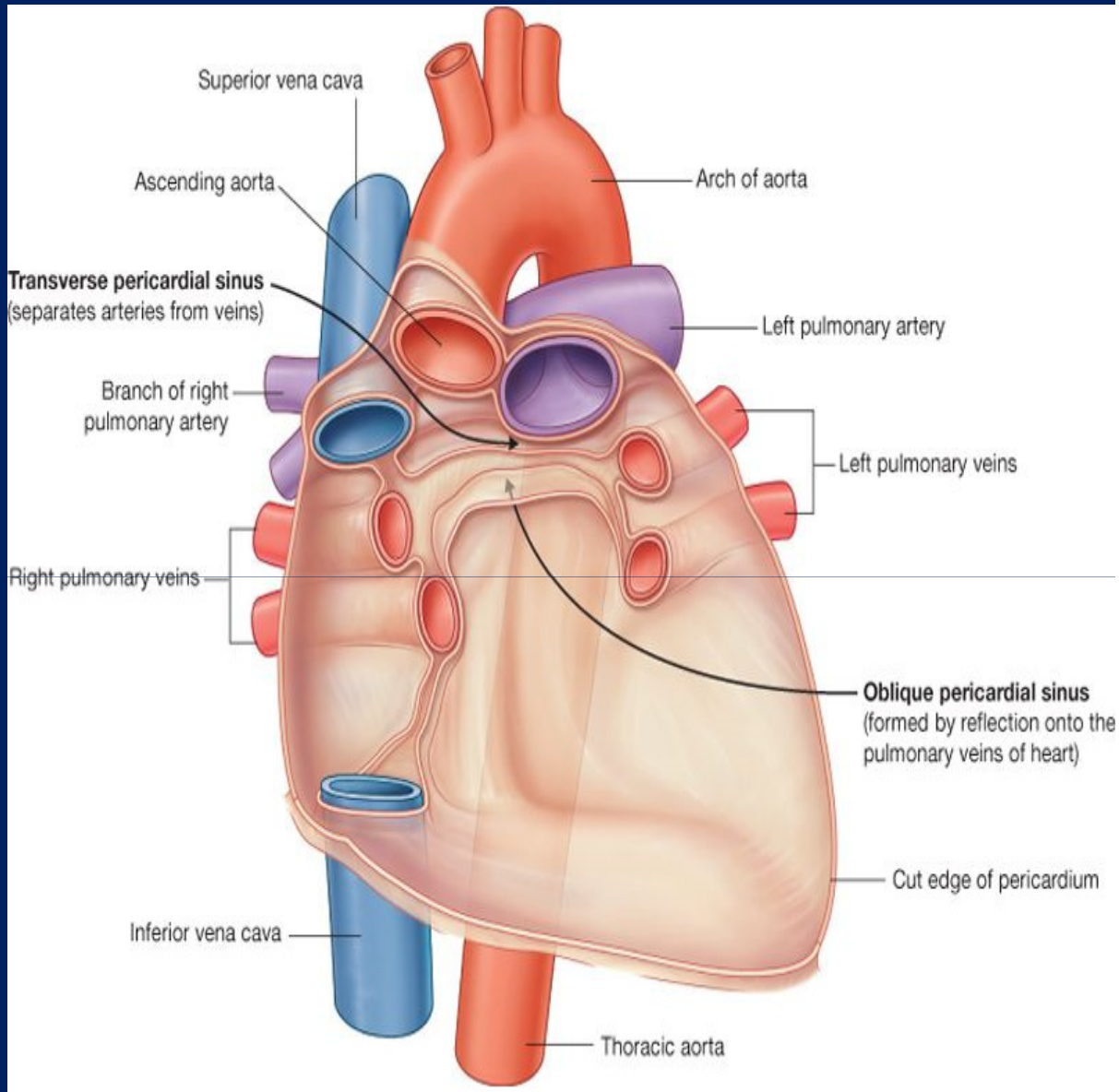
Serous Pericardium

- The serous pericardium lines the fibrous pericardium and coats the heart.
- It is divided into **parietal** and **visceral layers**.
- The **parietal layer** lines the fibrous pericardium and is reflected around the **roots of the great vessels** to become continuous with the visceral layer of serous pericardium that closely covers the heart.
- The **visceral layer** is closely applied to the heart and is often called the **epicardium**.
- The slitlike space between the parietal and visceral layers is referred to as the **pericardial cavity**.
- Normally, the cavity contains a small amount of tissue fluid (about 50 mL), the pericardial fluid.



Pericardial Sinuses

- On the <u>posterior</u> surface of the heart, the reflection of the serous pericardium around the **large veins** forms a recess called the **oblique sinus**.
- Also on the <u>posterior</u> surface of the heart is the **transverse sinus**, which is a short passage that lies between the reflection of serous pericardium around the **aorta** and **pulmonary trunk** and the reflection around the **large veins**.



Nerve Supply of the Pericardium

- The fibrous pericardium and the parietal layer of the serous pericardium are **supplied** by the **phrenic** nerves.
- The visceral layer of the serous pericardium is innervated by **branches** of the **sympathetic trunks** and the **vagus** nerves.

Thank You & Good Luck