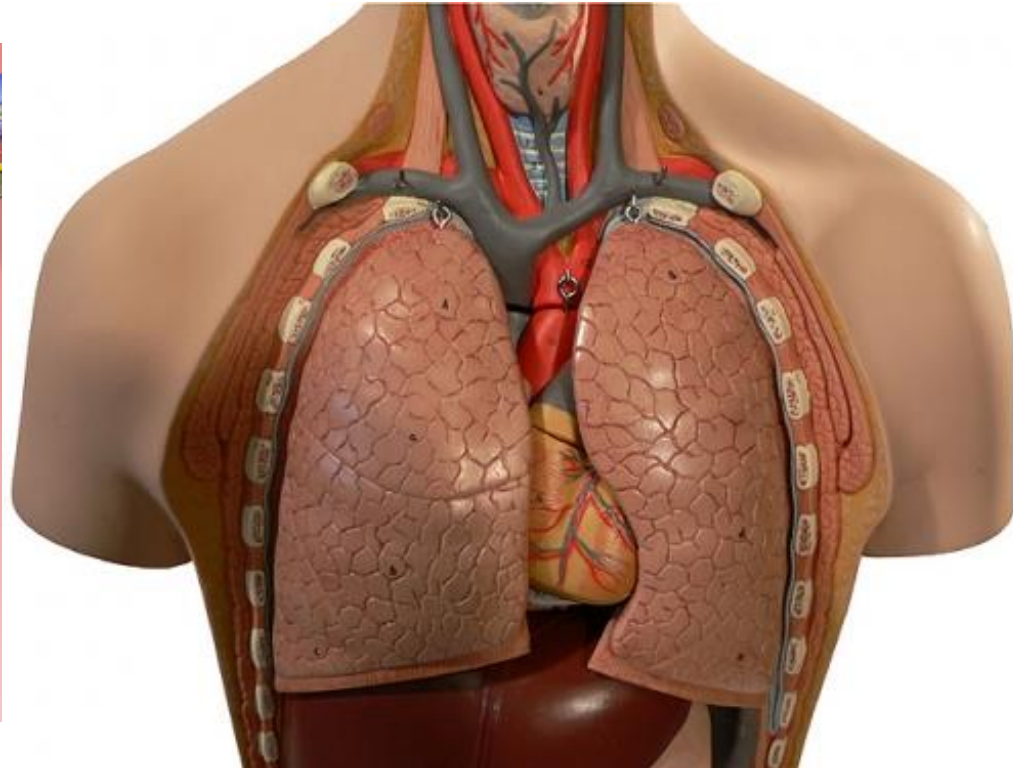
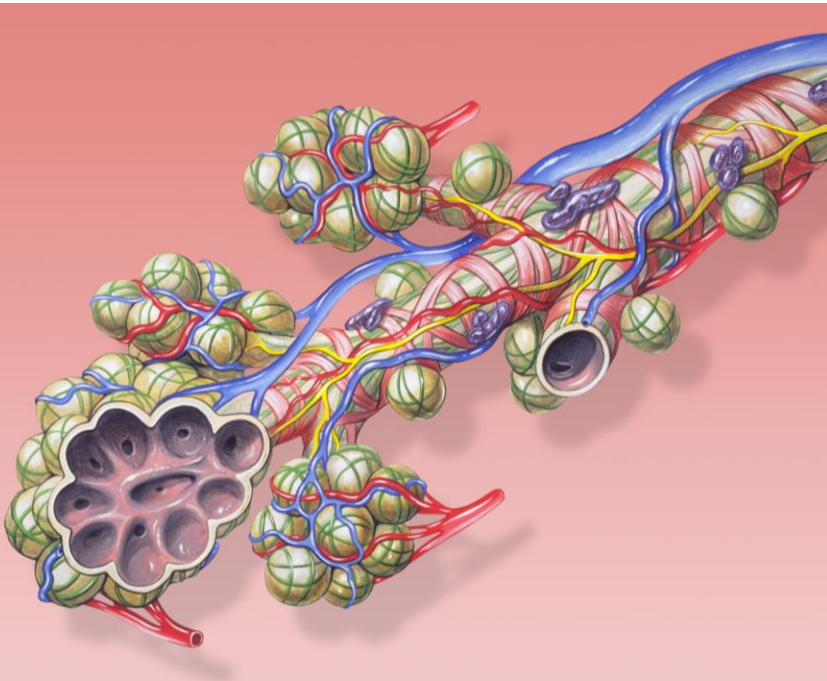


RESPIRATORY SYSTEM

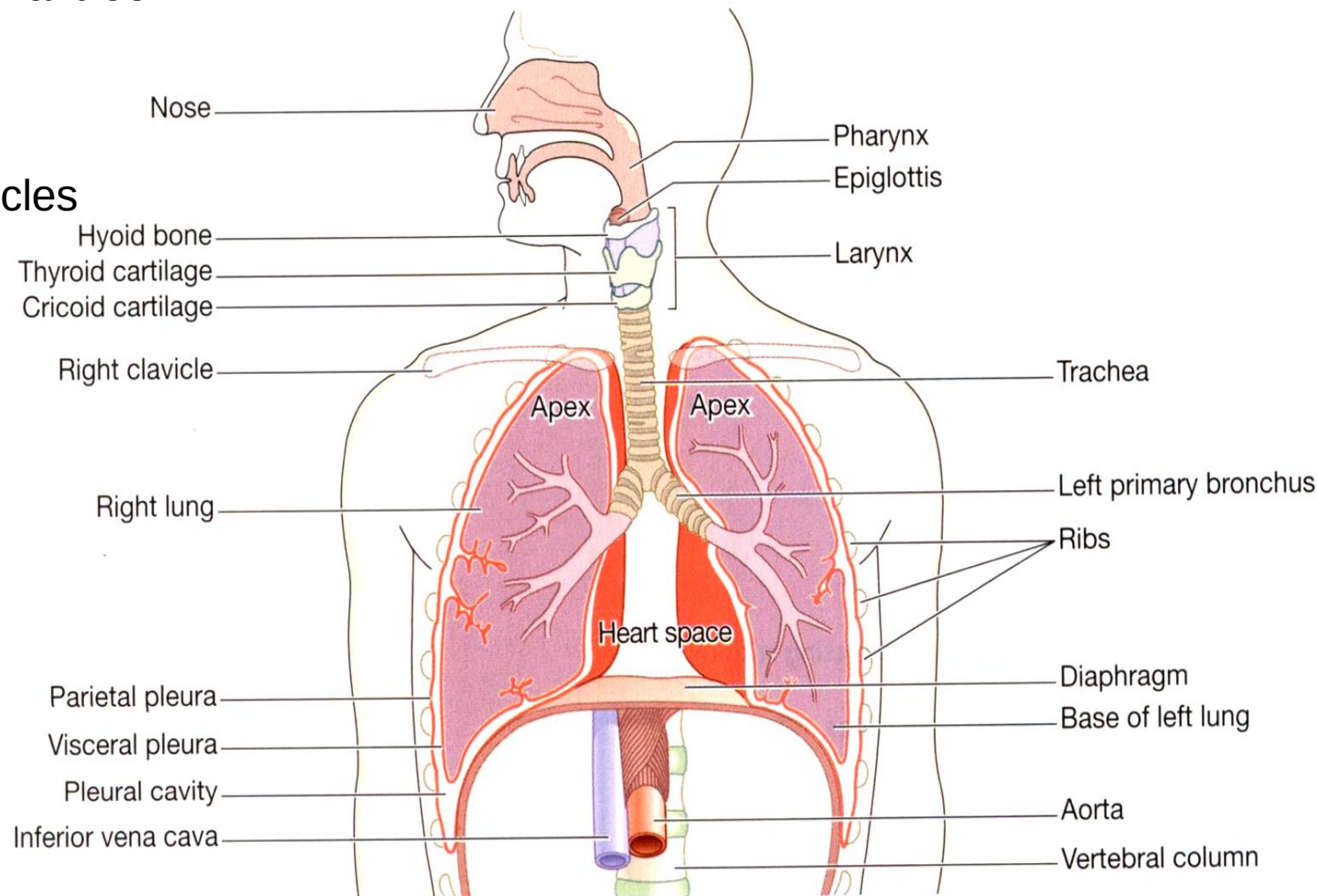
1. It provides a **route of entry** for air containing **oxygen** into the lungs and **exit** for air containing **carbon dioxide** to the outside
2. Exchange of gases (oxygen & carbon dioxide) between the alveoli and blood



Organs belonging to the respiratory system

- Nose
- Pharynx
- Larynx
- Trachea
- Bronchi & bronchial tree
- Lungs

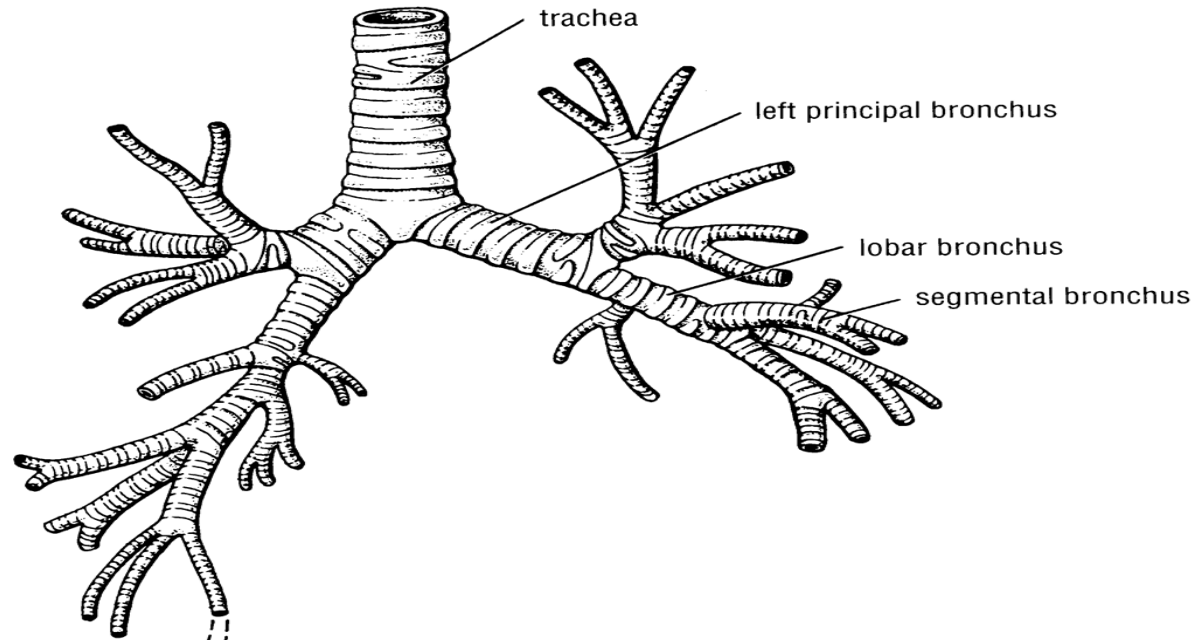
- Thoracic wall
- Respiratory muscles



The respiratory system can be divided into:

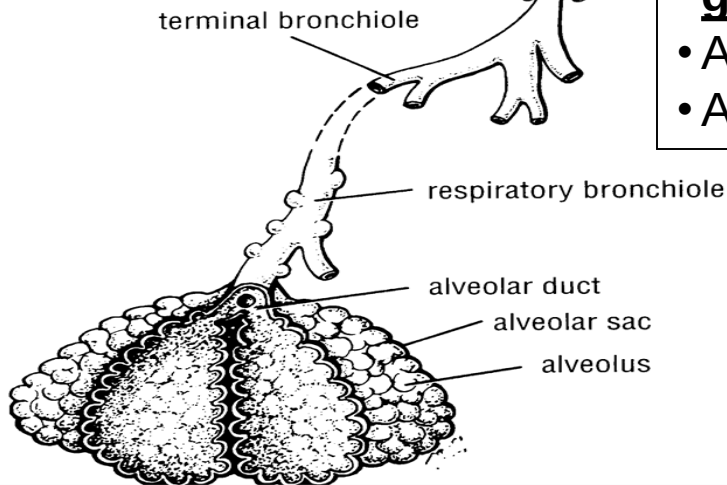
Conductive portion, concerned with conduction of air, it includes:

- Nose
- Pharynx
- Larynx
- Trachea
- Bronchi (lobar & segmental)
- Bronchioles
- Terminal bronchioles



Respiratory portion, concerned with gas exchange, it includes:

- Alveolar ducts
- Alveoli



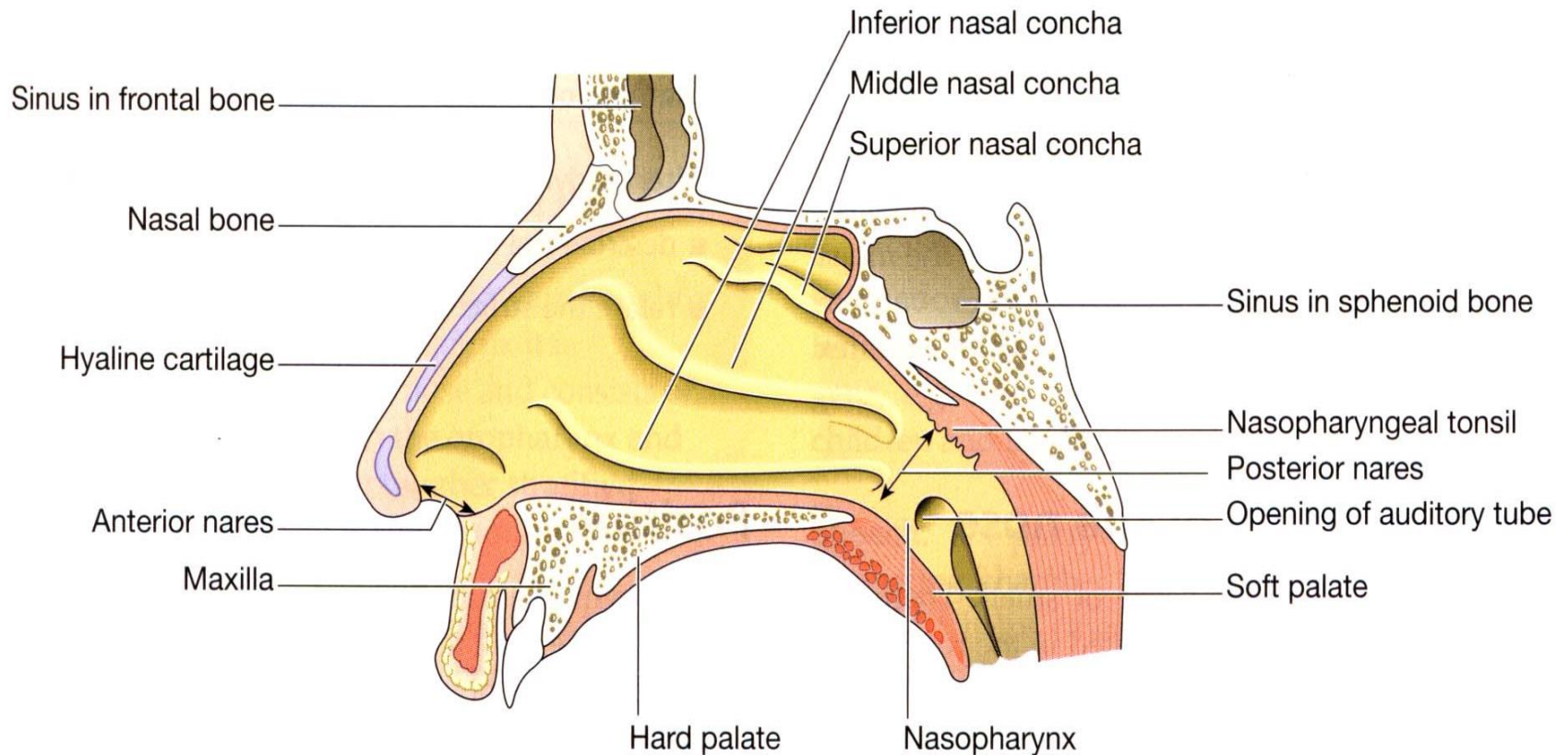
THE NOSE

External Nose:

- The part of the nose that projects into the face
- Formed by the **nasal bones** and **nasal cartilage**

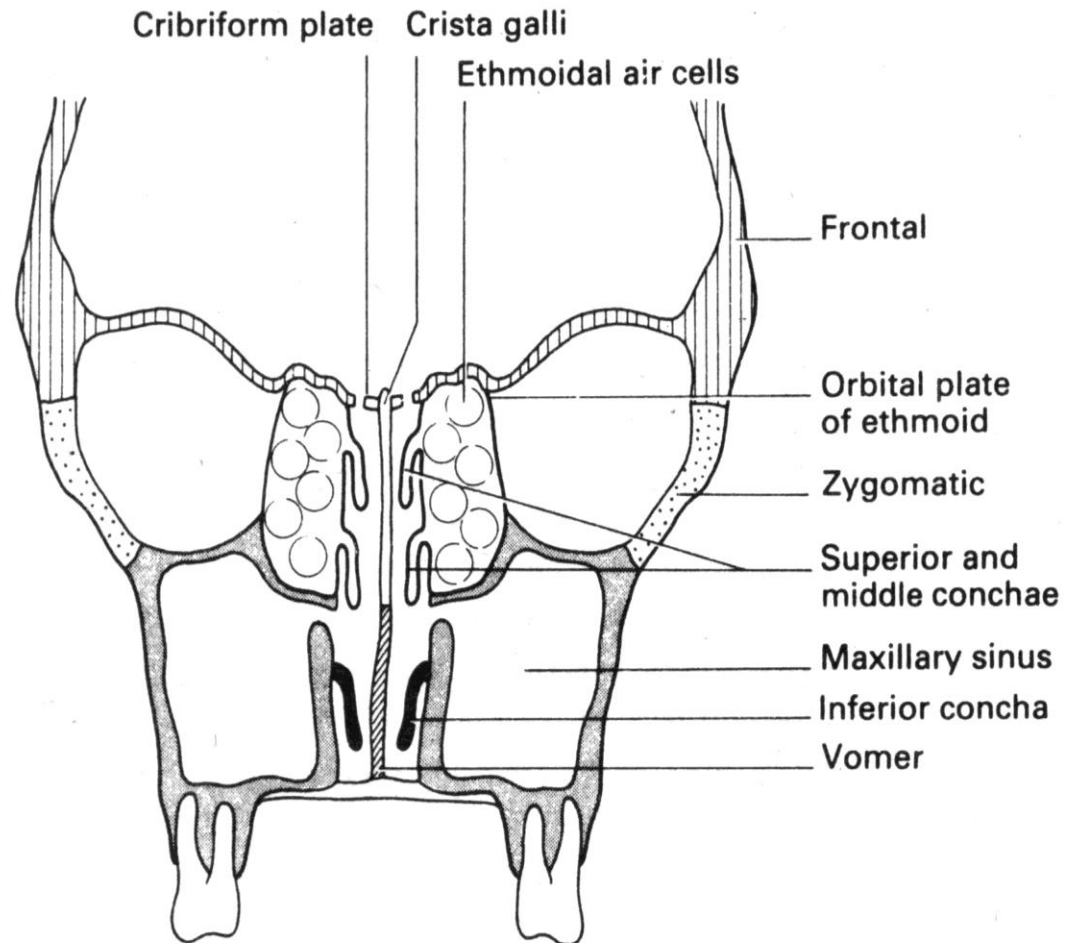
Nasal cavity:

- It is divided into two halves by the **nasal septum**
- It opens anteriorly on the face through the anterior nasal apertures
- It opens posteriorly into the **nasopharynx** through the posterior nasal apertures



Boundaries of the nasal cavity:

- **Roof:** cribriform plate of ethmoid
- **Floor:** hard palate
- **Medial wall:** nasal septum
- **Lateral wall:**
 - It is irregular and shows **3 bony projections**; superior, middle & inferior **conchae**
 - The spaces deep to the conchae are called **meatuses**, thus there are 3 meatuses; **superior, middle & inferior**



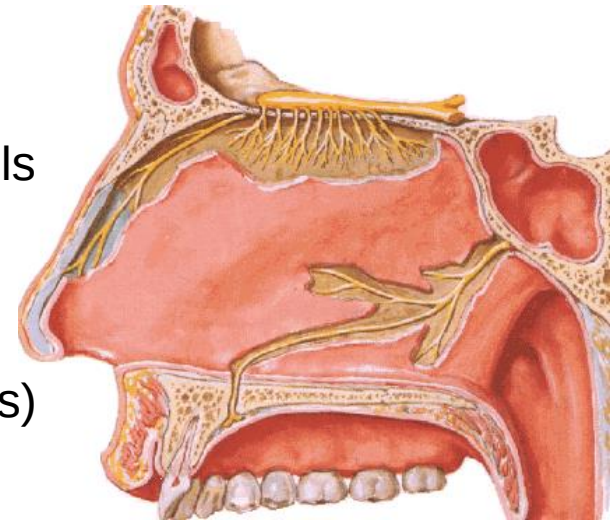
Mucous membrane of the nose

Olfactory mucosa

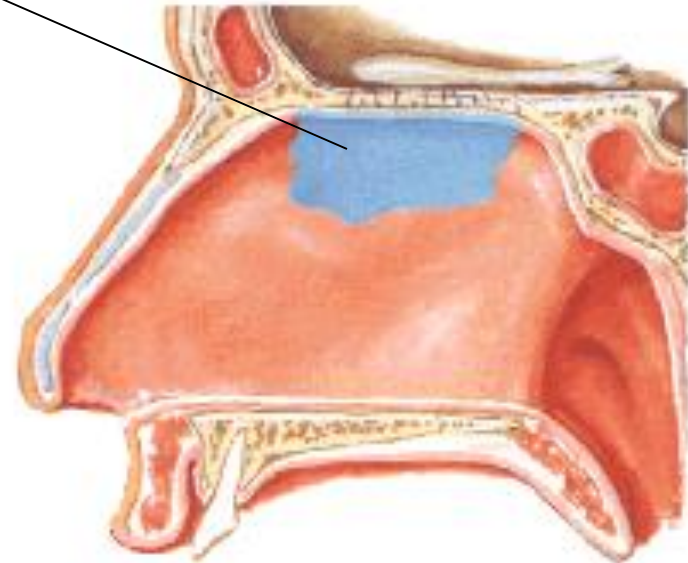
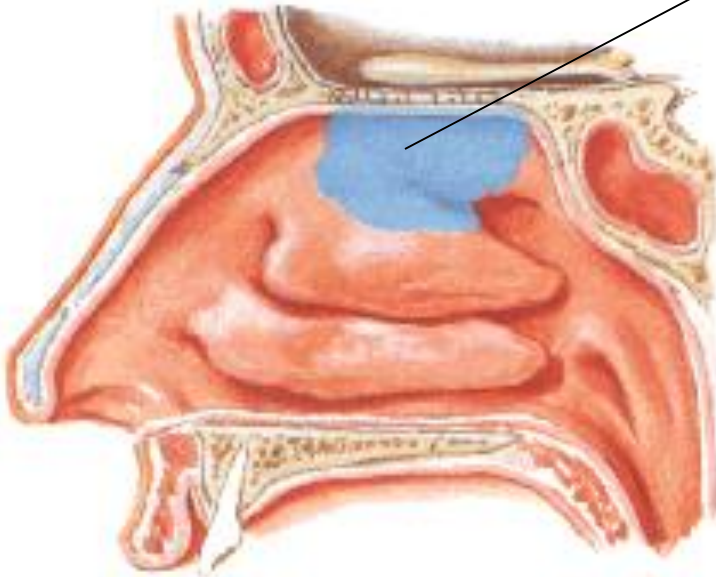
Present in the roof and upper part of the medial & lateral walls

Respiratory mucosa

The rest of the nasal cavity is lined by **respiratory mucosa** (pseudostratified ciliated columnar epithelium with goblet cells)



Areas covered by olfactory mucosa

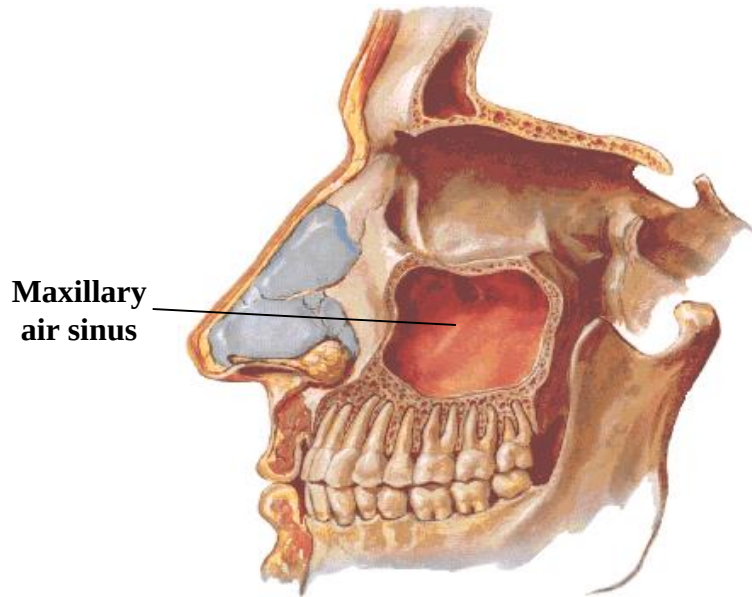
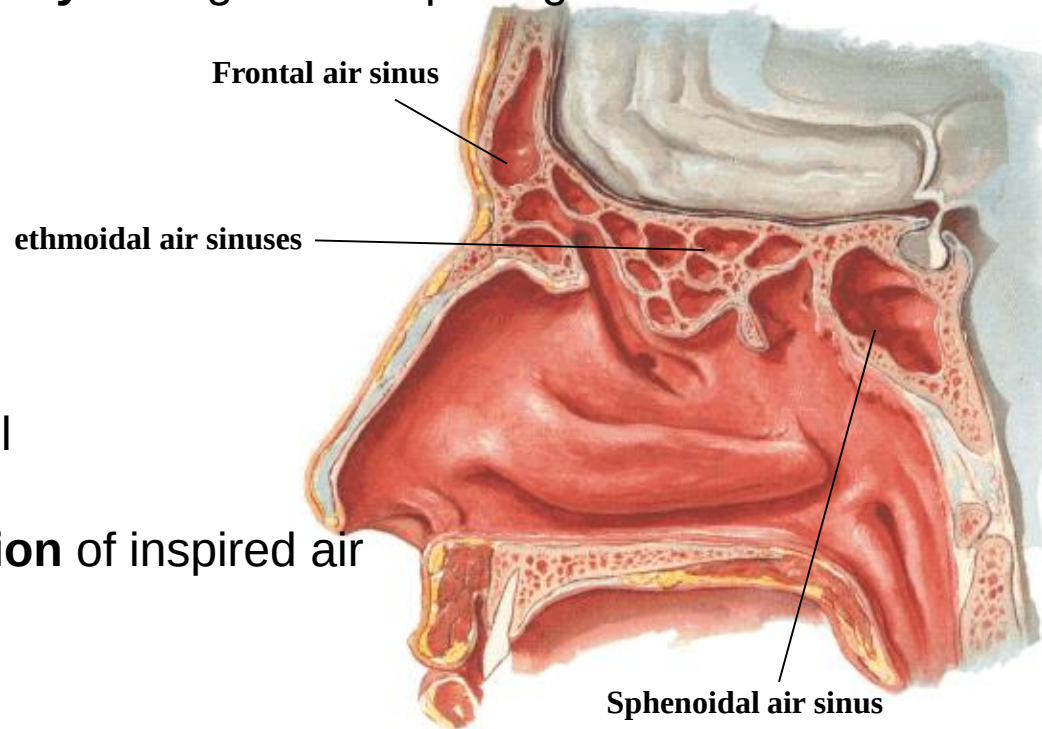


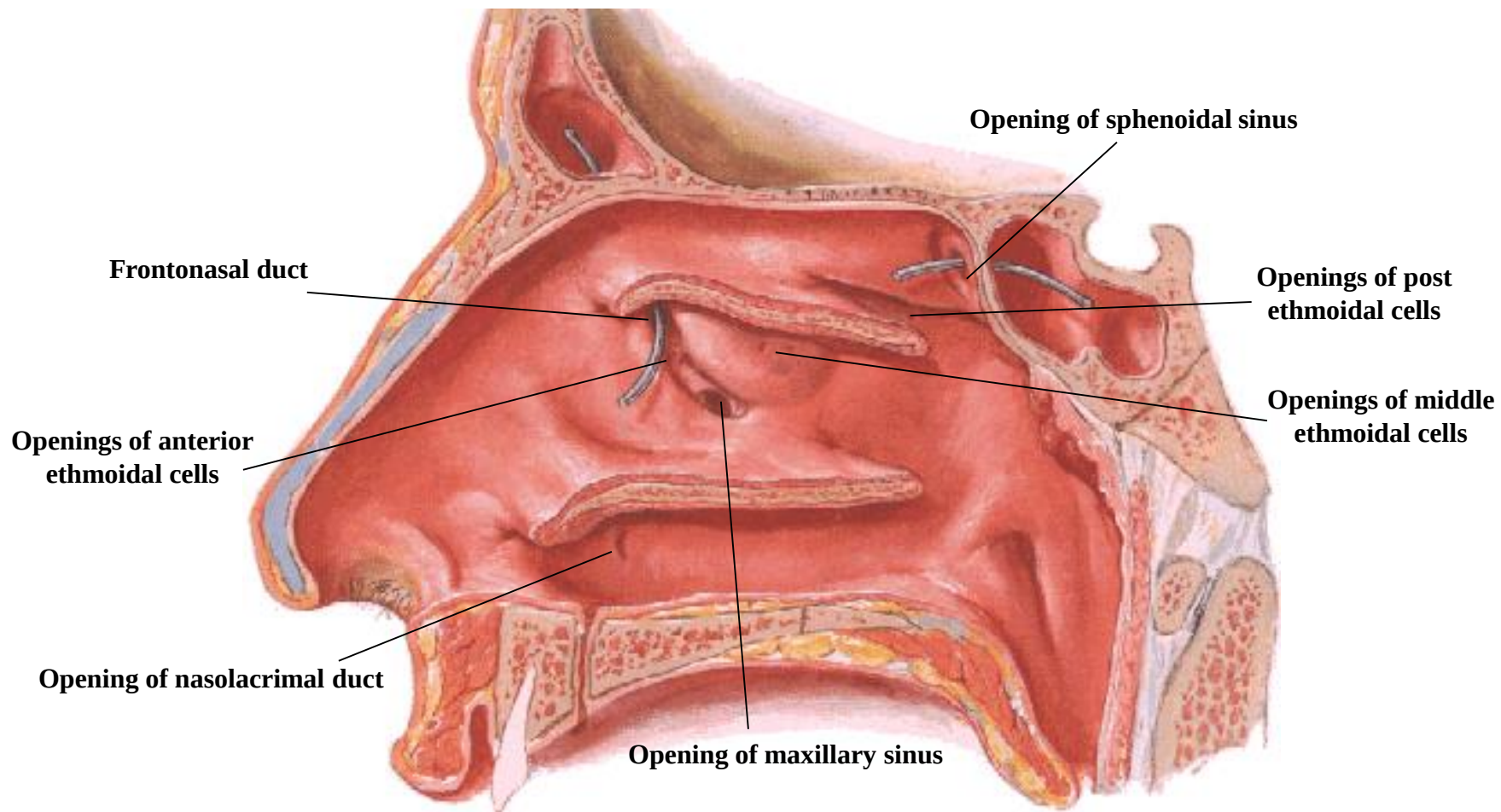
Paranasal Sinuses

- These are **air-containing spaces** in the skull around the nose.
- They **communicate with the nasal cavity** through small openings
- There are 4 paired paranasal sinuses:
 - **Frontal** air sinus
 - **Ethmoidal** air sinuses
 - **Sphenoidal** air sinus
 - **Maxillary** air sinus

Functions of paranasal sinuses:

- They **decrease the weight** of the skull
- They add **resonance to voice**
- They help in **warming & humidification** of inspired air





Pharynx

- It is a **musculo-membranous tube** that extends behind the **nose, mouth and larynx**
- It extends from the **base of the skull to the 6th cervical vertebra**
- The pharynx consists of 3 parts:

1. Nasopharynx

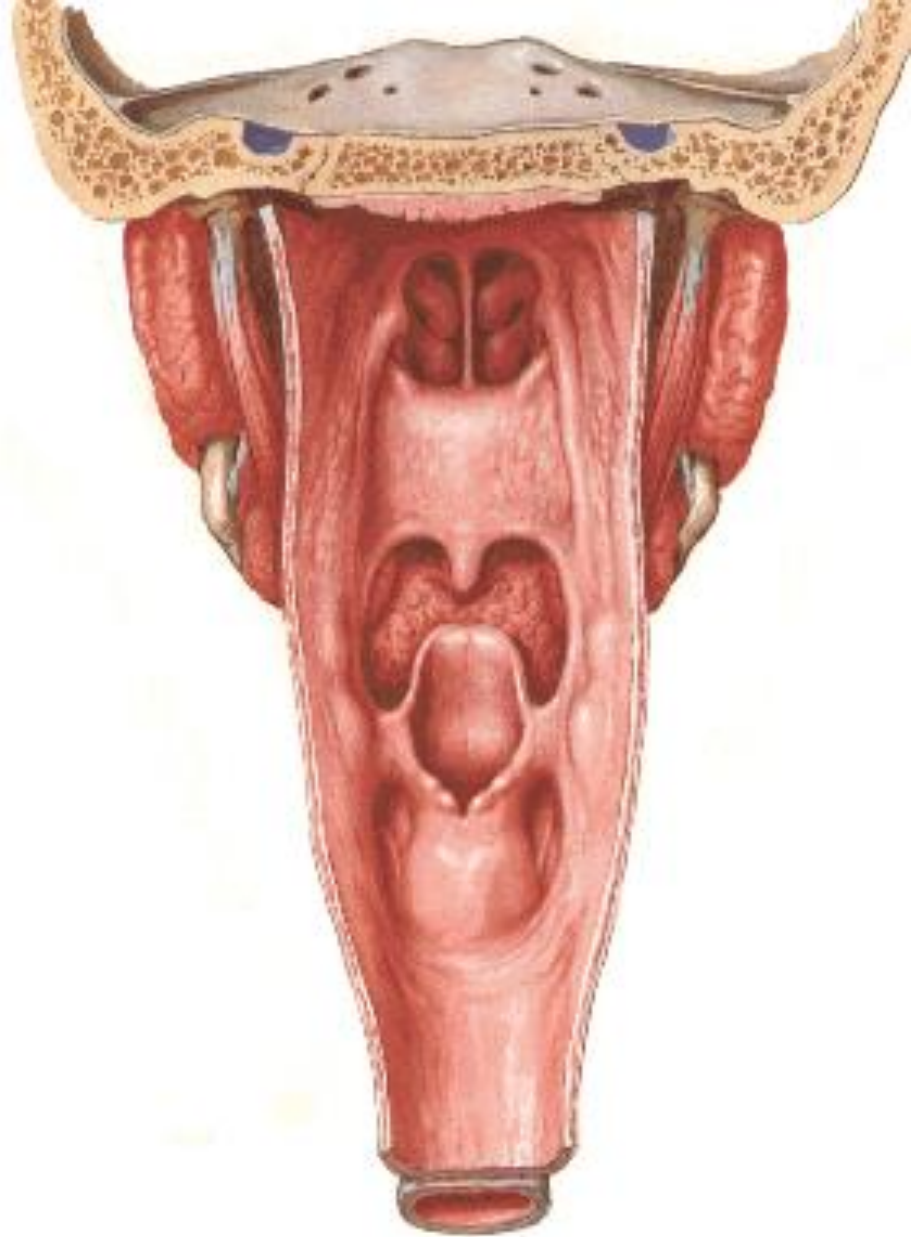
- Lies behind the nose
- Extends from the base of the skull to the level of the soft palate
- The **pharyngeal tonsil** (adenoids) lies in the roof of the nasopharynx
- The nasopharynx communicates with:
 - The **nose**; through the posterior nasal apertures
 - The **middle ear**; through the auditory tube
 - The **oropharynx**

2. Oropharynx

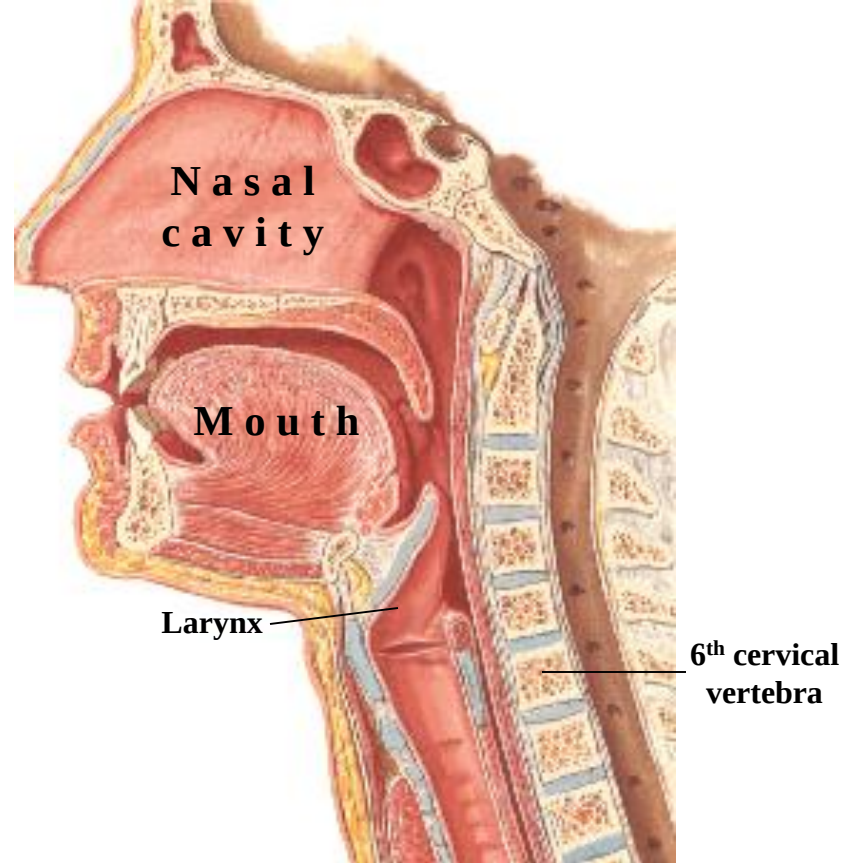
- It lies behind the mouth cavity
- Extends from the level of the soft palate to the upper border of the epiglottis
- The **palatine tonsils** lie in the lateral wall of the oropharynx
- The oropharynx communicates with
 - Nasopharynx
 - Mouth cavity
 - Laryngopharynx

3. Laryngopharynx

- It lies behind the larynx and communicates with the laryngeal inlet



Pharynx open & seen from behind



Larynx

- It is a specialized organ that forms **part of the respiratory passage**
- It is responsible for **production of voice**
- It is made up of a number of **cartilages** connected together by **membranes**, **ligaments** and moved by **muscles**



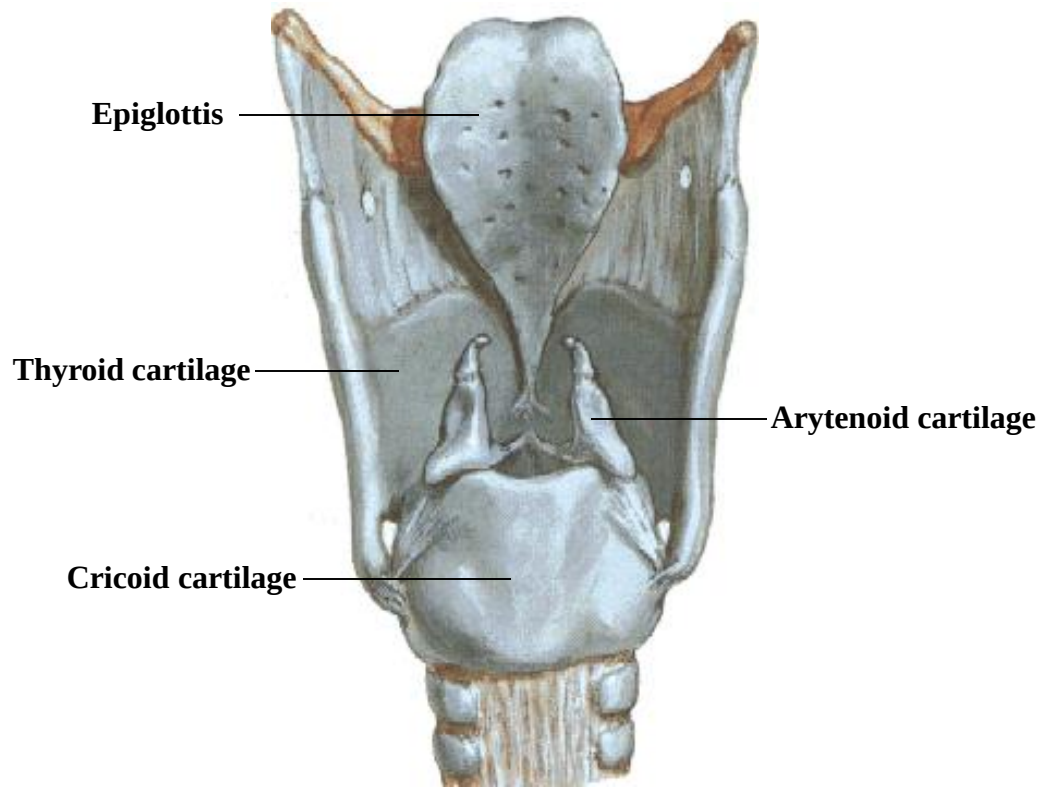
Cartilages of the larynx:

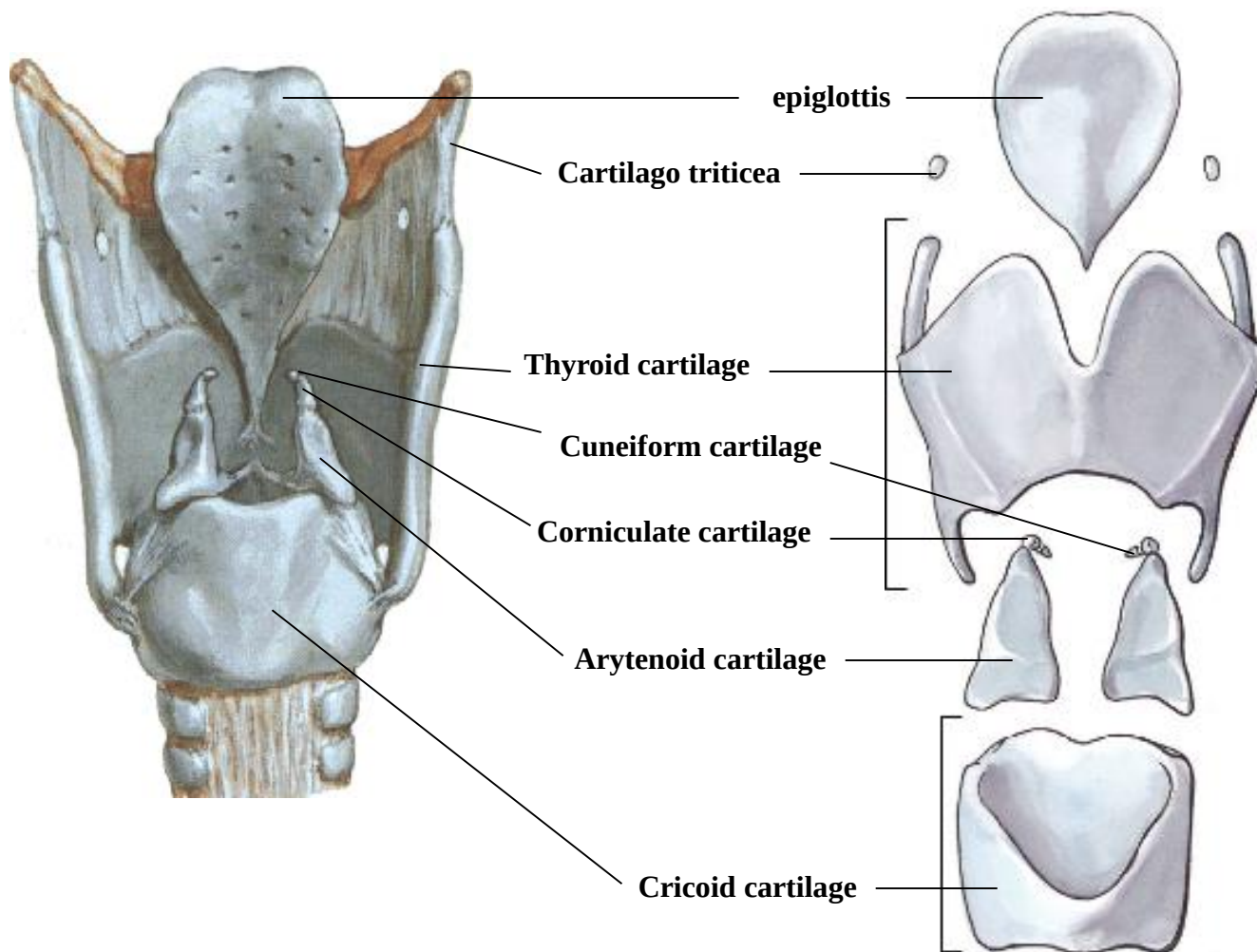
• 3 single cartilages

- **Thyroid**: formed of 2 laminae fused together anteriorly forming the laryngeal prominence (Adam's apple)
- **Cricoid**: a ring of cartilage which is broader posteriorly
- **Epiglottis**: a leaf-like cartilage behind the root of the tongue and hyoid bone

• 3 paired cartilages

- **Arytenoids**: small pyramidal cartilages. They give attachment to the vocal cords
- **Corniculate & Cuneiform**: small cartilages located in a mucous fold





Laryngeal cavity

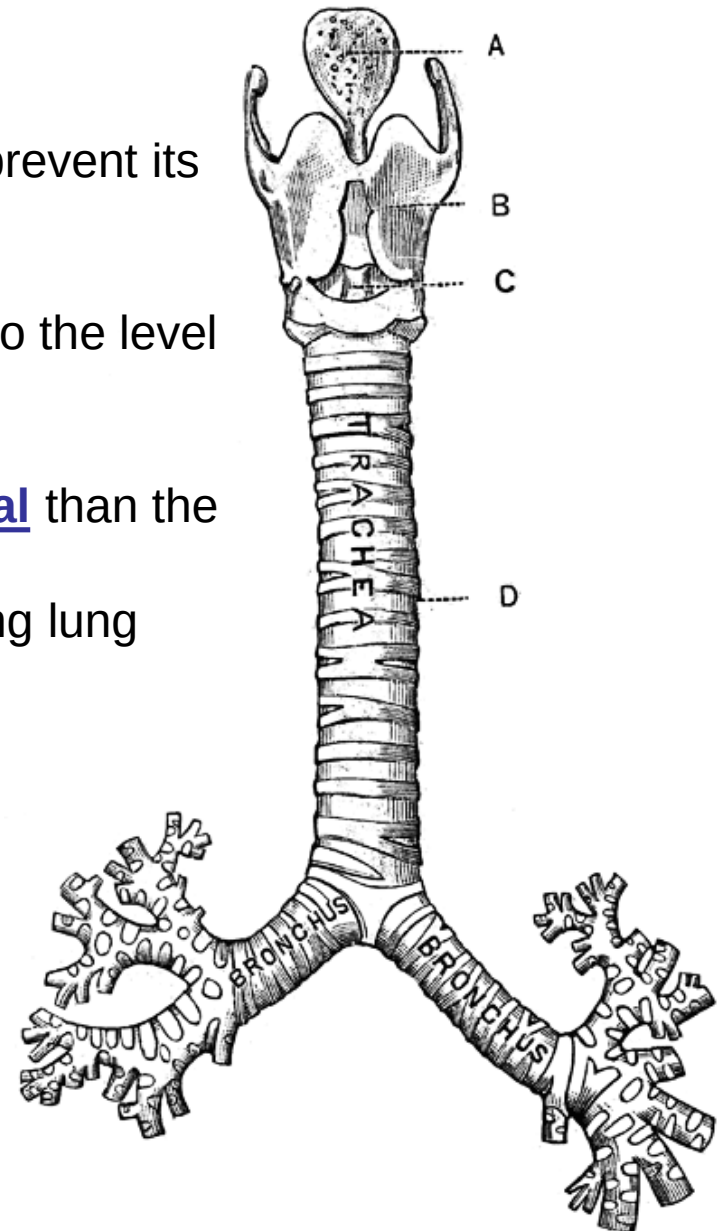
It is lined by mucosa which is formed of **respiratory epithelium**, Except the **vocal cords**

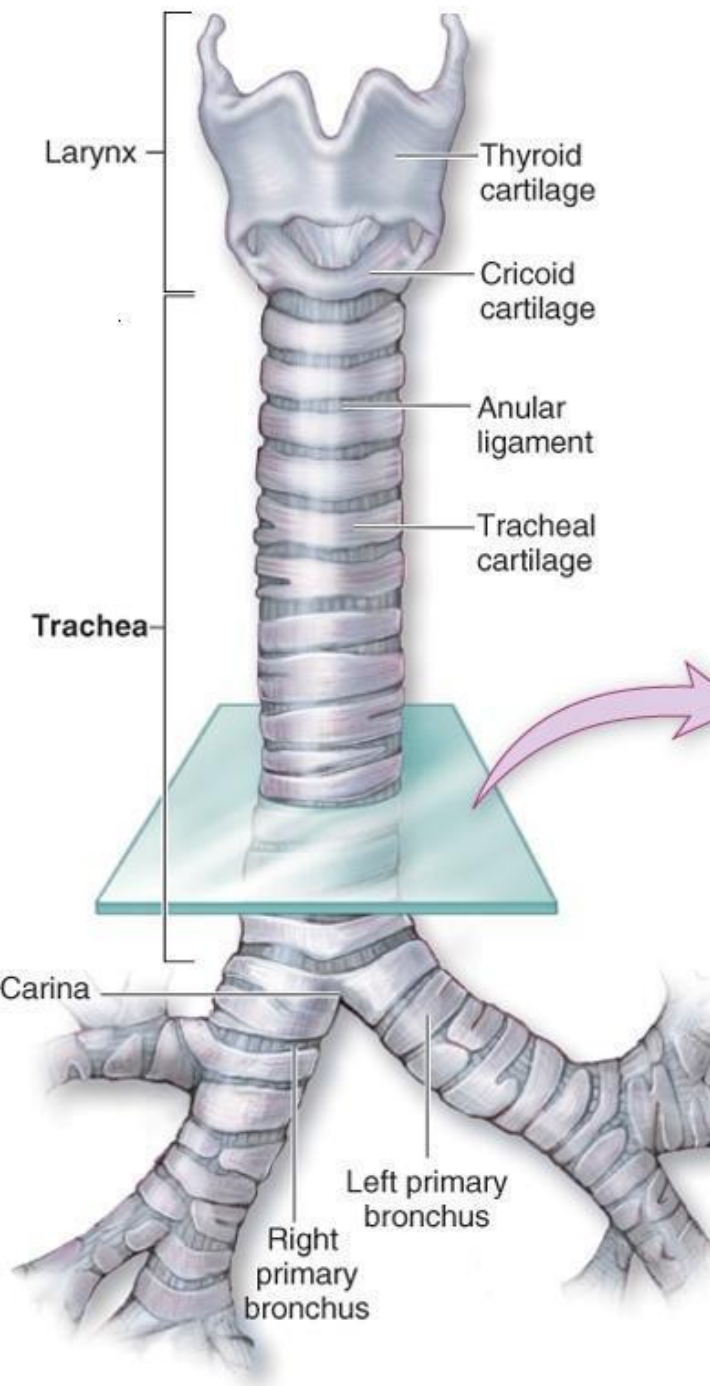
Functions of the larynx

- **Sound** production
- It is closed:
 - During swallowing to prevent passage of food to trachea
 - To **increase intra-abdominal pressure**

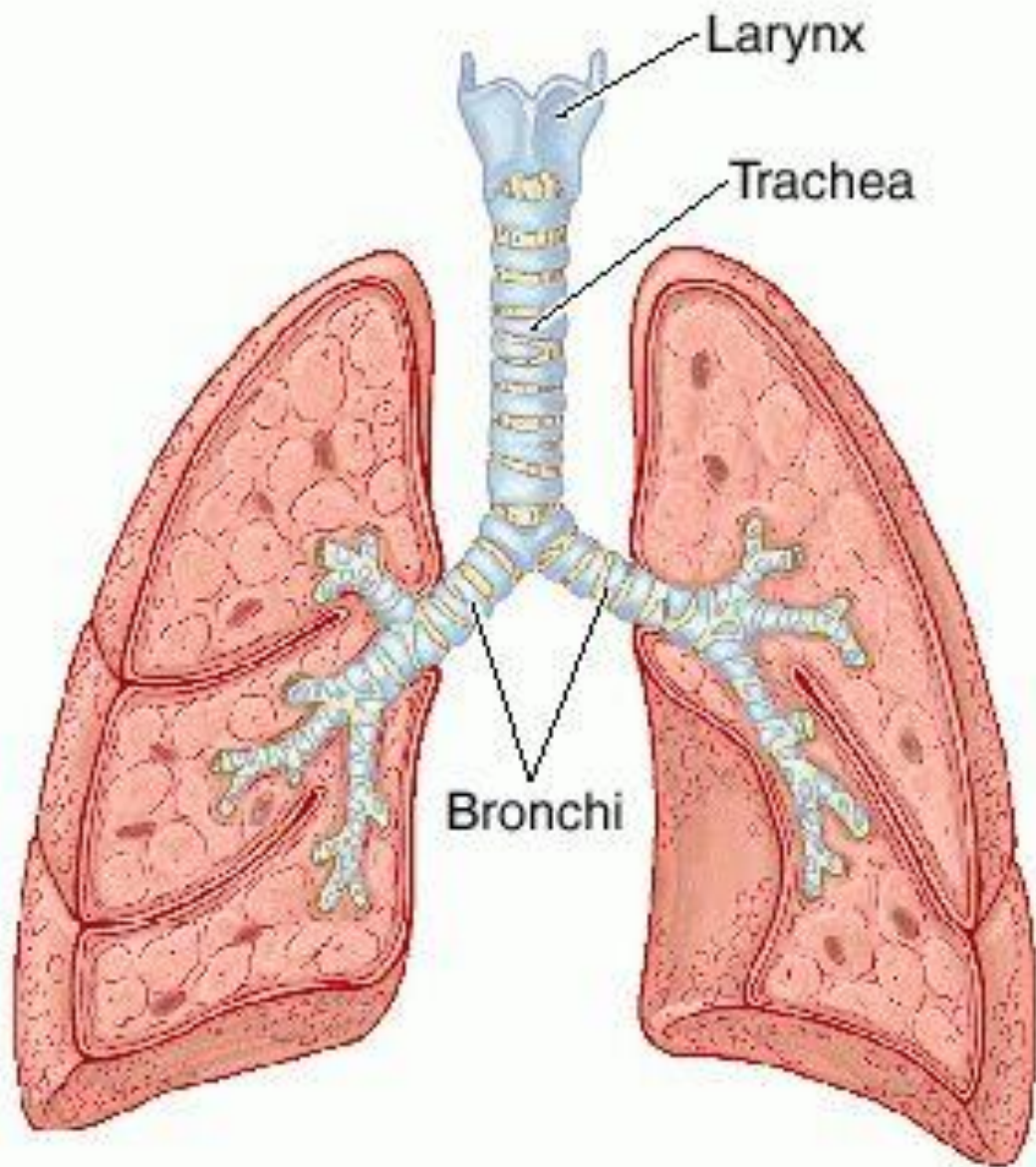
Trachea

- It is a **fibro-cartilaginous tube**, 10-12cm long
- It lies partly in the **neck** and partly in the **thorax**
- Its wall is formed of **15-20 C-shaped cartilages** to prevent its collapse
- It is closed posteriorly by **fibroelastic membrane**
- It extends from the lower border of cricoid cartilage to the level of the **sternal angle**
- It ends by dividing into **right & left main bronchi**
- The right bronchus is **shorter, wider & more vertical** than the left
- Each bronchus enters the **hilum** of the corresponding lung and branches forming the bronchial tree

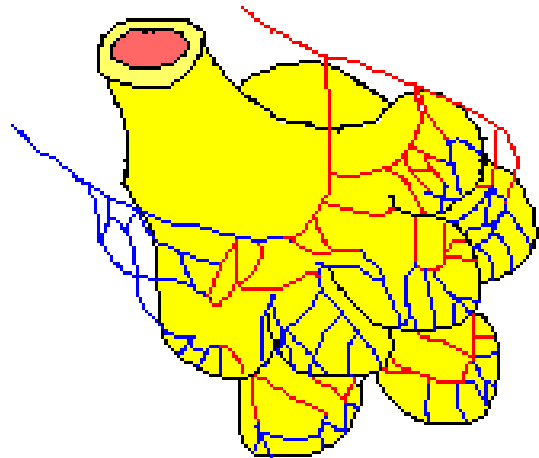
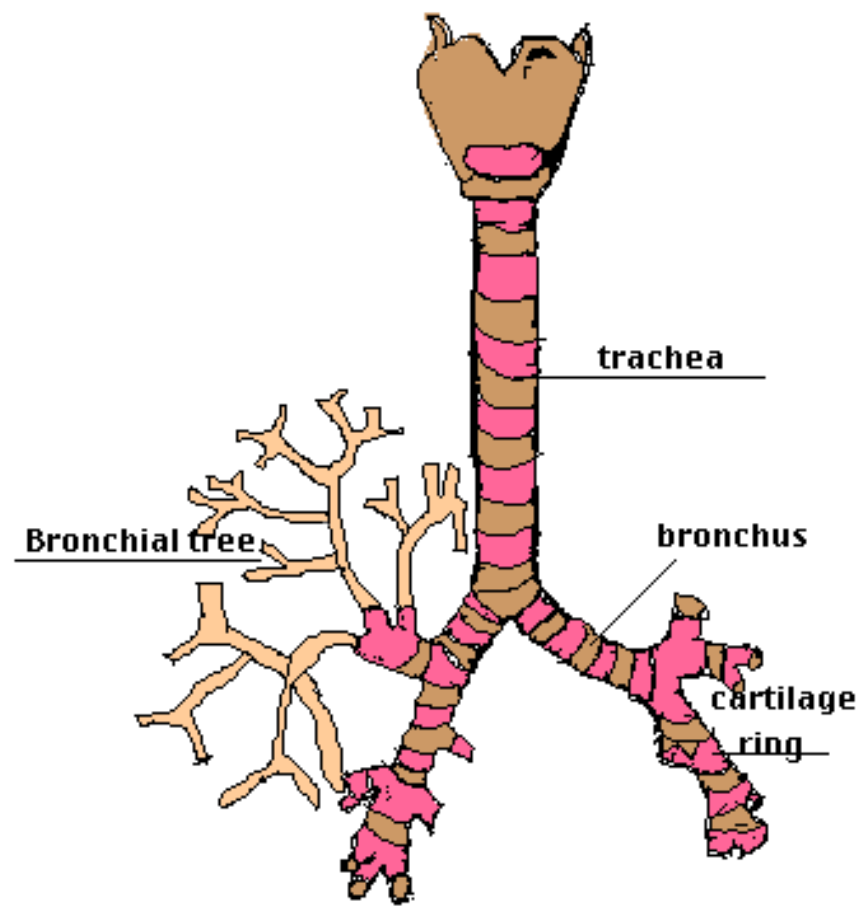
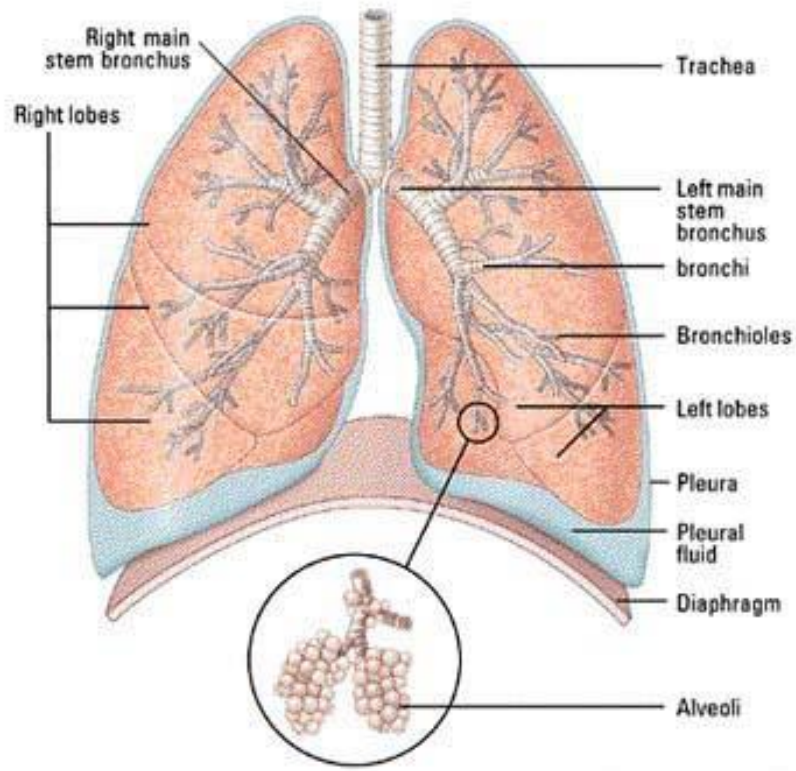




(c) Anterior view

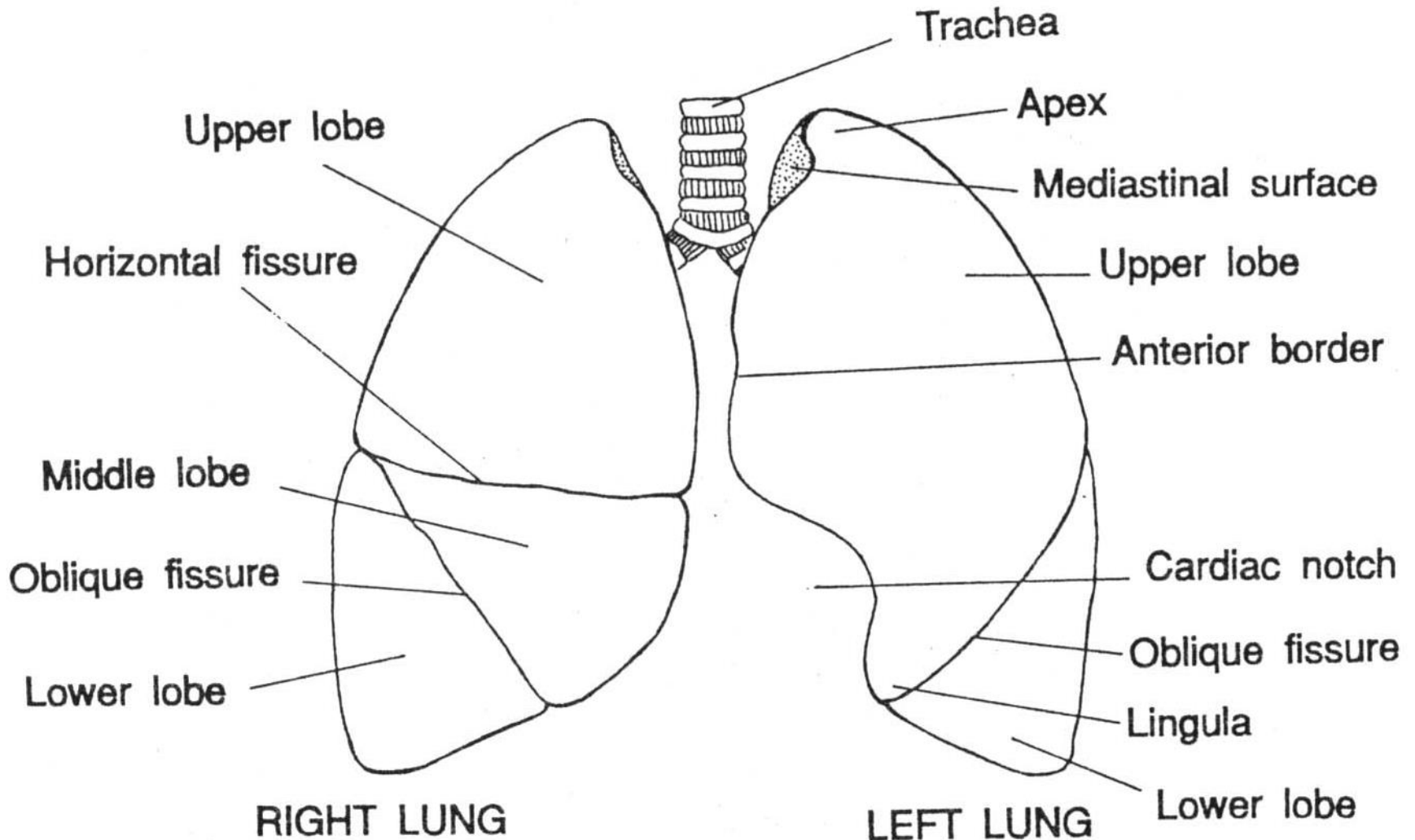


Lungs



The lungs

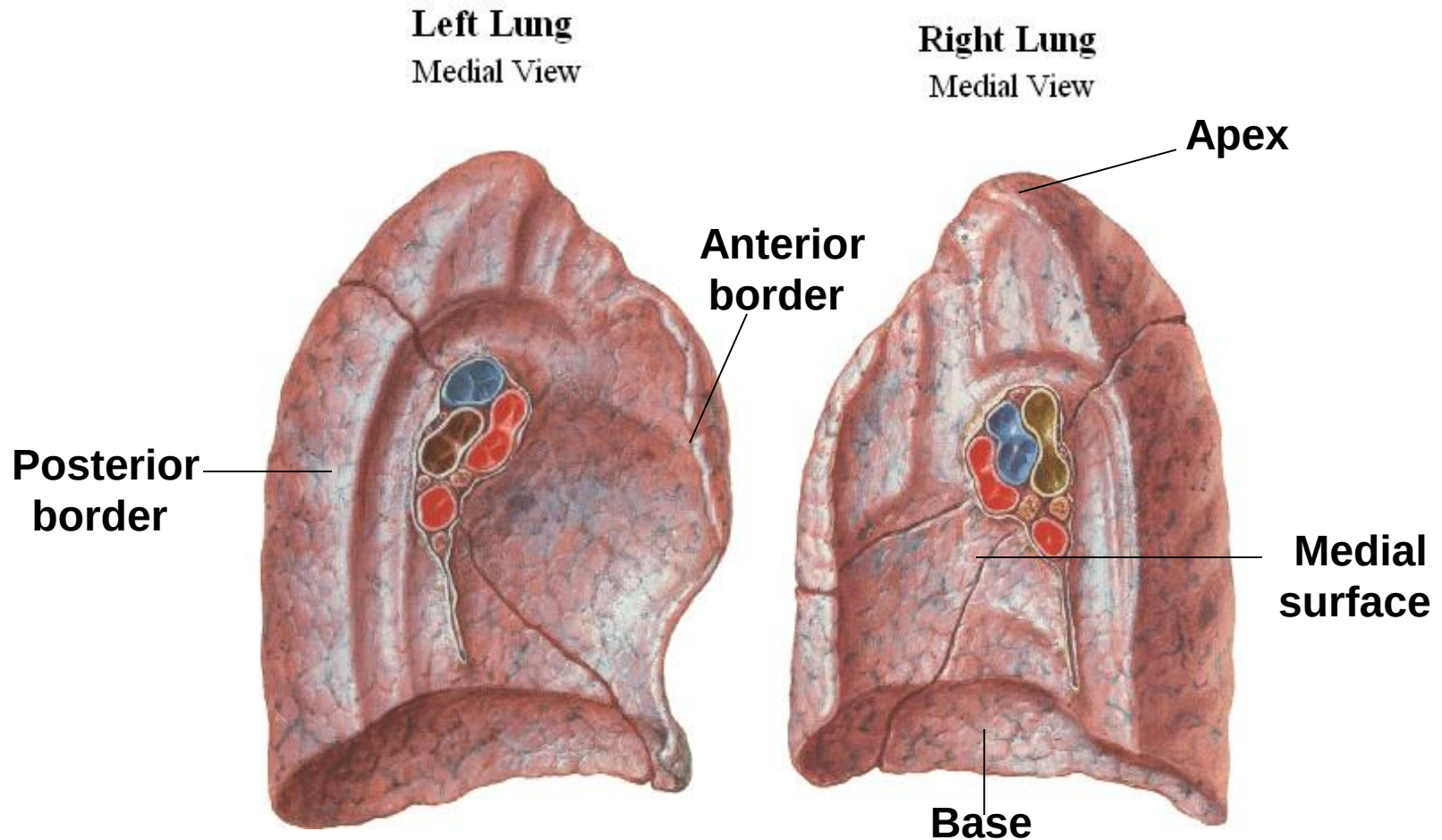
- The lungs occupy the lateral compartments of the thoracic cavity
- The **mediastinum** lies between the 2 lungs
- Each lung is surrounded by a closed serous sac called the “**pleura**”



External features of the lung

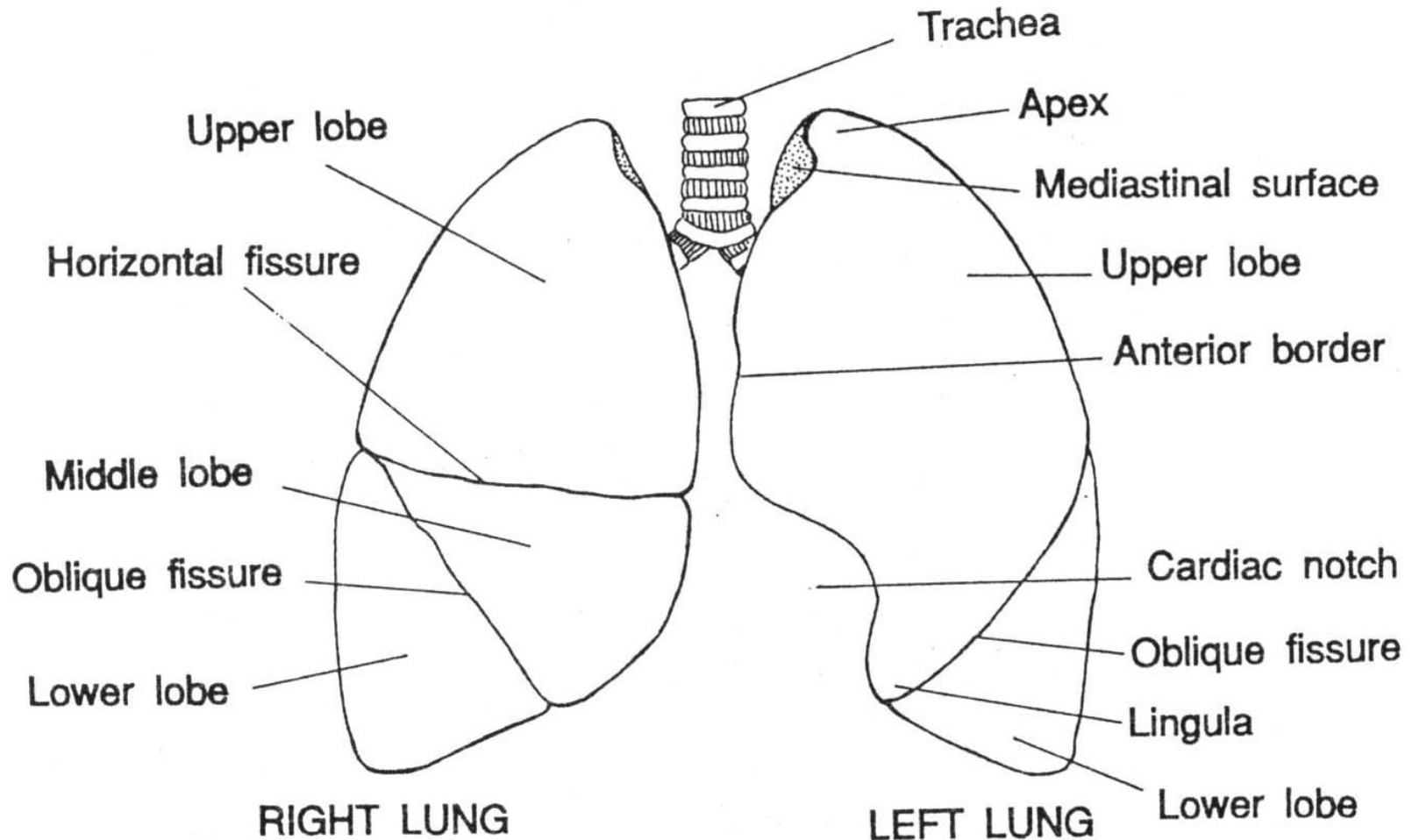
Lungs are **cone-shaped**, they have:

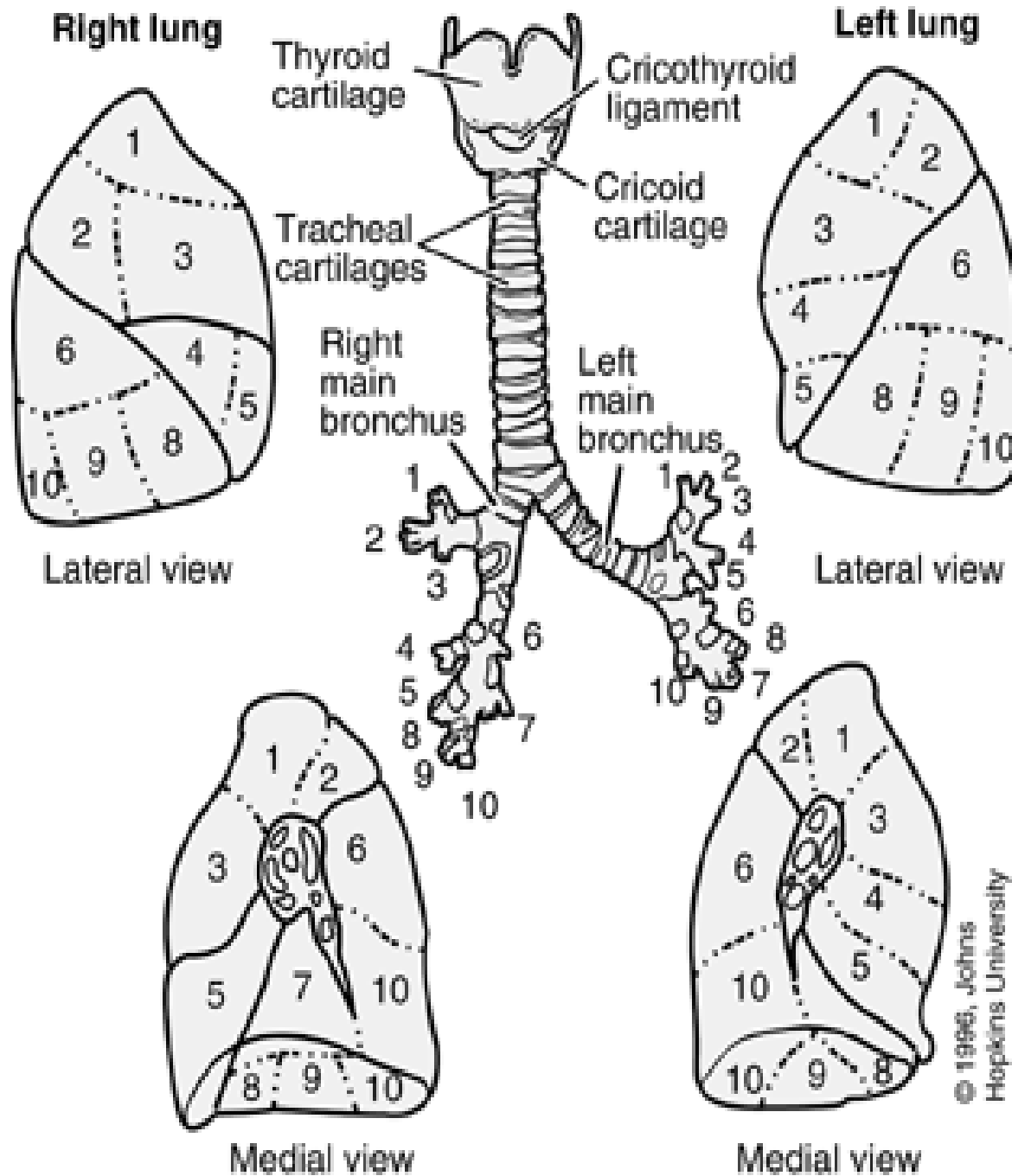
- **Apex**
- **Base**: rests on the diaphragm
- **Costal surface**: convex and related to the thoracic wall
- **Medial (mediastinal) surface**: concave and faces the mediastinum
- **Anterior border**: sharp
- **Posterior border**: broad



Lobes of the lung

- Each lung is divided into lobes
- The right lung is divided into **3 lobes** by horizontal and oblique fissures
- The left lung is divided into **only 2 lobes** by an oblique fissure
- Each lobe is further divided into **bronchopulmonary segments**



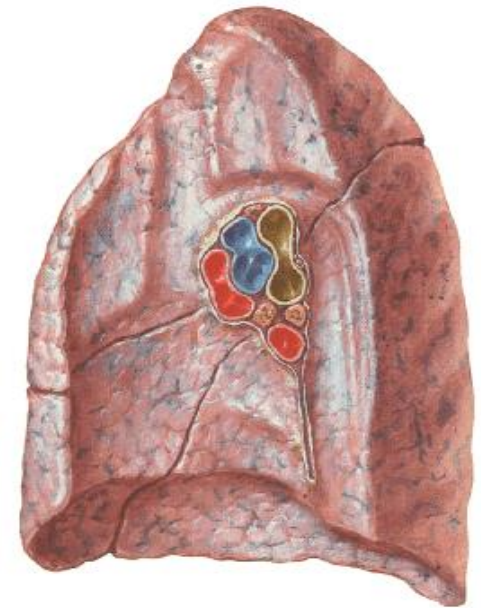
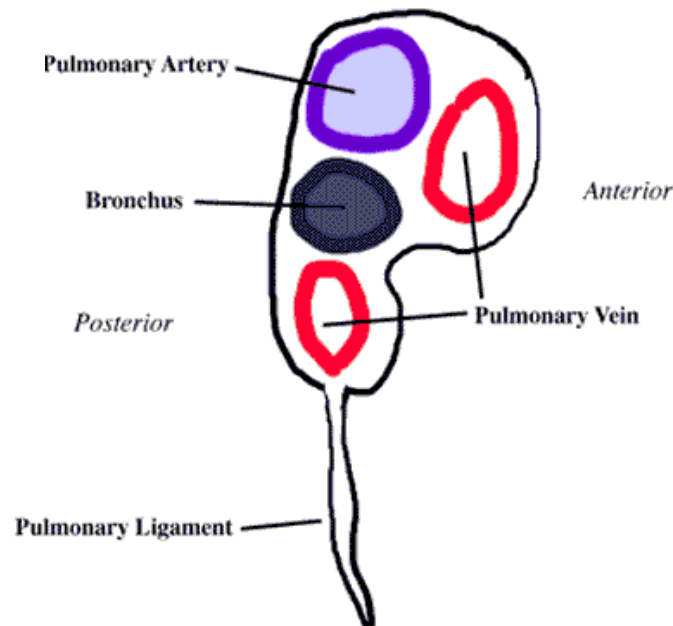


The medial surface presents the **hilum** of the lung, which gives passage to:

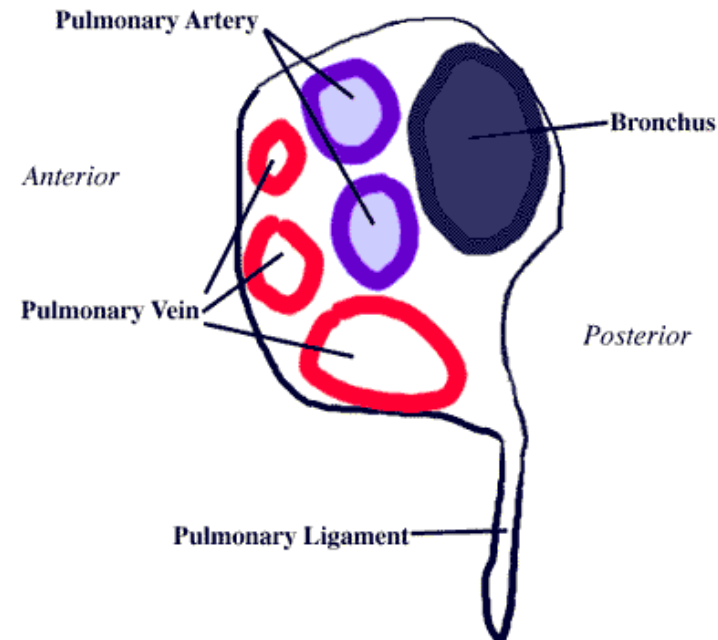
- **Primary bronchus**, posterior in position
- **Pulmonary artery**; intermediate in position
- **Two Pulmonary veins**; anterior in position



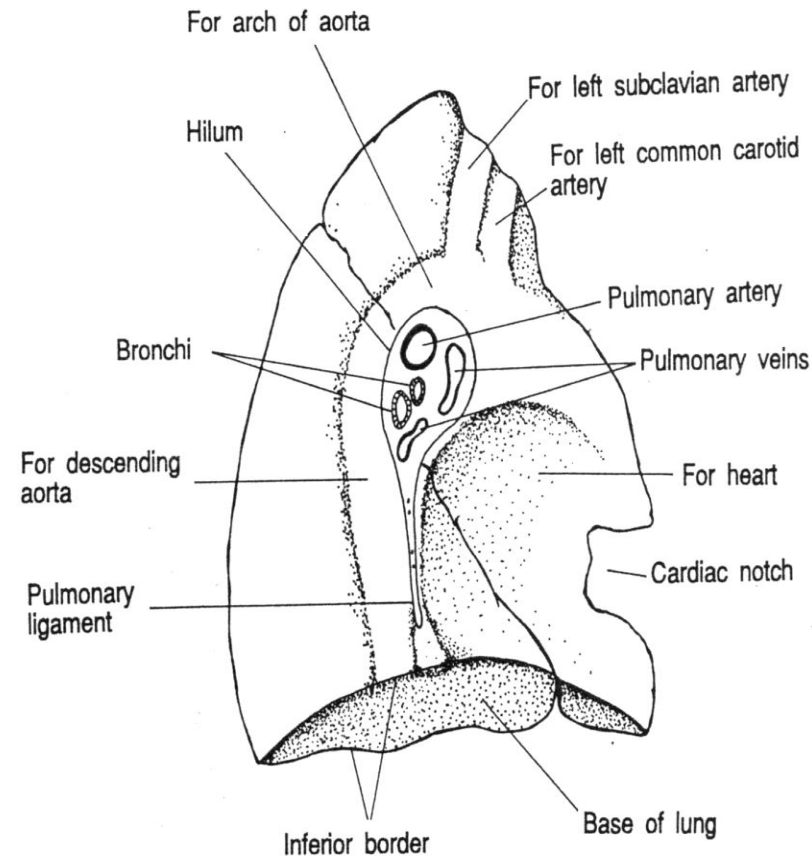
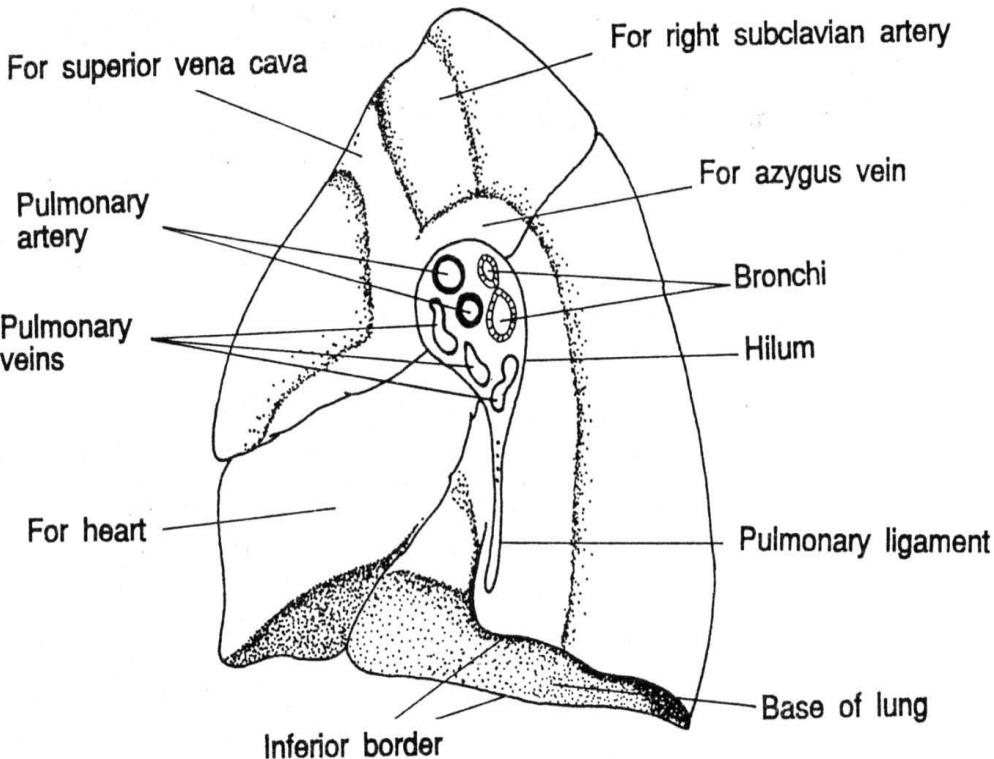
Left Lung Hilum



Right Lung Hilum

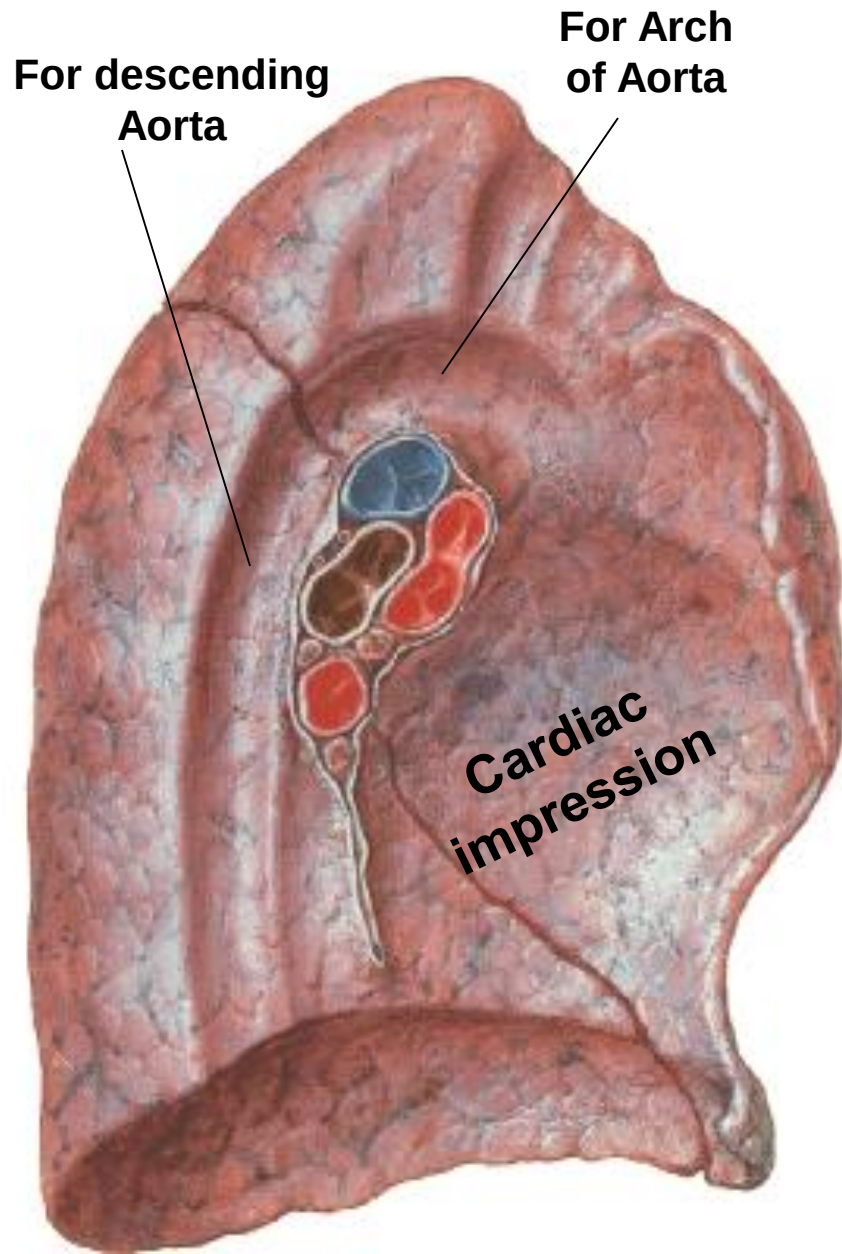


- The medial (**mediastinal**) surface of each lung shows a number of **impressions**
- The Mediastinal surface of the **right lung** shows impressions of:
 - **SVC**
 - **Azygos vein**
 - **Cardiac impression** (Right atrium)
- The Mediastinal surface of the **left lung** shows impressions of:
 - **Arch of aorta**
 - **Descending aorta**
 - **Cardiac impression** (left ventricle)



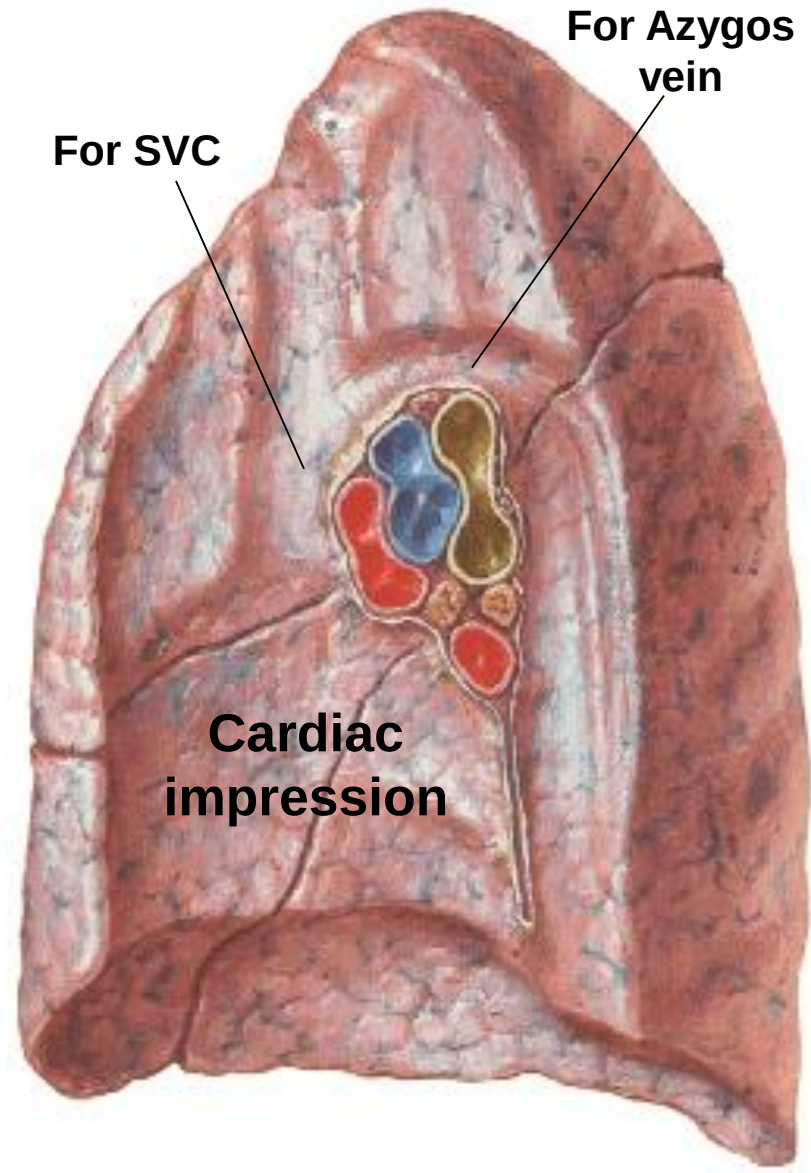
Left Lung

Medial View



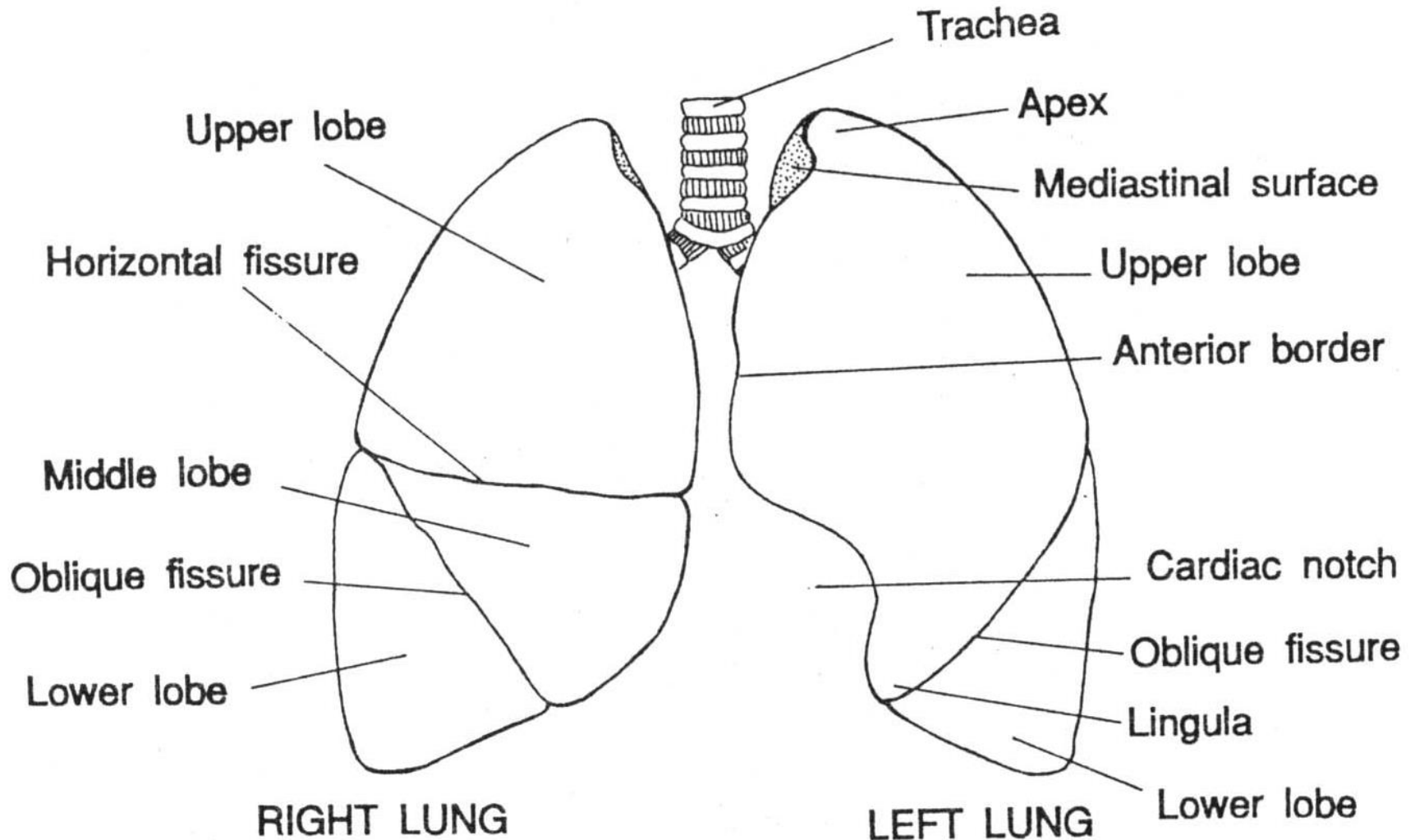
Right Lung

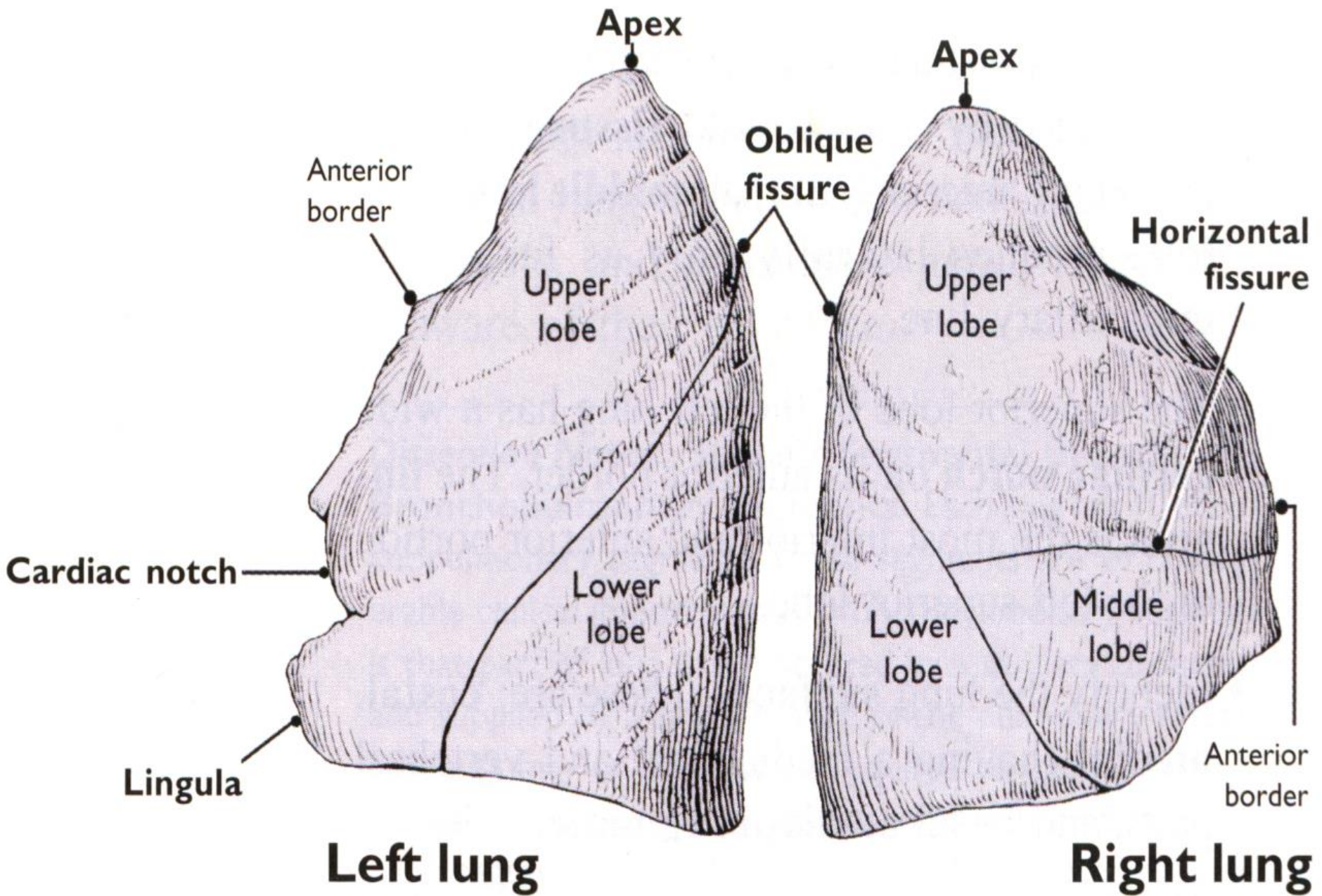
Medial View



Differences between right & left lungs:

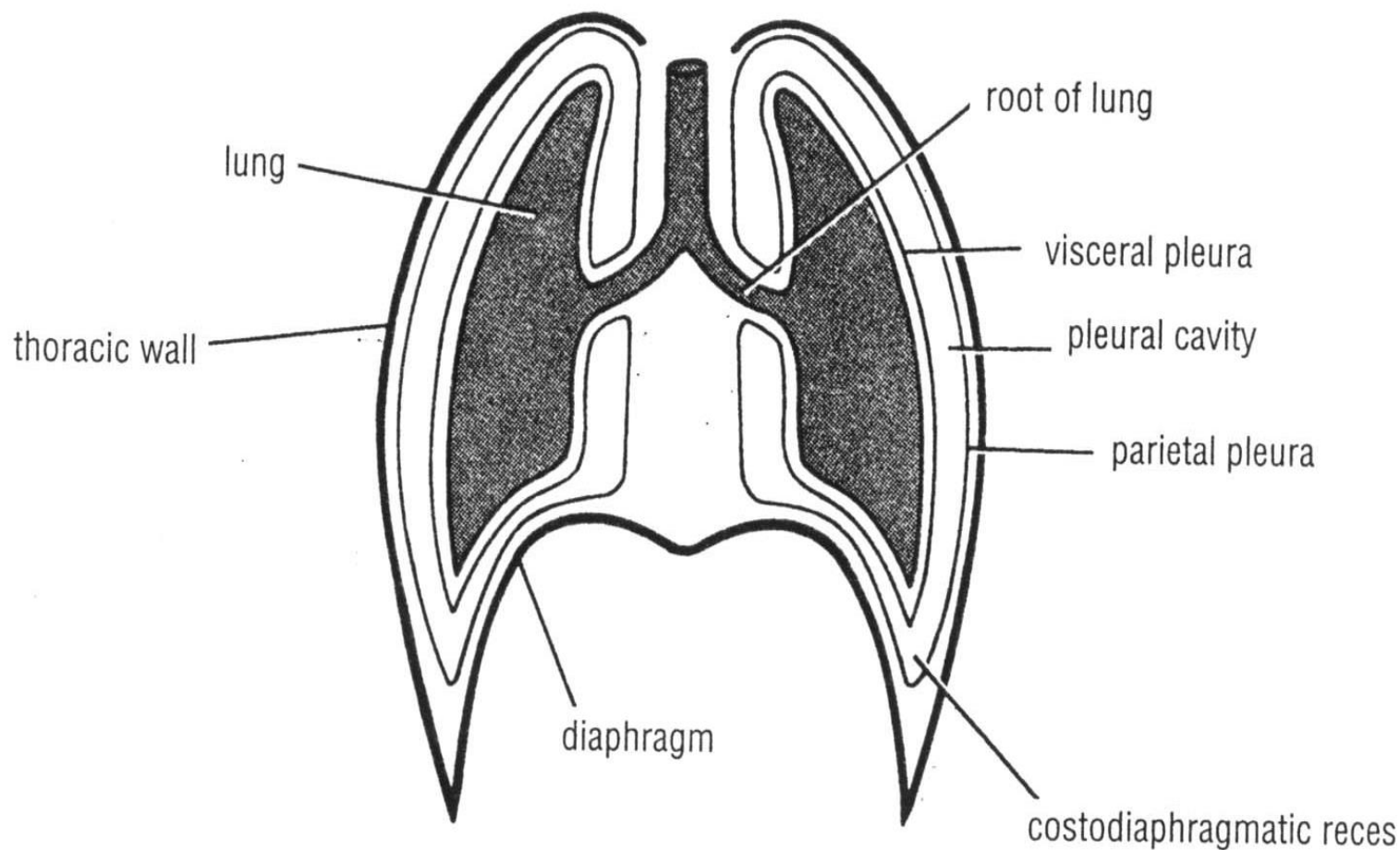
- The right lung is **larger** in size, **shorter** and **wider**
- The anterior border of right lung is **straight**, while the left is **notched** (cardiac notch)
- The right lung has **2 fissure and 3 lobes**
- The left lung has **1 fissure and only 2 lobes**





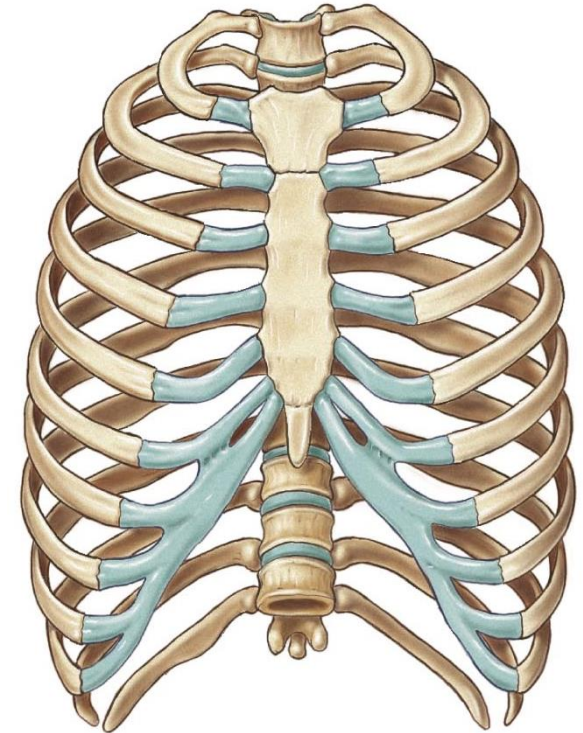
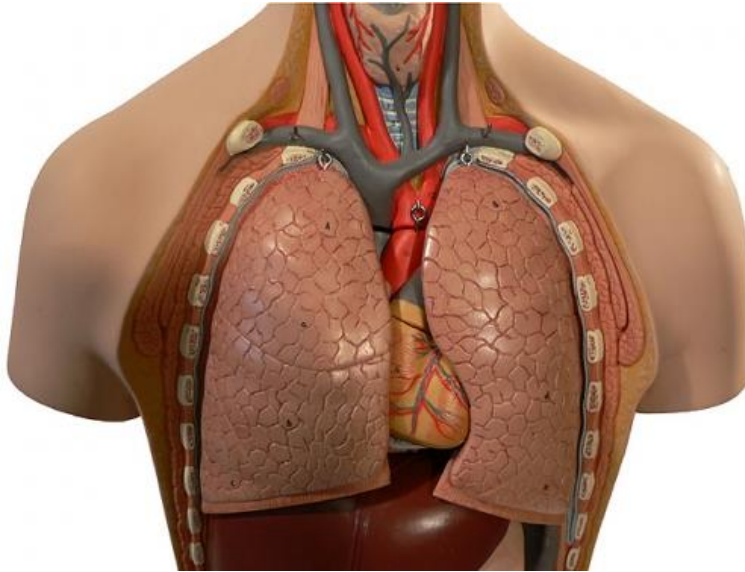
Pleura

- A closed **serous sac** that surrounds each lung
- It is composed of:
 - **Visceral** layer; surrounding the lung
 - **Parietal** layer; lines the thoracic cavity
- The space between the 2 layers is called “**pleural cavity**”



The thorax

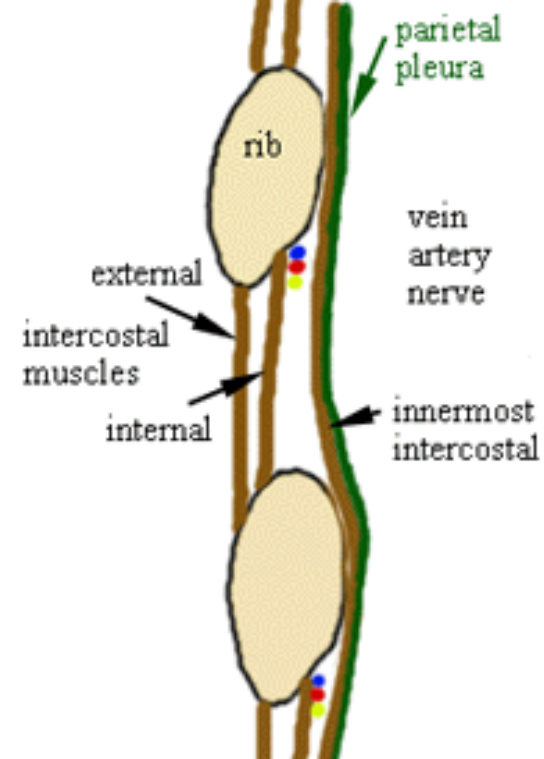
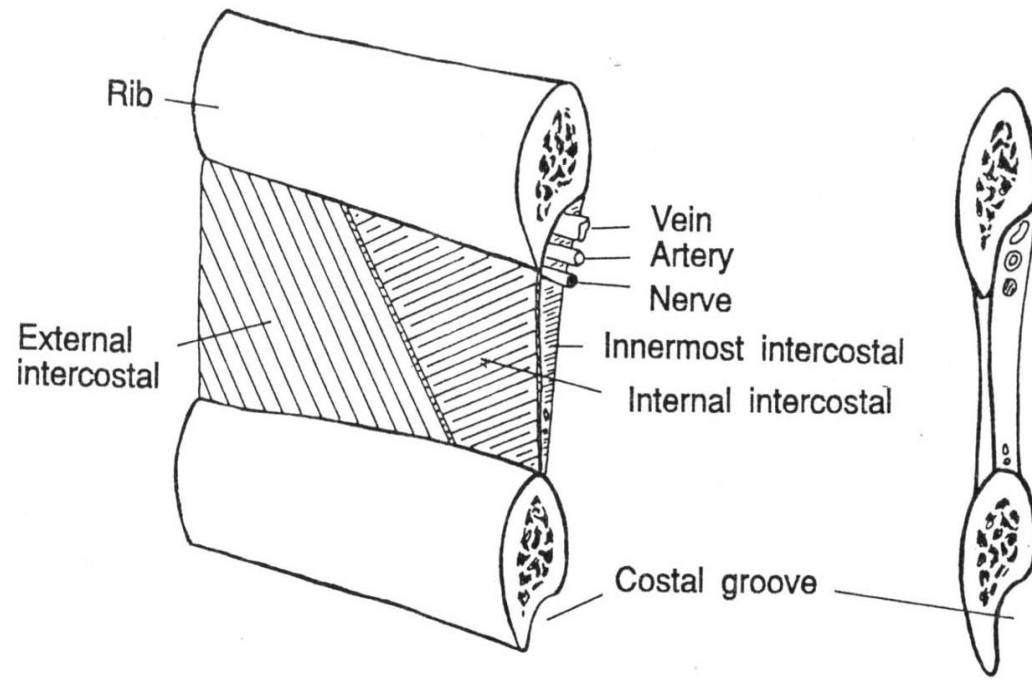
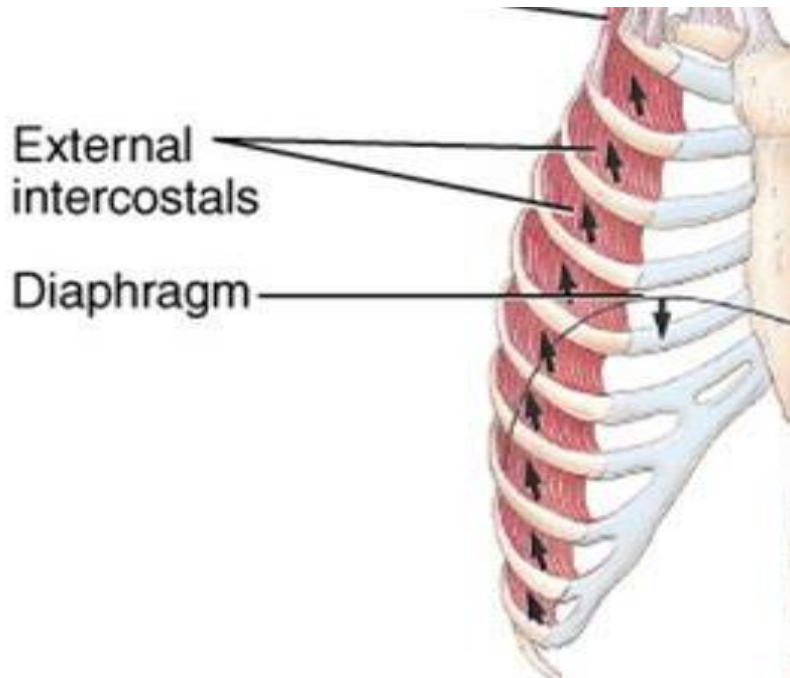
- It is formed of a bony **thoracic cage** which encloses the **thoracic cavity**
- The thoracic cavity is separated from the abdominal cavity by the **diaphragm**
- The thoracic cavity is divided into:
 - **Mediastinum**; central in position and contains the heart
 - Two **lateral compartments**; contain the lungs



- The thoracic cage is formed of:
 - **Thoracic vertebrae**, posteriorly
 - **Ribs**; laterally
 - **Sternum**; anteriorly
- The ribs are separated by **intercostal spaces**
- The Intercostal spaces are occupied by **intercostal muscles**

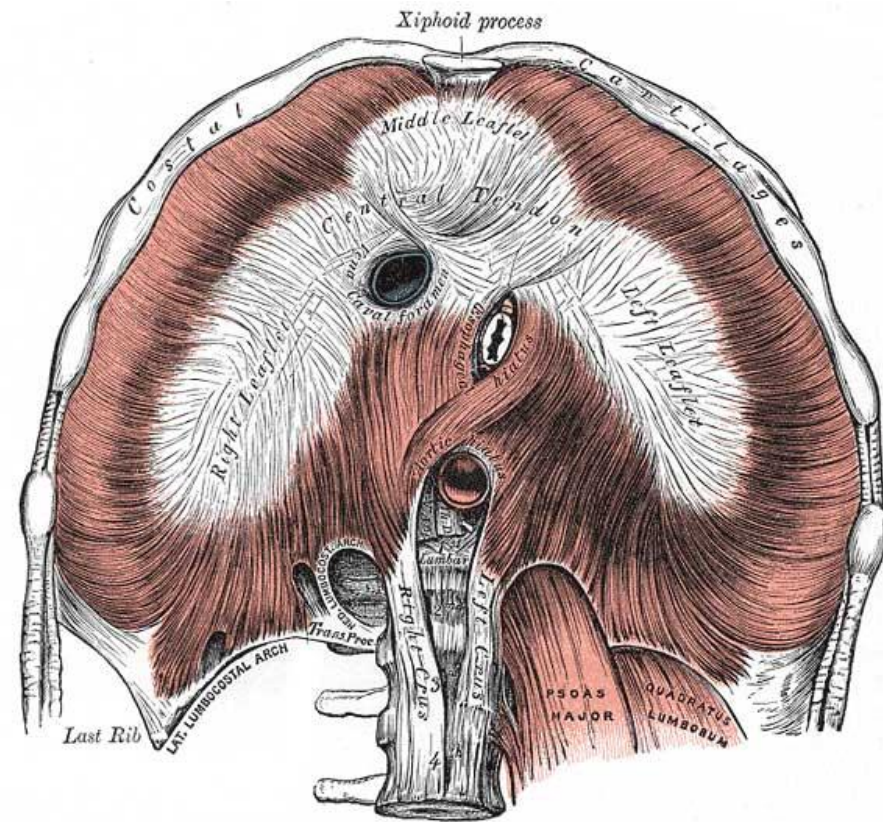
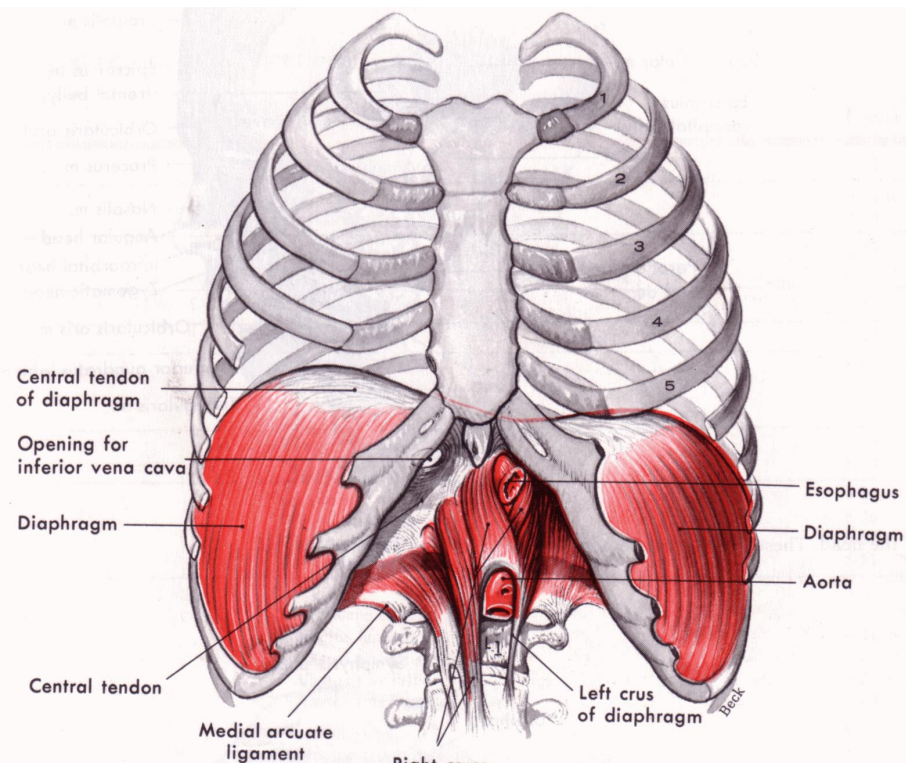
Respiratory Muscles

- They include the **diaphragm and intercostal muscles**
- The intercostal muscles are arranged in 3 layers:
 - **External intercostal** muscles
 - **Internal intercostal** muscles
 - **Innermost intercostal** muscles

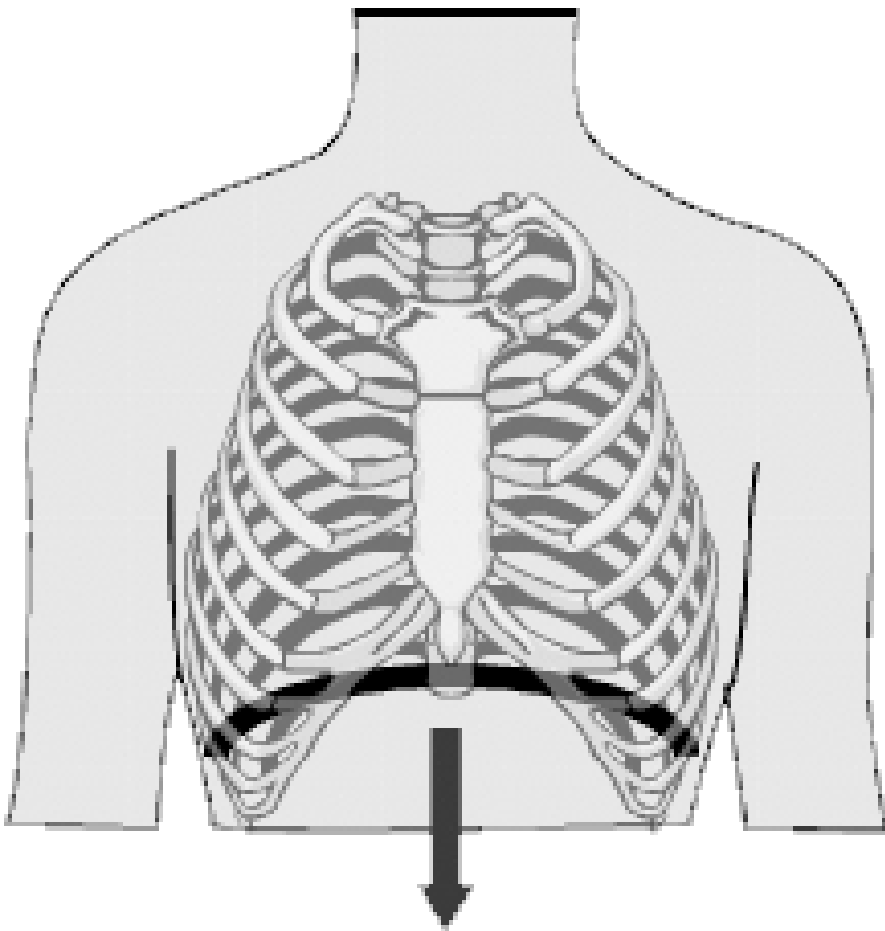


The diaphragm

- It is a musculotendinous partition which separates the thoracic from the abdominal cavity
- It has 3 main openings:
 - **Vena Caval** opening; at the level of the **8th thoracic vertebra** and transmits the IVC
 - **Oesophageal** opening; at the level of **10th thoracic vertebra** & transmits the oesophagus
 - **Aortic** opening; at the level of the **12th thoracic vertebra** and transmits the aorta

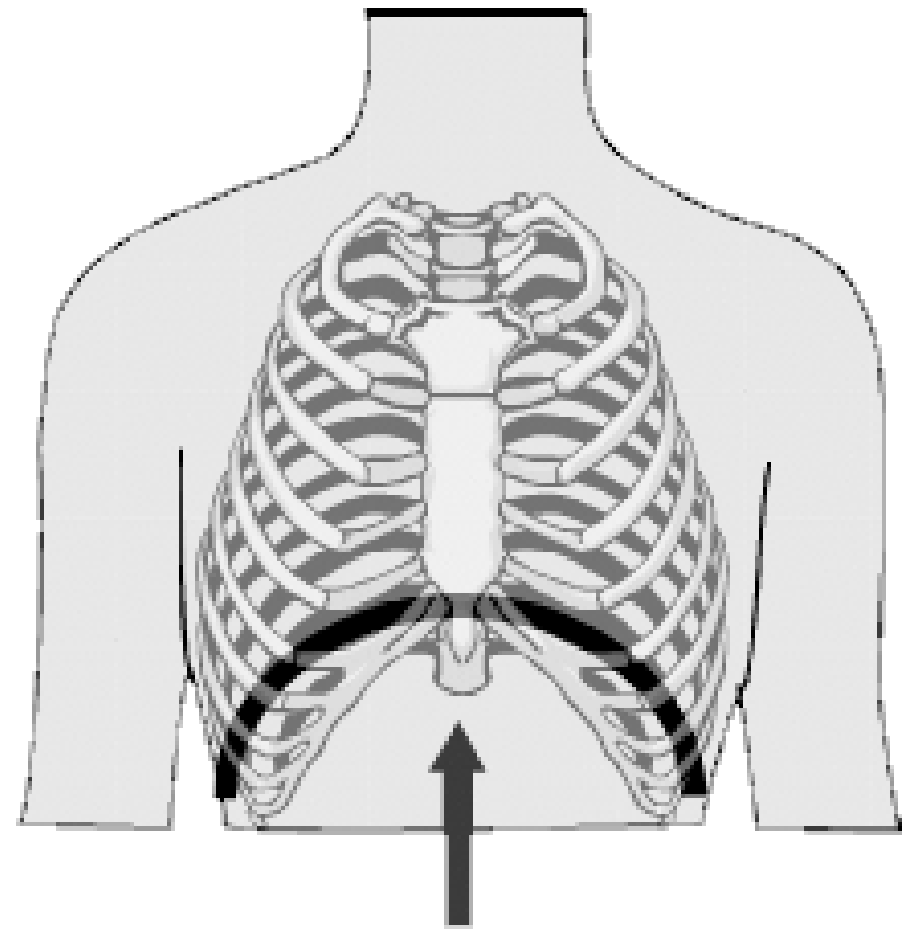


During Inhalation



Diaphragm contracts
and flattens as the lungs
fill up with air.

During Exhalation



Diaphragm relaxes and
moves upward as the air
is released.