



**ANATOMY
SHEET NO.
4**

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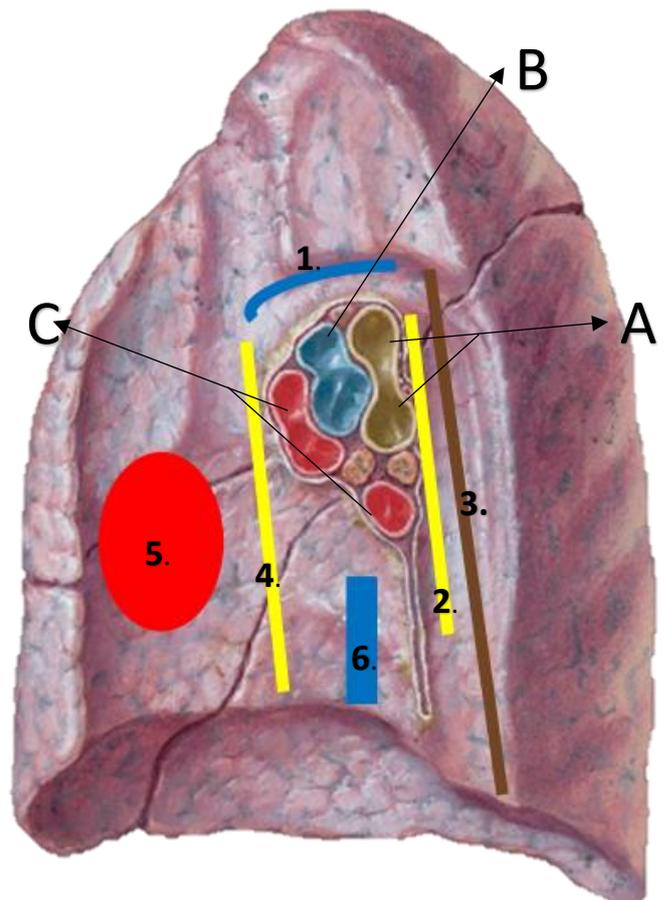
The right lung:

- Larger & shorter than left lung.
- Divided by **2 fissures** (oblique & horizontal) into **3 lobes** (upper, middle and lower lobes).
- You can see different markings above, in front of and behind the root of the lungs where you can find important structures that are associated with each lung. Pay attention to the picture below.

The mediastinal surface of the RIGHT lung:

Structures with relation to the root: (major relations)

1. Azygos vein and its arch (posterior and over the root of the lung).
2. Vagus nerve posterior to the root.
3. Esophagus above and posterior to the root and behind the Vagus nerve.
4. Phrenic nerve anterior to the root.
5. Cardiac impression: related to right atrium. (low pressure because it's a venous structure).
6. Below hilum* and in front of pulmonary ligament: Groove for I.V.C.



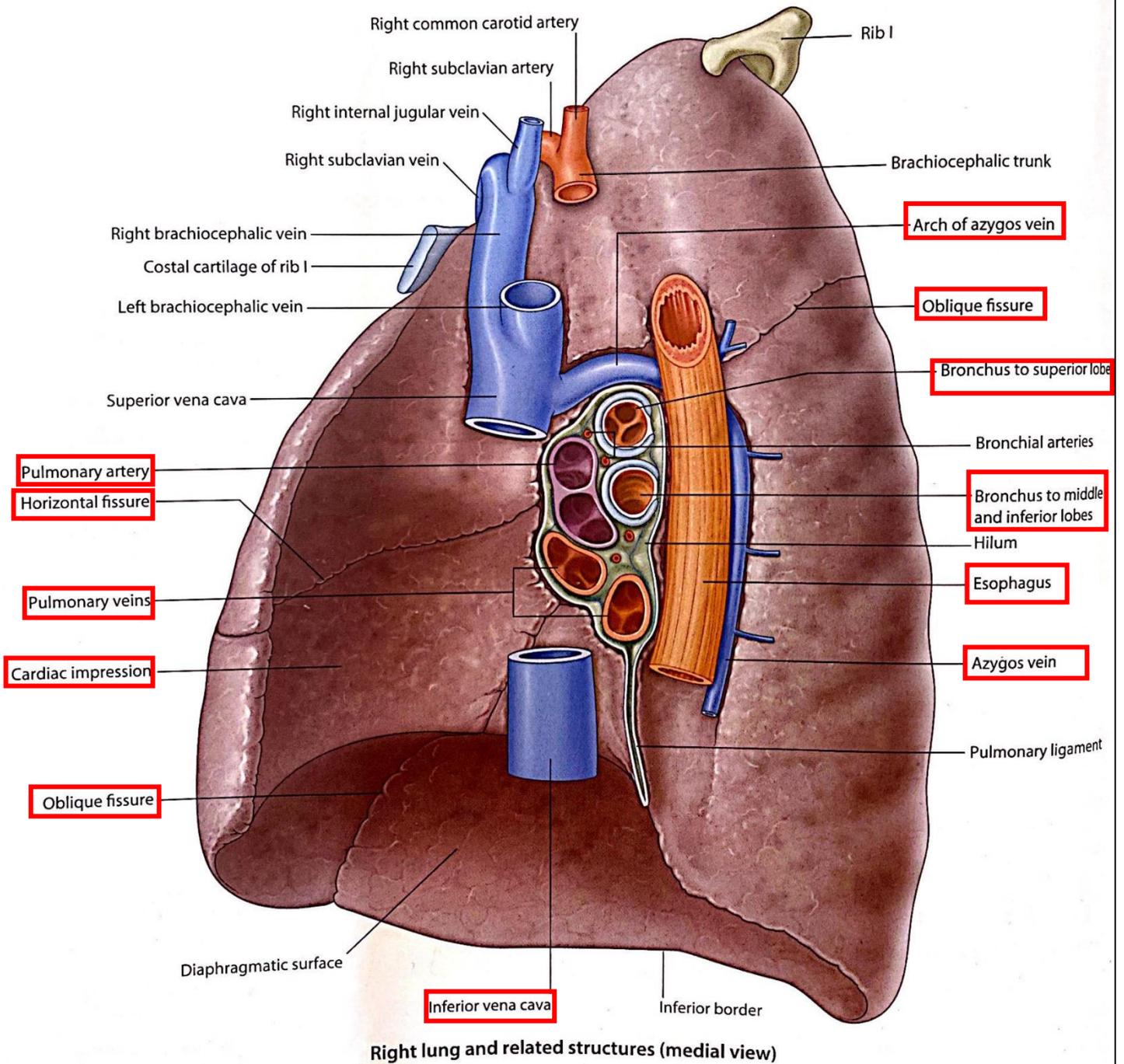
Notice how we have **TWO veins** (IVC, Azygos) and the root is lying between **TWO nerves** (Vagus posteriorly, Phrenic anteriorly) an

impression related to the heart chambers (cardiac impression related to the RIGHT atrium) and the **esophagus**.

The root* of the RIGHT lung:

- A. 2 bronchi lie posteriorly
- B. Pulmonary artery is superior
- C. 2 Pulmonary veins are inferior and anterior

A clear picture of everything mentioned below:



Remember we have two nerves also but you can't see them in this picture

- ❖ Something strange to notice here is that the pulmonary artery is blue while the pulmonary veins are red and that is because the blood in the pulmonary veins is oxygenated and in the pulmonary artery it isn't. Remember that artery simply means a vessel carrying the blood out of and away from the heart and vein means a vessel carrying blood to the heart.
- ❖ The pulmonary artery leaves the heart out of the right ventricle and it's the only artery in the adult body that contains deoxygenated blood. In the embryo the umbilical vein has oxygenated blood and the umbilical artery has deoxygenated blood.
- ❖ Also remember that the pulmonary veins (two out of each lung) enter the heart through the left atrium where we have 4 openings for all them.

The left lung:

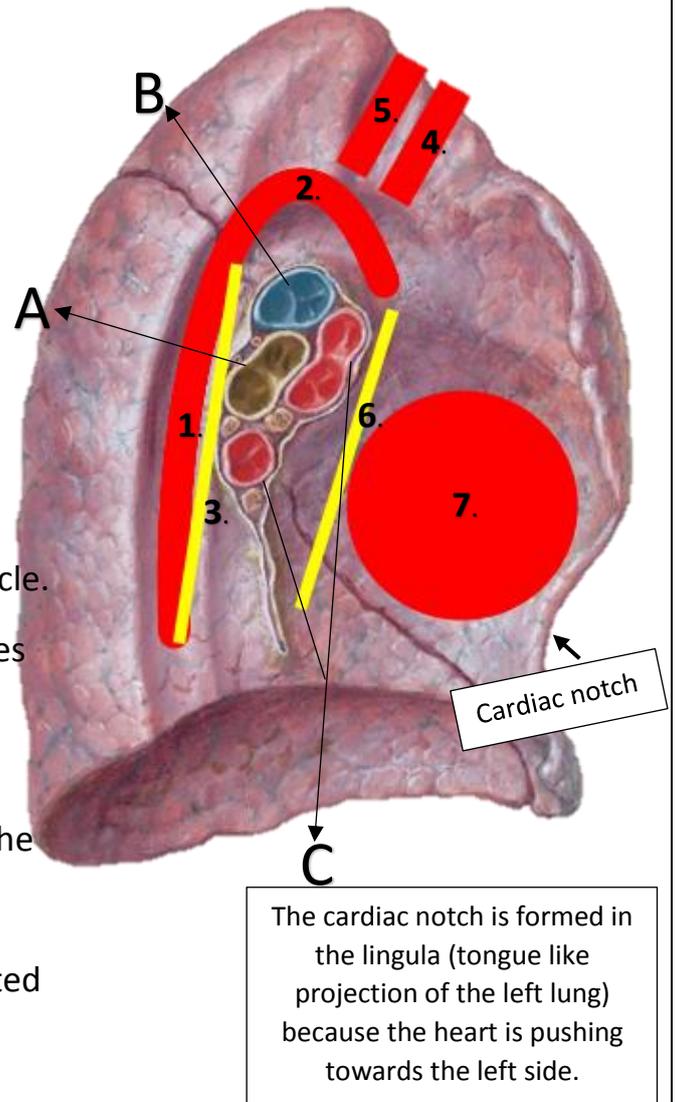
- Divided by **one oblique fissure** into 2 lobes, Upper and lower.
- There is **NO** horizontal fissure.
- It has a **cardiac notch** at lower part of its anterior border.

The mediastinal surface of the left lung:

Structures with relation to the root:

1. Descending aorta posterior to the root.
2. Arch of the aorta above the root.
3. Vagus nerve posterior to the root.
4. Groove for left common carotid artery.
5. Groove for left subclavian artery.
6. Phrenic nerve anterior to the root.
7. Cardiac impression: related to left ventricle.

Notice how we have **FOUR arterial** structures (descending aorta, aortic arch, grooves for left subclavian and left common carotid), **TWO nerves** just like the right lung and in the same position and also like right lung we have a cardiac **impression** but here it's related to the left ventricle.

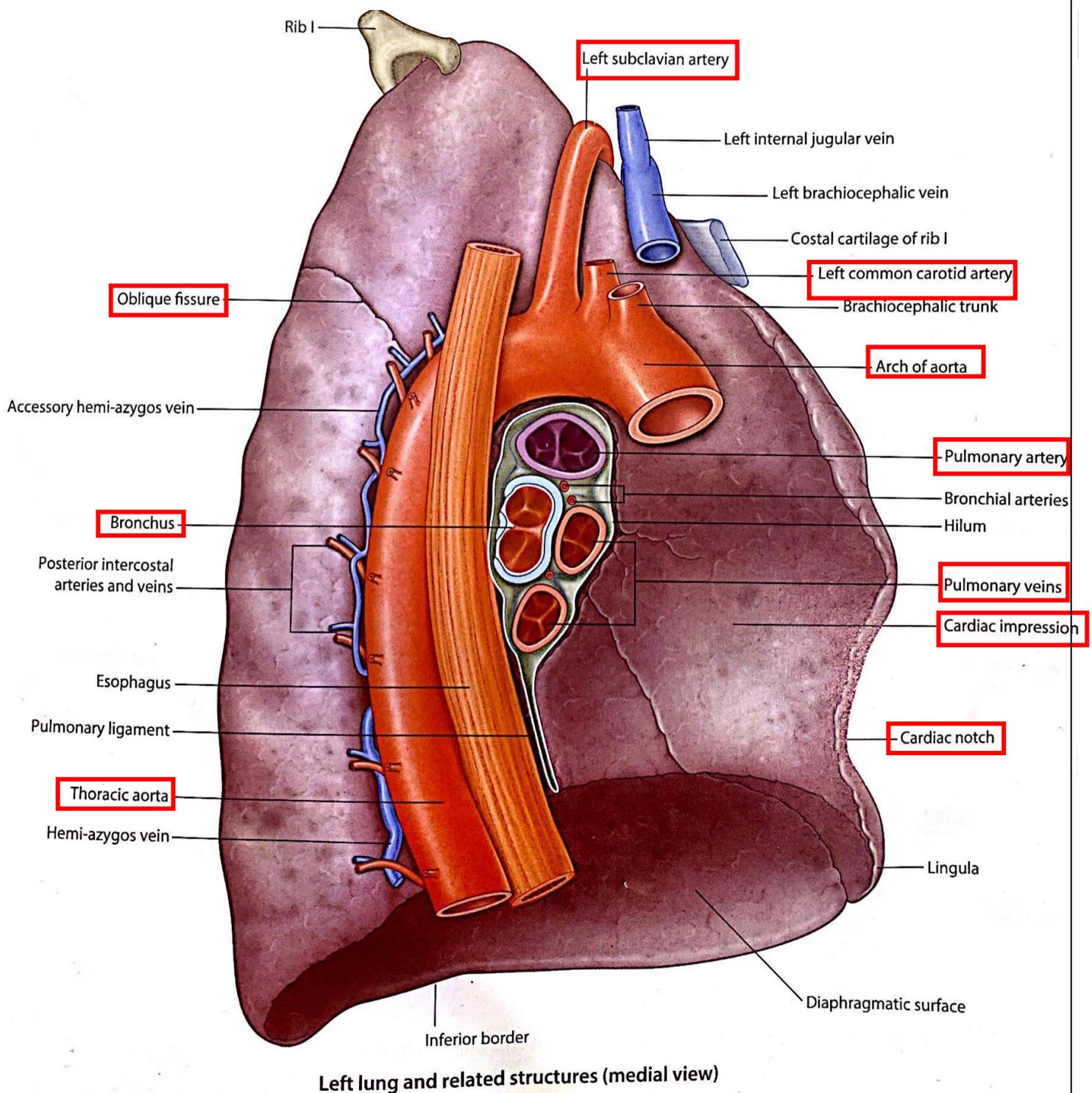


The root of the left lung:

- A. One bronchus lies posterior
- B. Pulmonary artery is superior
- C. 2 Pulmonary veins are inferior and anterior (maintained their position on both lungs).

Notice the difference in the position of the bronchi and the pulmonary artery between the two lungs.

A clear picture of everything mentioned below:



Remember we have two nerves also but you can't see them in this picture

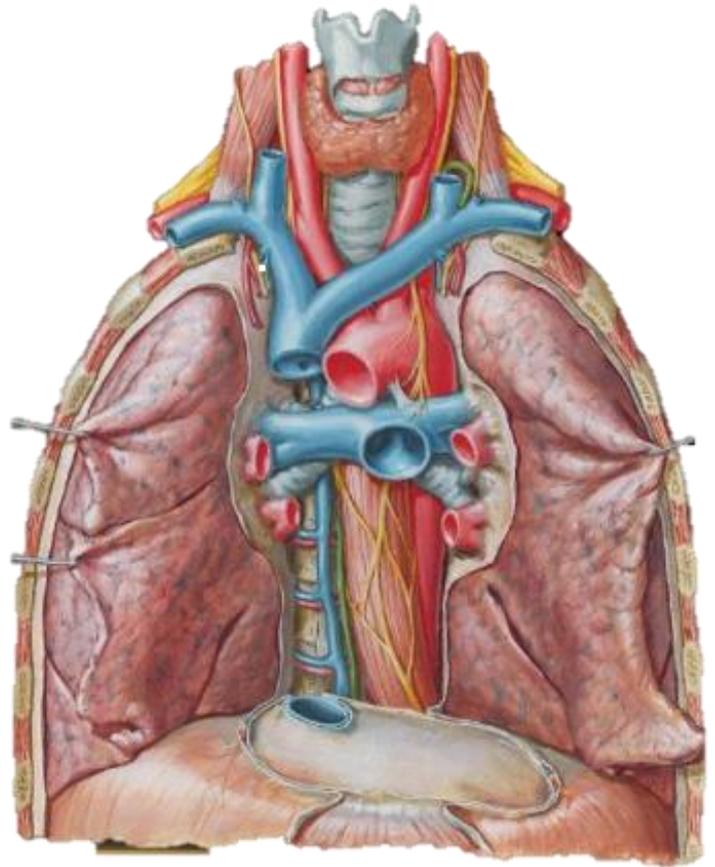
A VERY IMPORTANT NOTE: ON WHICH SIDE OF THE PLEURAL CAVITY ARE FLUIDS MORE LIKELY TO ACCUMULATE?

On the RIGHT side, because in the human body we actually don't have any spaces, we have potential spaces which are areas of low resistance. Fluids tend to accumulate in those areas of low resistance and where we have arterial structures, we have high pressure and high resistance. And as you know the right lung is associated with venous structures (low pressure) so the area around the right lung is of low resistance unlike the left side (where we have the left ventricle which is of very high pressure and the other major arterial structures).

- It has nothing to do with the drainage system because it's as efficient on both sides (thoracic duct *which has many valves and can be distinguished by touch* on the left side, right lymphatic trunk on the right side.)
- Note: ALWAYS in the body where we have low resistance, we have areolar connective tissue.

Blood supply of the lungs:

- **Bronchial arteries** (branches of descending thoracic aorta) supply oxygenated blood to bronchi, lung tissue & visceral pleura.
- **Bronchial veins:** drain into azygos & hemiazygos veins.
- **Pulmonary artery** carries non-oxygenated blood from right ventricle to the lung alveoli.
- **2 pulmonary veins from each lung:** carry oxygenated blood to the left atrium.



Nerve Supply of the Lung:

Pulmonary plexus: at the root of lung. It is formed of sympathetic & parasympathetic fibers.

1. Sympathetic: from sympathetic trunk they are broncho-dilators and vasoconstrictors
2. Parasympathetic: from the Vagus nerve. They are bronchoconstrictors and secretomotor to bronchial glands and vasodilators.

A clinical problem:

A patient with bronchial Asthma is given adrenaline (epinephrine) which is the neurotransmitter released from the sympathetic nervous system and it causes bronchodilation and the patient's breathing is back to normal within a minute.

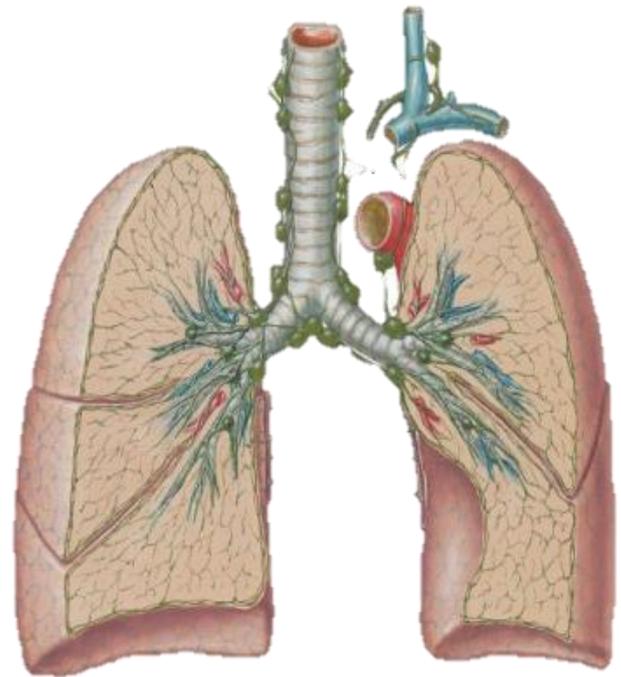


Lymph drainage of the lungs:

details are not required memorize what's highlighted

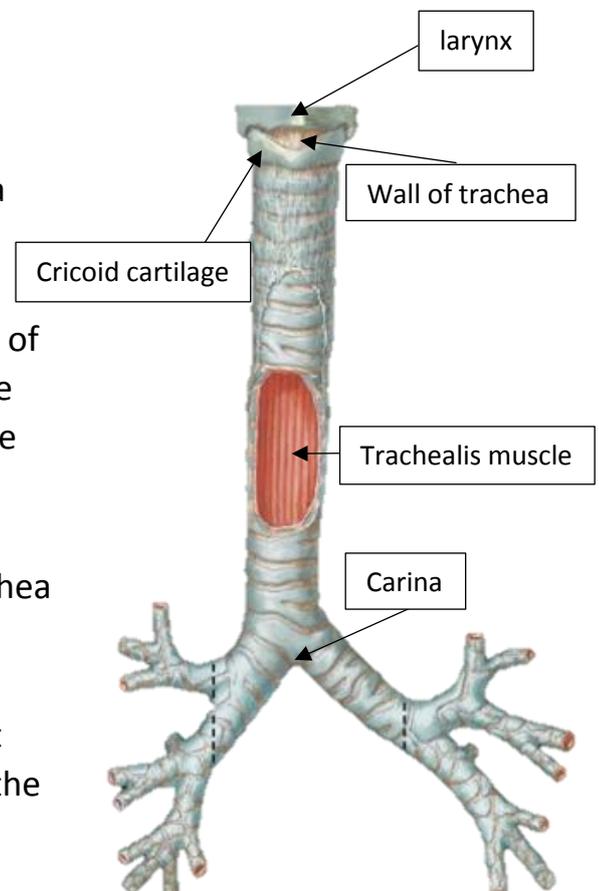
There are 2 lymphatic plexuses •

- **Superficial plexus (subpleural):** lies under the visceral pleura and drains to bronchopulmonary nodes in the hilum of lung.
- **Deep plexus:** Lies along the bronchial tree & pulmonary blood vessels and drain into the pulmonary nodes within the lung substance. Then into **bronchopulmonary nodes** in the hilum of lung. Then into the **tracheo-bronchial nodes** at the bifurcation of trachea, and finally into **broncho-mediastinal** lymph trunks to end in thoracic duct (left) or in right lymphatic duct (right).
- The most common type of cancer amongst males is lung cancer due to smoking and the cases in females are also increasing.



The Trachea

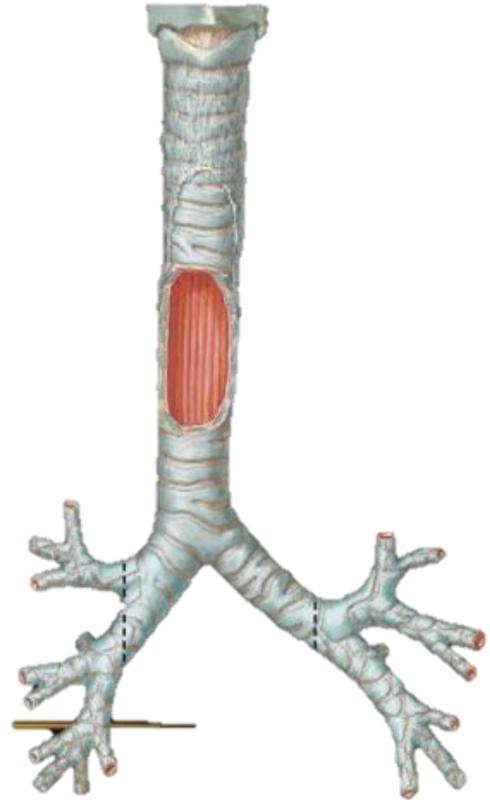
- It is a mobile cartilaginous structure lined with a mucous membrane.
- **It begins** as a continuation of the **larynx** at the lower border of the cricoid cartilage at the level of the **C6**. The cricoid cartilage is the only complete hyaline cartilage ring in the respiratory tract (like the letter O) while the others are C shaped.
- Remember behind the trachea we have the esophagus and on the posterior wall of the trachea we have a smooth muscle which is trachealis muscle.
- **Trachea ends** at the carina by dividing into right and left principal (main) bronchi at the level of the sternal angle **T4**.



- The carina is a cartilaginous ridge within the trachea at the site of the tracheal bifurcation
- In adults the trachea is 11-12 cm long (15-20 tracheal ring) and 2.5 cm in diameter.

Structure of trachea

- U-shaped cartilaginous bars (rings) of hyaline cartilage embedded in its wall and keep the trachea patent. Those cartilaginous rings are connected together by ligaments.
- The trachealis muscle: a smooth muscle that connects the posterior free ends of the cartilage. The main function of this muscle is that it provides a soft area for the esophagus to dilate when we swallow food. Therefore, if the other rings were complete, dilation of the esophagus would have been impossible and swallowing food would have been difficult.
- The mucous membrane: the trachea is lined with pseudostratified ciliated columnar epithelium and contains many goblet cells and tubular mucous glands in the submucosa layer.

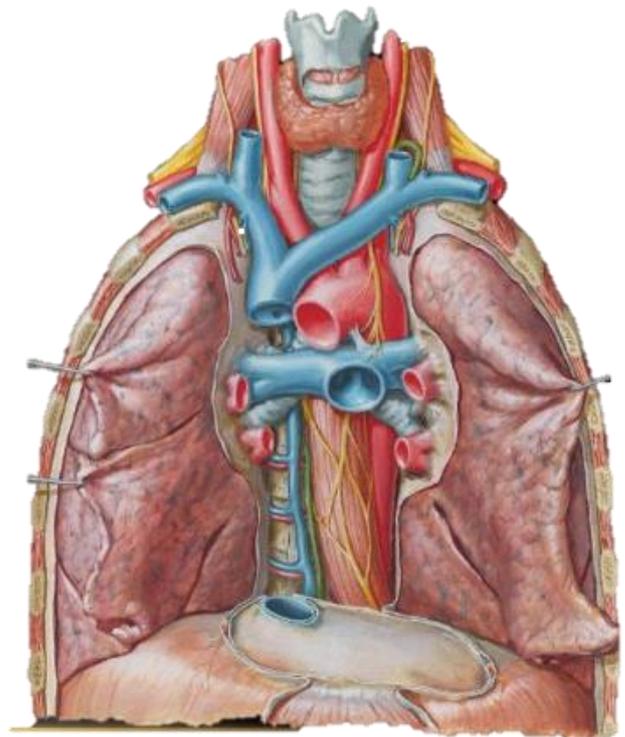


The relations of the trachea (in the thorax):

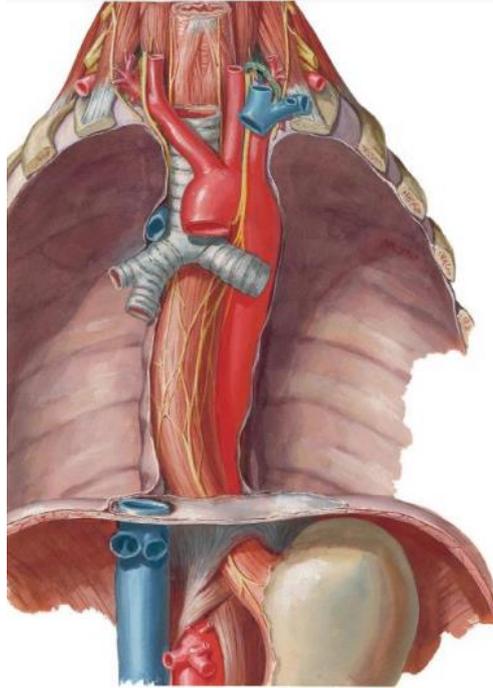
In the superior mediastinum

the trachea is related to:

- 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 on the left side. (in the cervical part we also have the right recurrent laryngeal nerve)
- Right side: The azygos vein, the right vagus nerve, and the pleura.



- Left side: The aortic arch, left common carotid and left subclavian arteries, the left vagus and left phrenic nerves, and the pleura. (the trachea is not covered by the pleura at all).

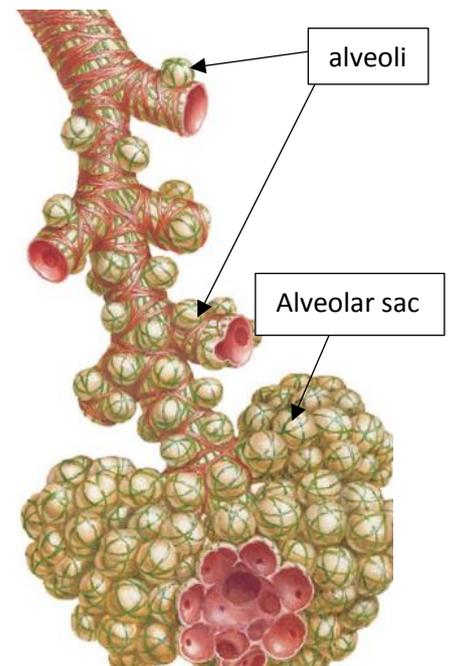


Blood Supply, lymph drainage and innervation of the Trachea:

- The upper two thirds of the trachea (as well as the upper part of the esophagus) 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:

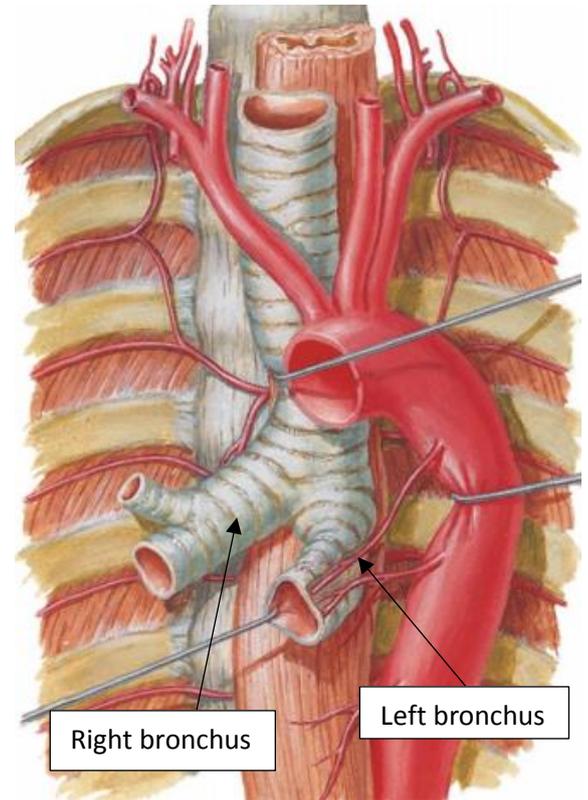
- The trachea bifurcates at the level of sternal angle (T4) into the right and left principal (primary, major or main bronchi)
- The bronchi divide dichotomously, giving rise to several million terminal bronchioles that terminate in one or more respiratory bronchioles.
- Each respiratory bronchiole divides into 2 to 11 alveolar ducts that enter the alveolar sacs. The alveoli arise from the walls of the sacs as diverticula.
- Two types of bronchioles: terminal and respiratory. The terminal bronchioles function in delivering air to the respiratory bronchioles. The respiratory bronchioles are the sites of exchange of gases between the air coming from the trachea and the bronchi and the deoxygenated blood in the pulmonary artery.



The alveoli are found on respiratory bronchioles and they increase in number as we move downward. Millions of alveoli are found in each lung

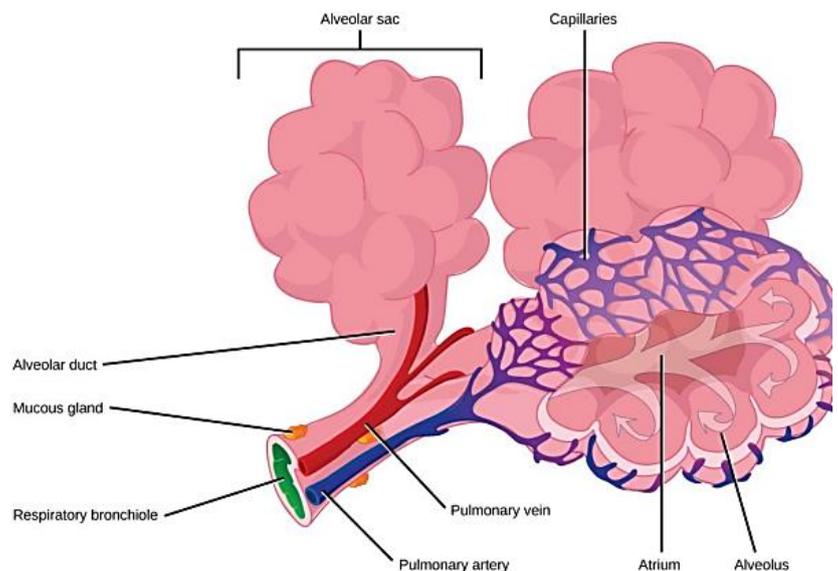
Principal (Major) Bronchi:

- **The right principal (main) bronchus** is wider, shorter, and more vertical (more in line with trachea) than the left. It is about 2.5 cm long. It appears as the continuation of the trachea. (inhaled small objects are more likely found in the right bronchus).
 - Before entering the hilum, it gives off the superior lobar bronchus and the inferior.
 - On entering the hilum, the inferior 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, it divides into a superior and an inferior lobar bronchus.



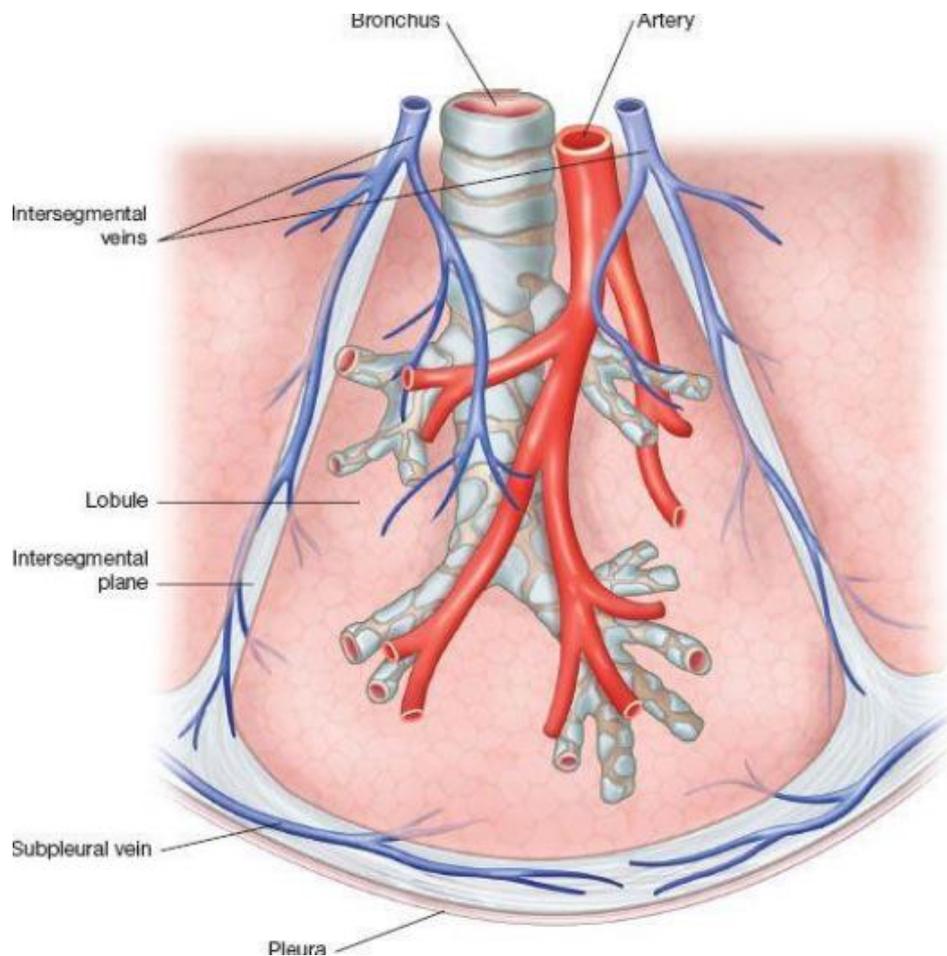
Bronchopulmonary Segments:

- They are the anatomic, functional, and surgical units of the lungs.
- Each lobar (secondary) bronchus gives off segmental (tertiary) bronchi.
- Each segmental bronchus divides repeatedly into bronchioles.
- Bronchioles divide into terminal bronchioles, which show delicate outpouchings 'the respiratory bronchioles'.

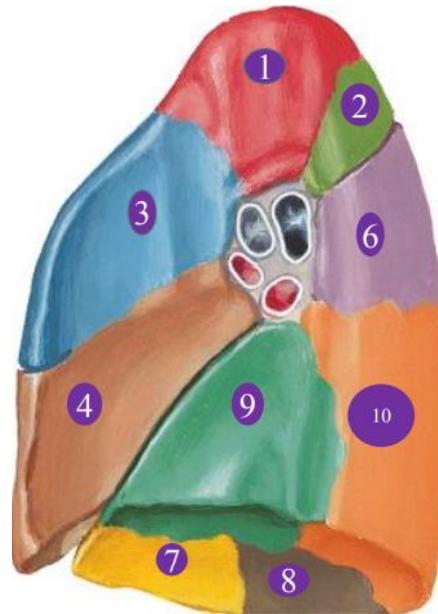
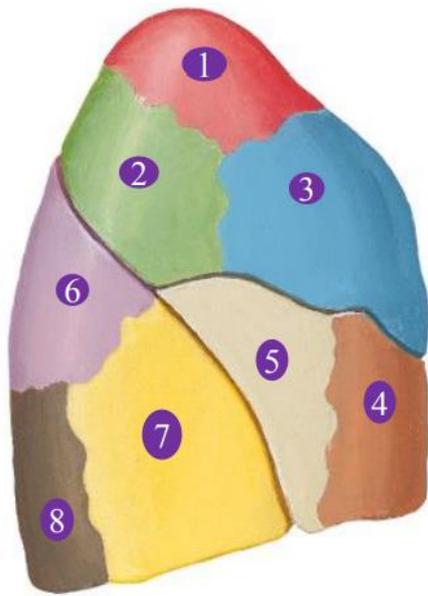


Bronchopulmonary Segments:

- The respiratory bronchioles end by branching into alveolar ducts, which lead into alveolar sacs.
- The alveolar sacs consist of several alveoli, each alveolus is surrounded by a network of blood capillaries for gas exchange.
- It is pyramidal in shaped, its apex lies toward the root, while its base lies on the lung surface.
- It is surrounded by connective tissue septa.
- **A diseased segment can be removed surgically, because it is a structural unit.** Before the entire lung would be removed in the cases of cancer (pneumonectomy) then the diseased lobes were removed (lobectomy) and now only the diseased bronchopulmonary segments are removed (segmentectomy).



Bronchopulmonary Segments of the Right Lung:

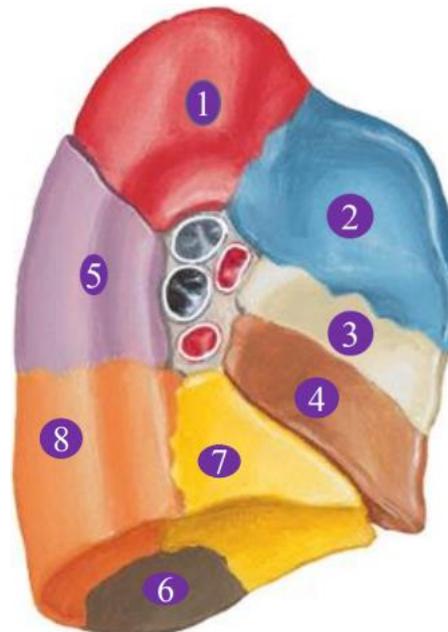
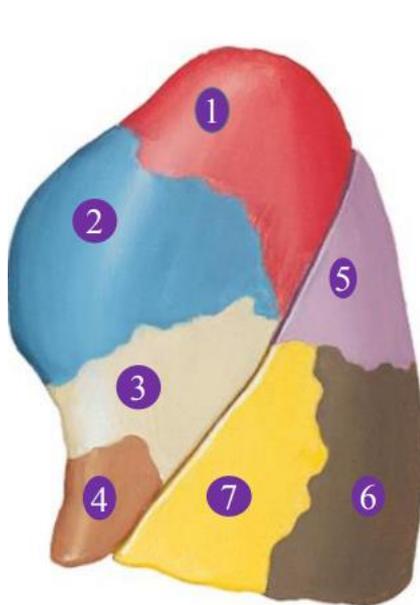


Notice how some of these segments are continuous on both the anterior and the mediastinal surfaces

- 1- Apical Segment
 - 2- Posterior Segment
 - 3- Anterior segment
 - 4- Medial Segment
 - 5- Lateral Segment
- Upper lobe
- middle lobe

- 6- Superior Segment
 - 7- Anterior Basal Segment
 - 8- Lateral Basal Segment
 - 9- Medial Basal Segment
 - 10- Posterior Basal Segment
- Lower lobe

Bronchopulmonary Segments of the Left Lung:



- 1- Apicoposterior Segment
 - 2- Anterior Segment
 - 3- Superior Segment
 - 4- Inferior Segment
- upper lobe

- 5- Superior Segment
 - 6- Lateral Basal Segment
 - 7- Anteromedial Basal Segment
 - 8- Posterior Basal Segment
- lower lobe

- Some of the segments of the left lung like the apicoposterior segment are sometimes considered as two segments apical and posterior. That's why some books may state that the number of segments in the left lung is 8-10.

-everything mentioned in the slides and the lecture was added and the extra pictures of the lungs added for a better understanding were taken from Gray's atlas of anatomy second edition.

and we're done, best of wishes and good luck to all of you <3

