



RESPIRASI

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Basic functions of the respiratory system

- Breathing (Pulmonary Ventilation) : movement of air in and out of the lungs
 - Inhalation (inspiration) draws gases into the lungs.
 - Exhalation (expiration) forces gases out of the lungs.
- Gas Conditioning : as gases pass through the nasal cavity and paranasal sinuses, inhaled air becomes turbulent. The gases in the air are
 - warmed to body temperature
 - humidified
 - cleaned of particulate matter
- Gas Exchange - respiration
 - Supplies body with oxygen
 - Disposes of carbon dioxide
- Produces Sounds
- Site for olfactory sensation

Respiration Includes

- Pulmonary ventilation
 - Air moves in and out of lungs
 - Continuous replacement of gases in alveoli (air sacs)
- External respiration
 - Gas exchange between blood and air at alveoli
 - O₂ (oxygen) in air diffuses into blood
 - CO₂ (carbon dioxide) in blood diffuses into air
- Transport of respiratory gases
 - Between the lungs and the cells of the body
 - Performed by the cardiovascular system
 - Blood is the transporting fluid
- Internal respiration
 - Gas exchange in capillaries between blood and tissue cells
 - O₂ in blood diffuses into tissues
 - CO₂ waste in tissues diffuses into blood

Organization of Respiratory Organs

Upper Respiratory System :

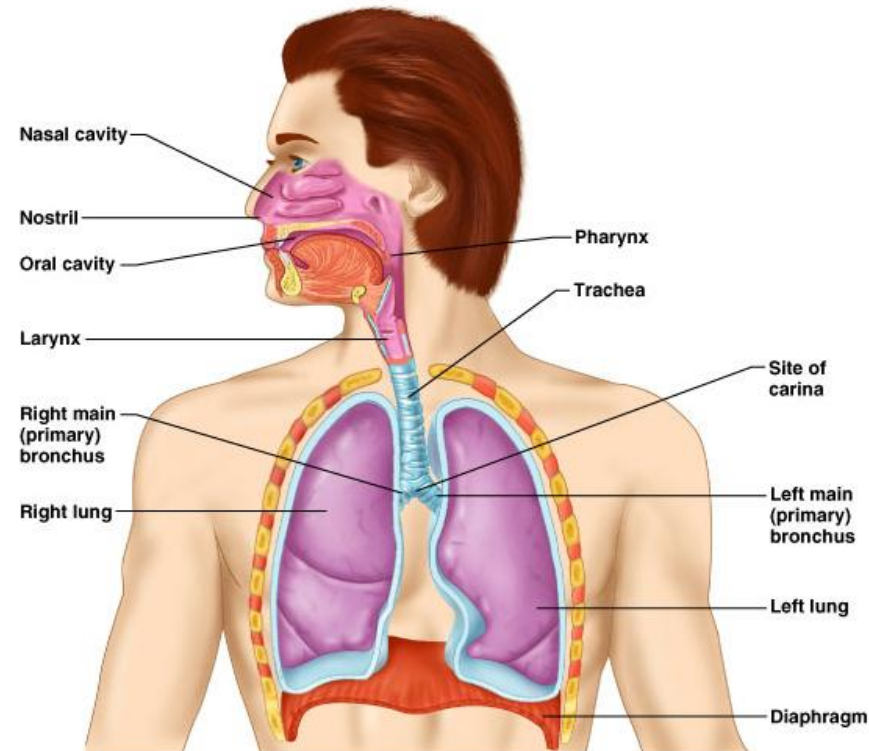
Composed of :

- Nose
- Pharynx
- Larynx

Lower Respiratory System :

Composed of :

- Trachea
- Bronchi
- Pulmo



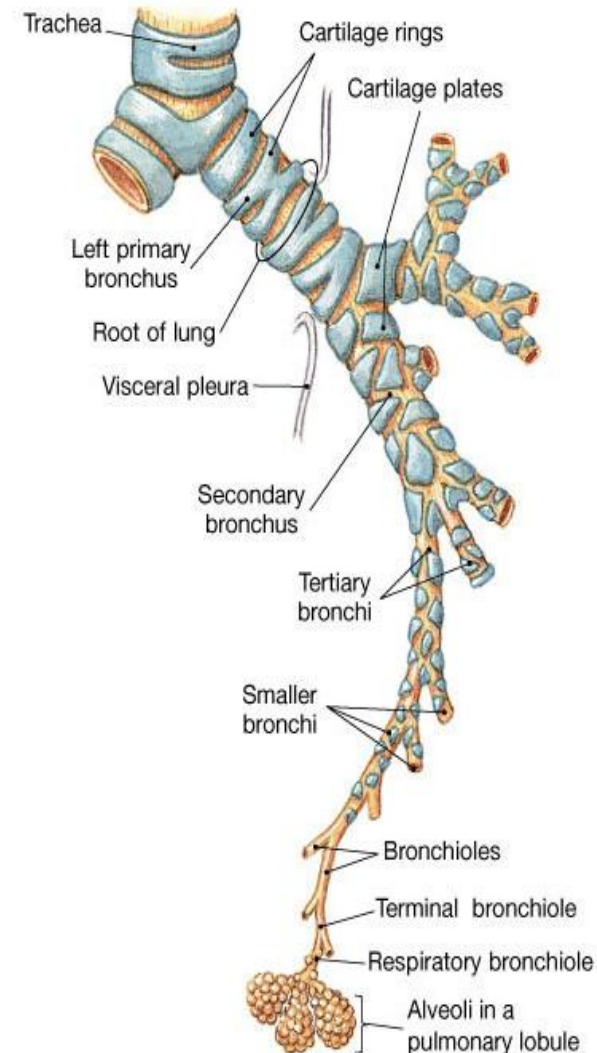
Functional Respiratory System

Conducting zone

- Respiratory passages that carry air to the site of gas exchange
- Filters, humidifies and warms air
- Composed of :
 - Nose – Bronchiolus Terminalis

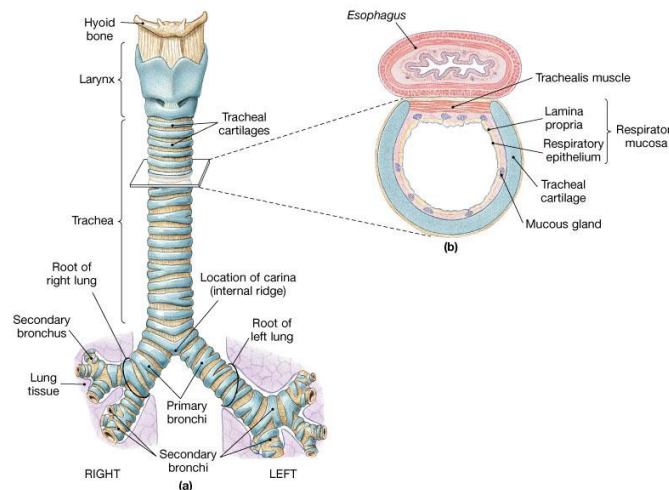
Respiratory zone

- Site of gas exchange
- Composed of
 - Bronchiolus respiratorius
 - Ductus Alveolaris
 - Saccus Alveolaris
 - Alveoli

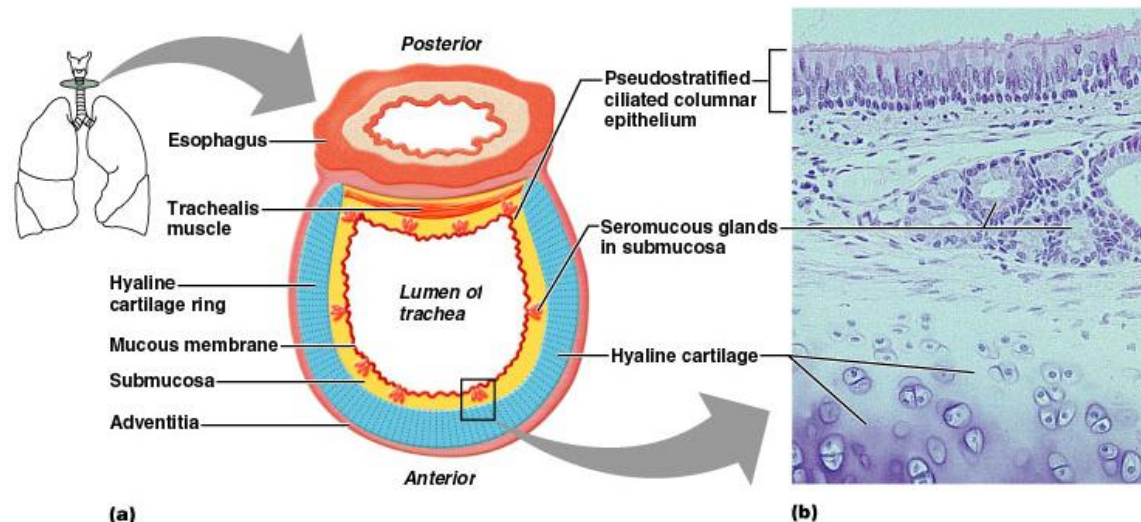


The Trachea

- Descends into the mediastinum
- C-shaped cartilage rings of hyaline cartilage keep airway open, joined by fibroelastic connective tissue
- **Carina** - marks where trachea divides into two primary bronchi
- Epithelium - pseudostratified ciliated columnar

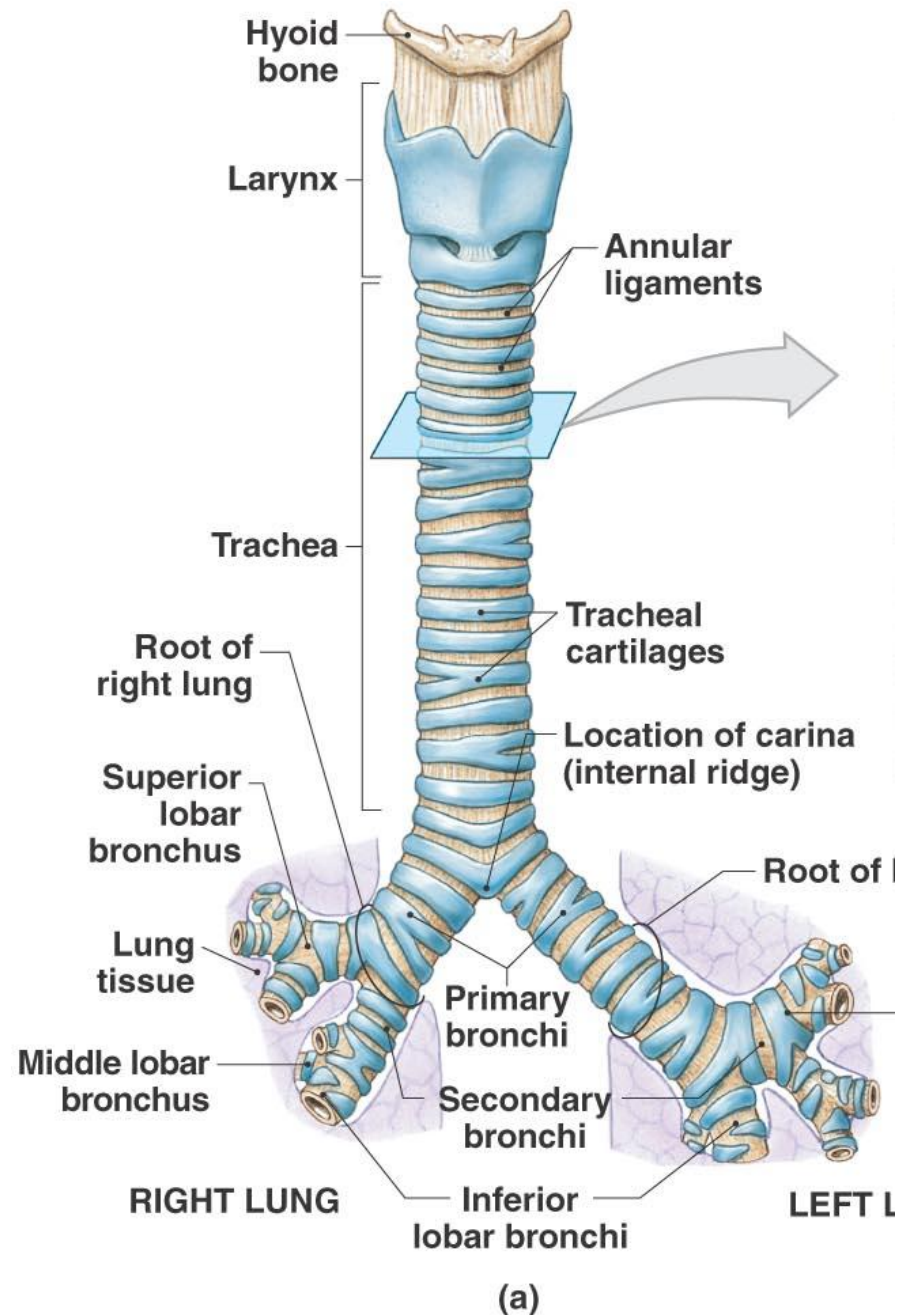


- Posterior open parts of tracheal cartilage abut esophagus
- *Trachealis* muscle can decrease diameter of trachea
 - Esophagus can expand when food swallowed
 - Food can be forcibly expelled
- Wall of trachea has layers common to many tubular organs – filters, warms and moistens incoming air
 - *Mucous membrane* (pseudostratified epithelium with cilia and lamina propria with sheet of elastin)
 - *Submucosa* (with seromucous glands)
 - *Adventitia* - connective tissue which contains the tracheal cartilages)



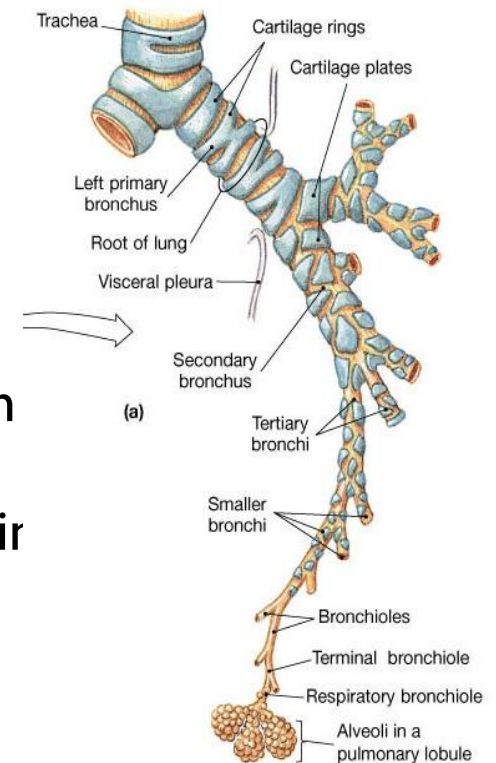
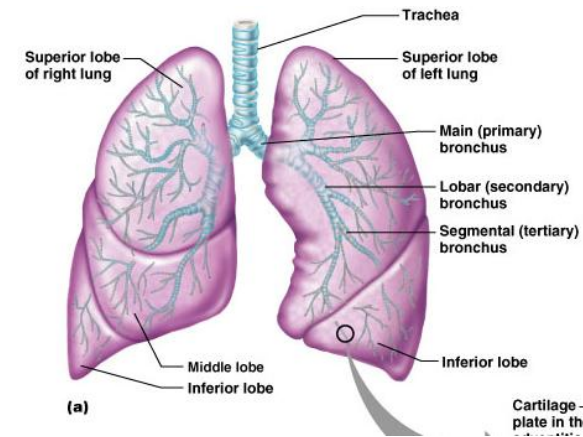
Carina

- Ridge on internal aspect of last tracheal cartilage
- Point where trachea branches (when alive and standing is at T7)
- Mucosa highly sensitive to irritants: cough reflex



Bronchial Tree

- Bronchial tree - extensively branching respiratory passageways
 - **Bronchus Primarius (main bronchi)**
 - Largest bronchi
 - Right main bronchi - wider and shorter than the left
 - **Bronchus Secundarius (Bronchus lobaris)**
 - Three on the right
 - Two on the left
 - **Bronchus Tertius (Bronchus segmentalis)** - branch into each lung segment
 - **Bronchiolus** - little bronchi, less than 1 mm in diameter
 - **Bronchiolus Terminalis** - less than 0.5 mm in diameter



THE BRONCHIAL TREE

RIGHT

SUPERIOR LOBAR
MIDDLE LOBAR
INFERIOR LOBAR

LEFT

SUPERIOR LOBAR
INFERIOR LOBAR

1° BRONCHI



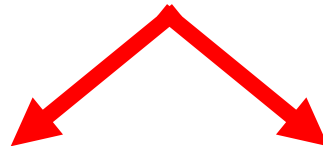
**2° BRONCHI (LOBAR
BRONCHI)**



**3° BRONCHI (SEGMENTAL
BRONCHI)**



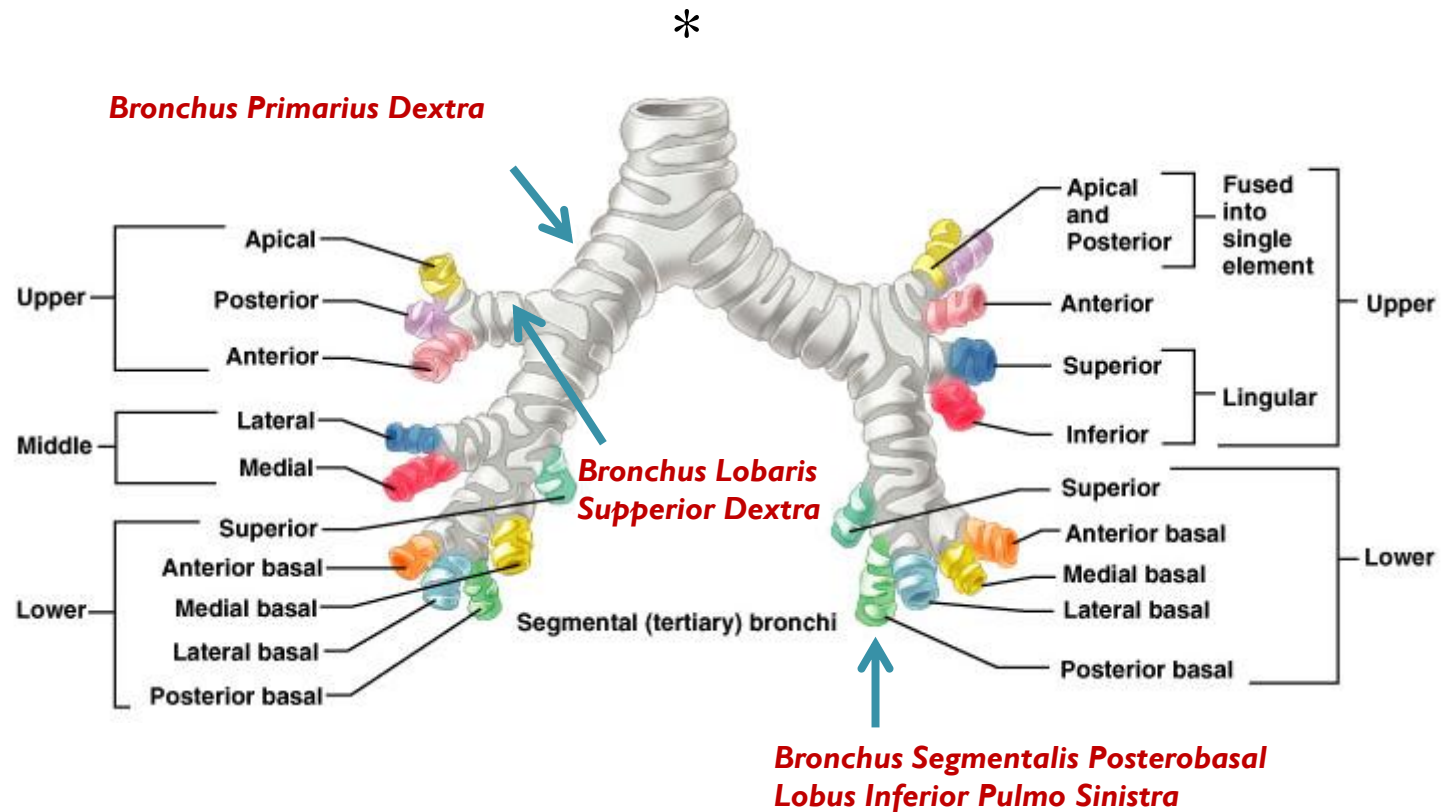
**SUPPLIES AIR TO SINGLE
BRONCHOPULMONARY SEGMENT**



10 RIGHT

8/9 LEFT

BRONCHUS SEGMENTALIS



BRONCHIOLUS

3° BRONCHI / BRONCHUS SEGMENTALIS



BRONCHIOLUS TERMINALIS



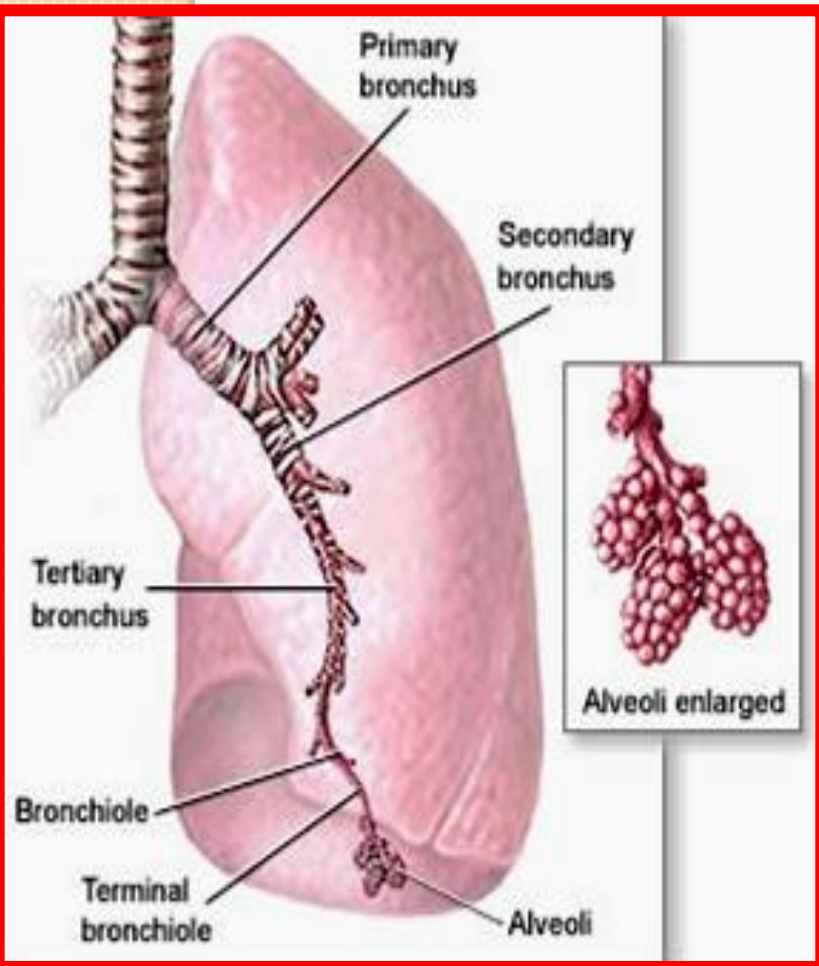
BRONCHIOLUS RESPIRATORIUS



THINNEST, MOST DELICATE BRANCHES OF
BRONCHIAL TREE ; DELIVER AIR TO THE
EXCHANGE SURFACES OF LUNG

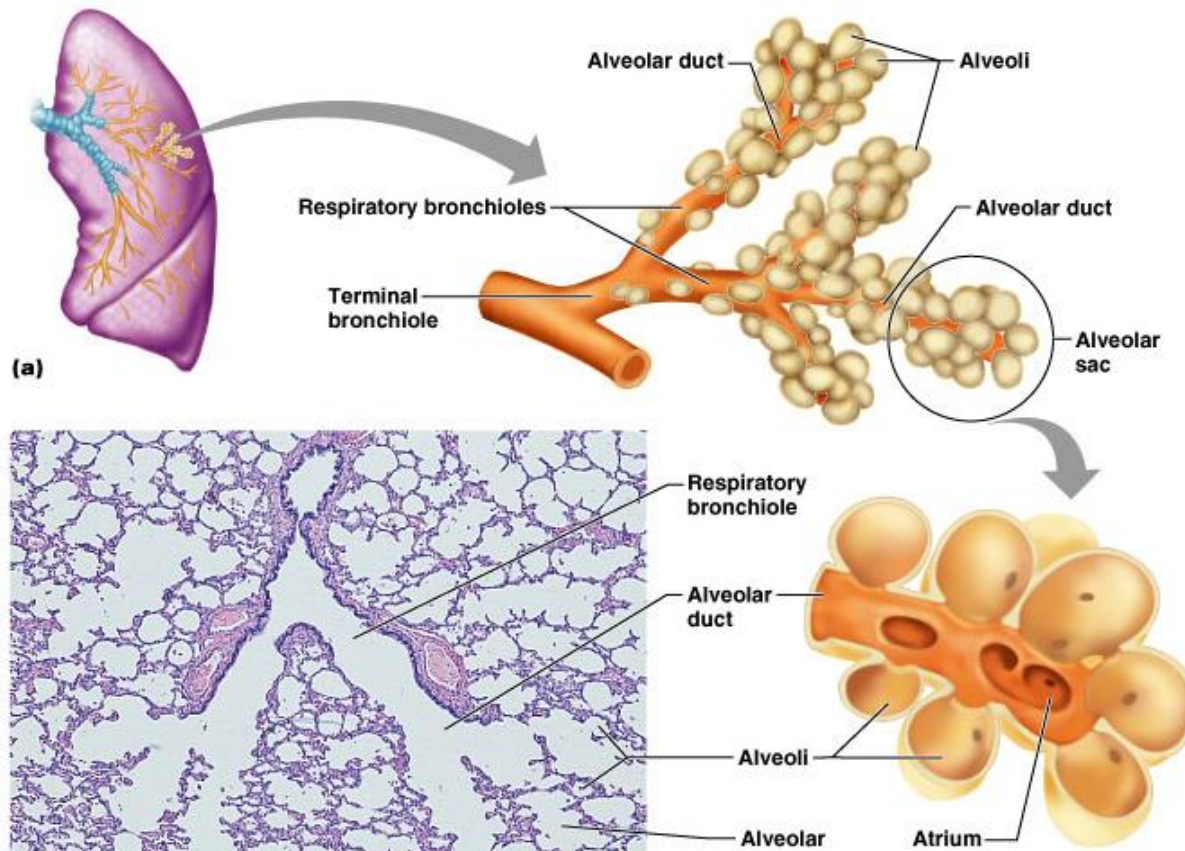


ALVEOLI



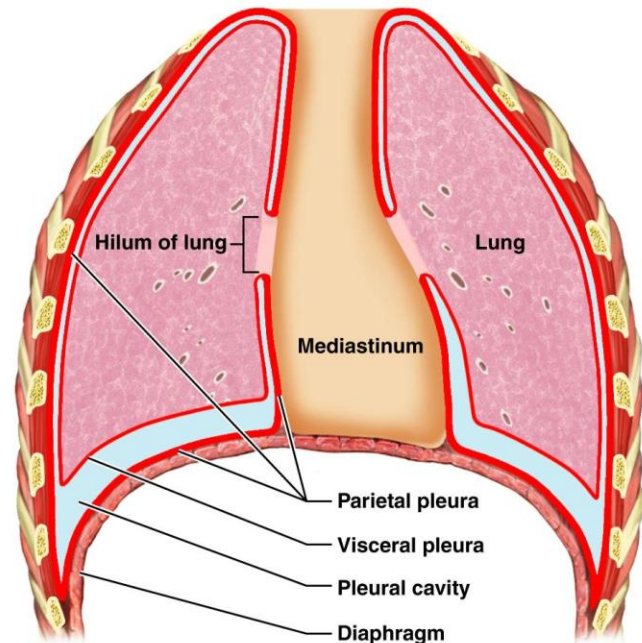
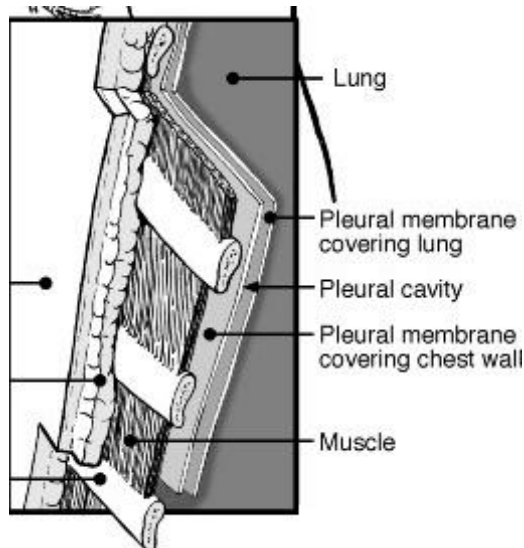
Respiratory Zone

- End-point of respiratory tree
- Structures that contain air-exchange chambers are called alveoli
- **Bronchiolus Respiratorius** lead into **Ductus alveolaris** (walls consist of alveoli)
- Ducts lead into terminal clusters called **Saccus alveolaris** – are microscopic chambers



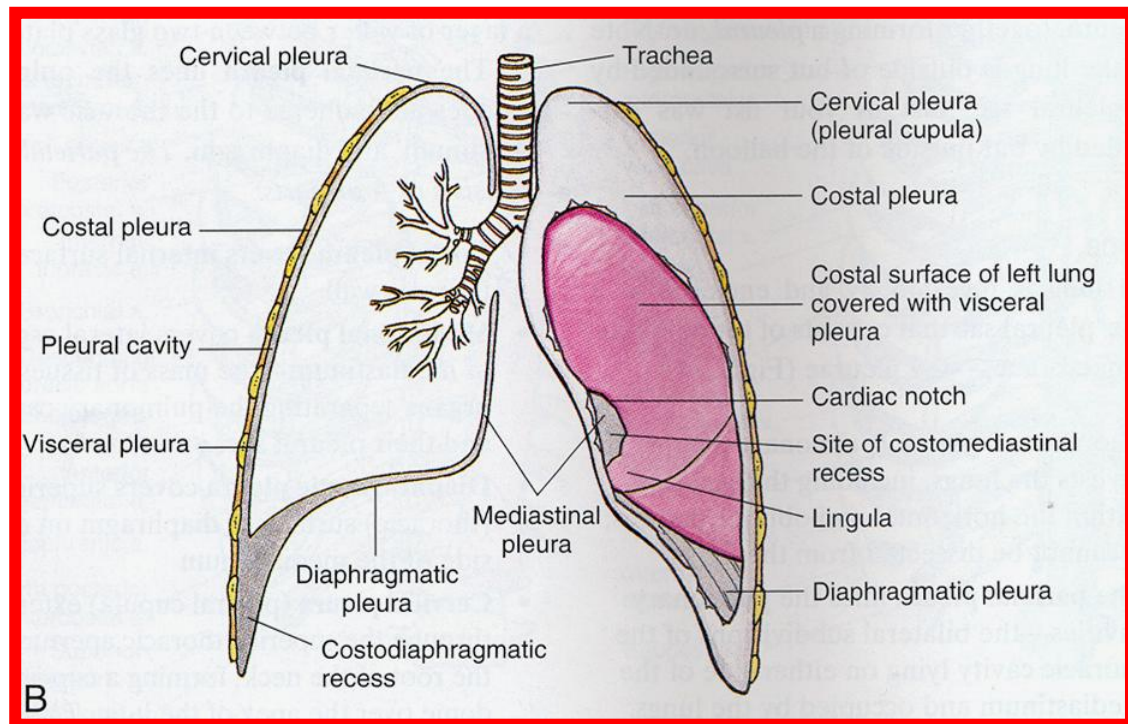
THE PLEURAE

- A double-layered sac surrounding each lung
 - Parietal pleura
 - Visceral pleura
- Pleural cavity - potential space between the visceral and parietal pleurae
- Pleurae help divide the thoracic cavity
 - Central mediastinum
 - Two lateral pleural compartments



PLEURA VISCERALIS

- **Covers surfaces & fissures of lung except at hilum & along attachment of pulmonary ligament where it is continuous with parietal pleura**
- **Firmly adherent to lung & cannot be removed from it**



PLEURA PARIETALIS

Thicker than pulmonary pleura

Has 4 parts

Costal pleura

Lines thoracic wall (ribs, intercostal spaces)

Mediastinal pleura

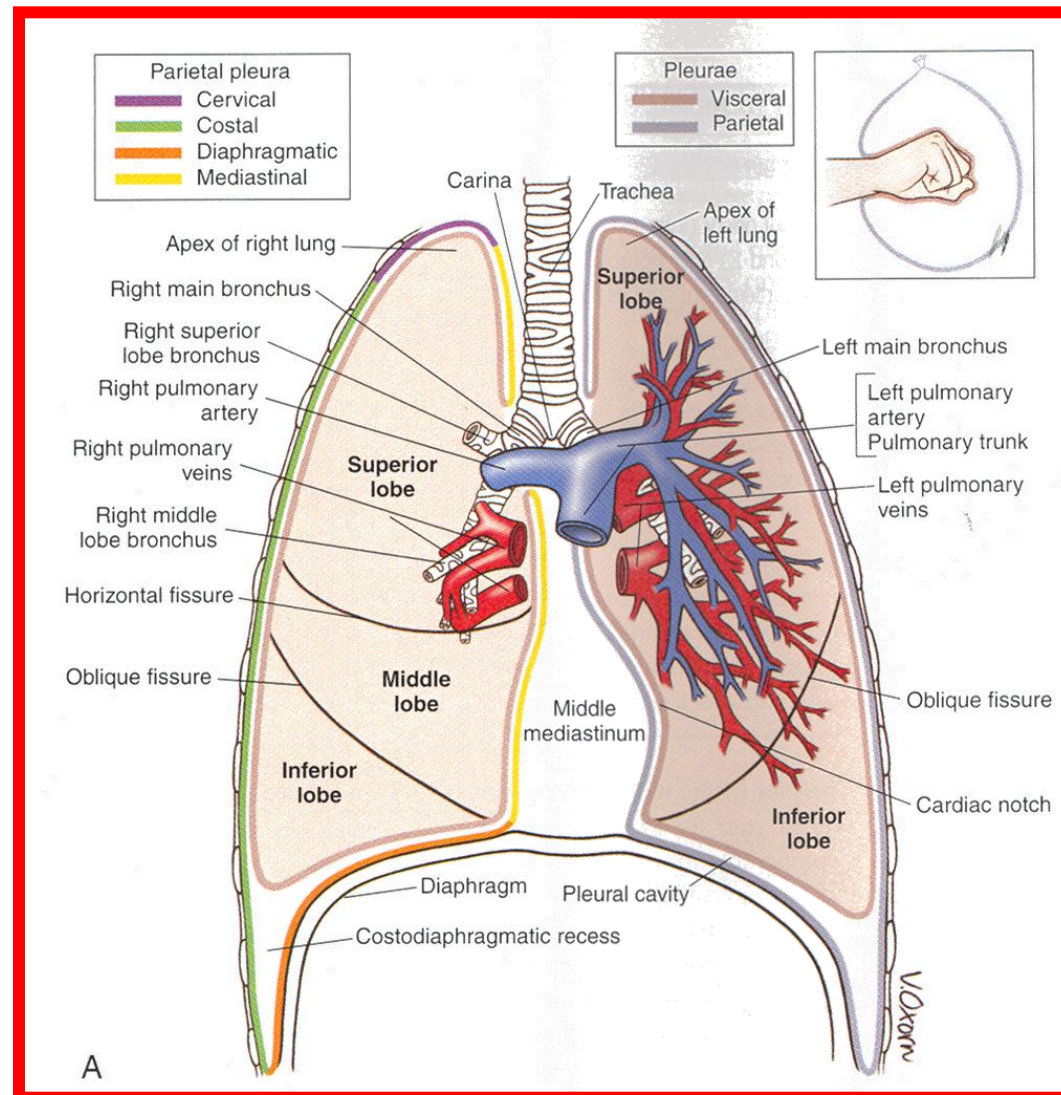
Lines corresponding surface of mediastinum; reflected over root of lung & becomes continuous with pulmonary pleura around hilum

Cervical pleura

Extends into neck about 2 inches above 1st costal cartilage & one inch above medial 1/3 clavicle; covers apex of lung

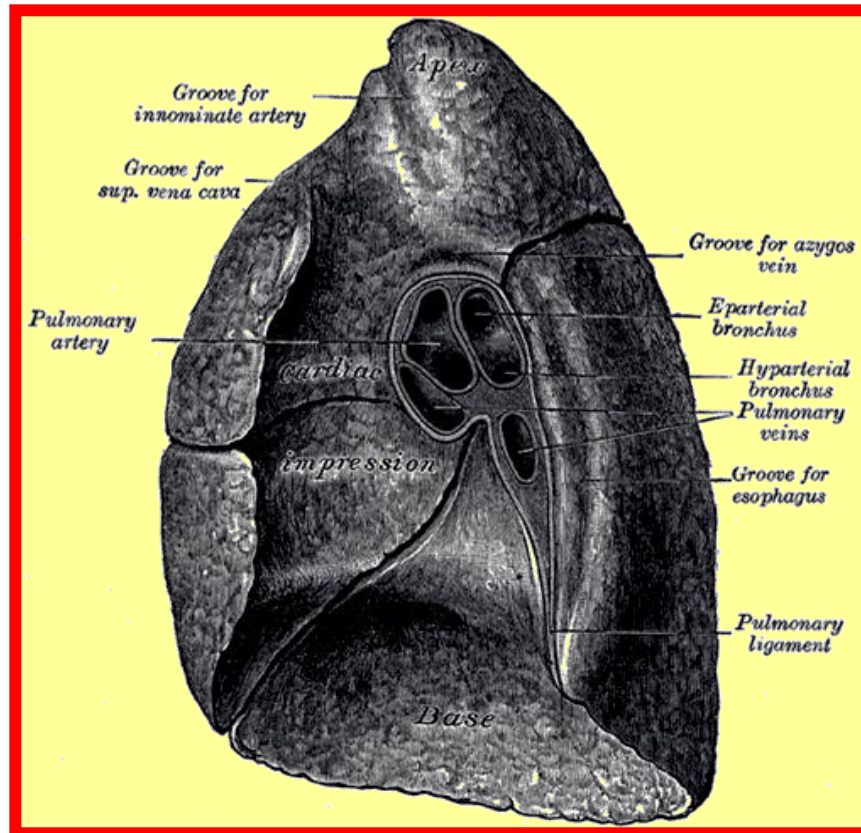
Diaphragmatic pleura

Lines superior surface of diaphragm



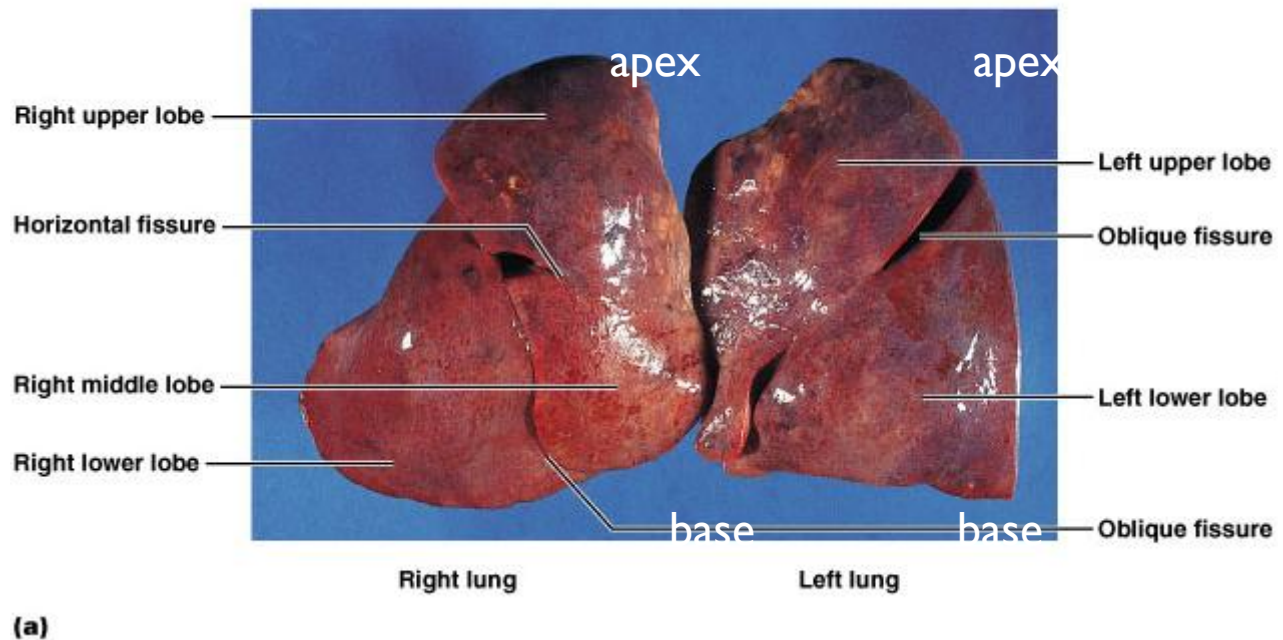
PULMONARY LIGAMENT

DEFINTION : Parietal pleura surrounding root of lung extending downward beyond root as a fold



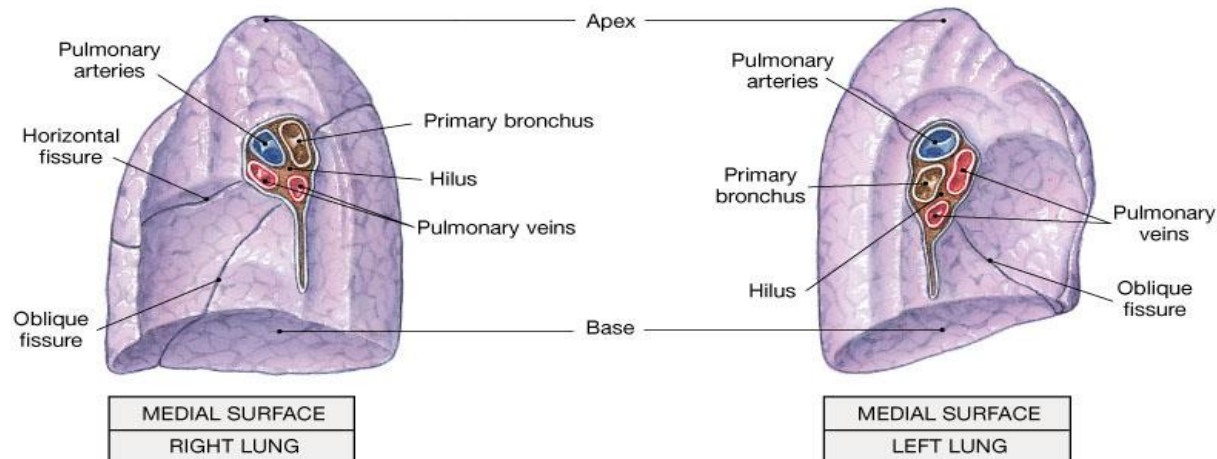
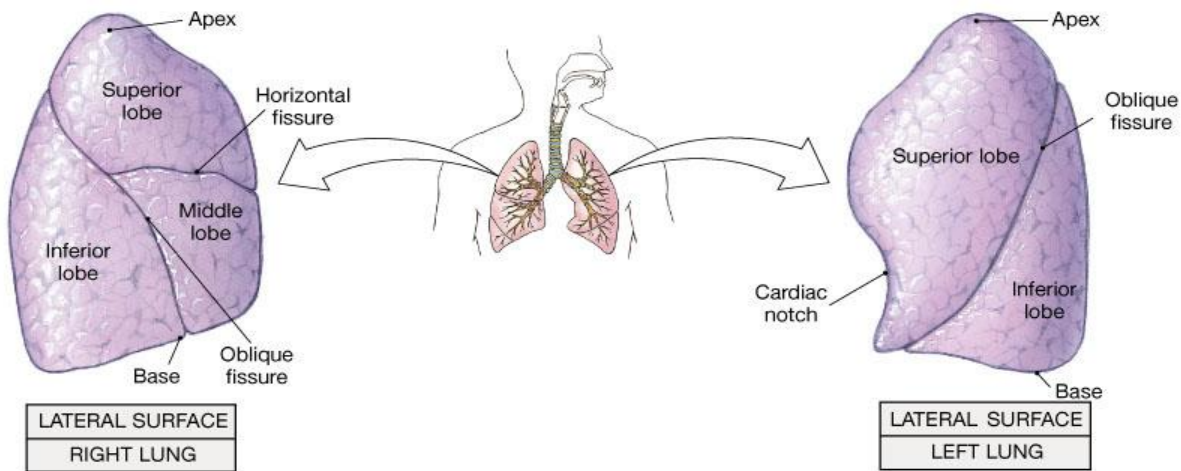
PULMO

- Each is cone-shaped with anterior, lateral and posterior surfaces contacting ribs
- Superior tip is apex, just deep to clavicle
- Concave inferior surface resting on diaphragm is the base



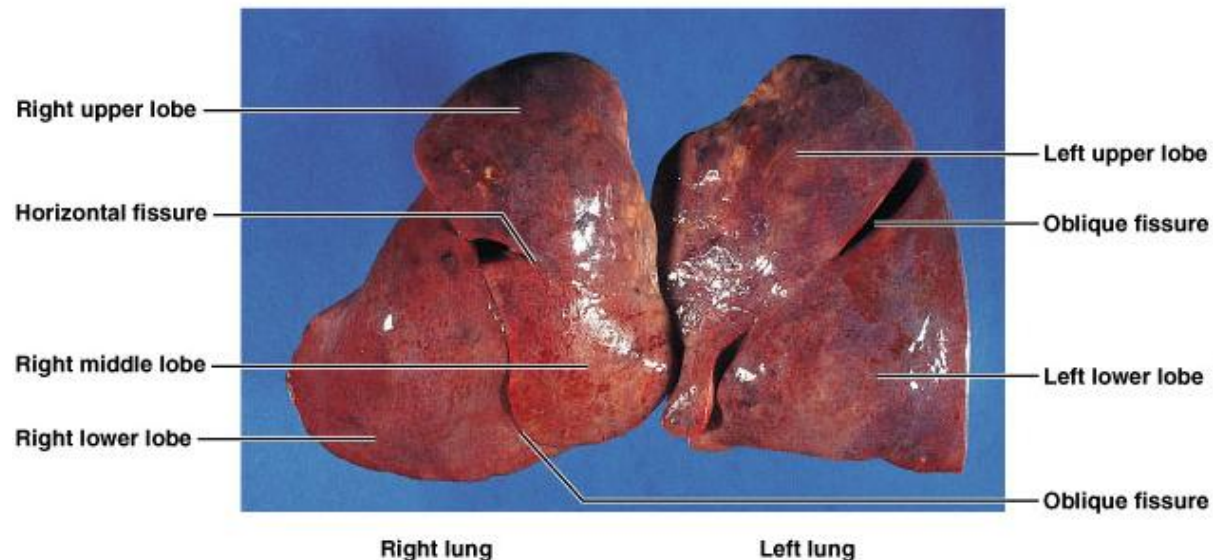
Lobes and Surfaces of the Pulmo


- Right lung has three lobes
- Left lung has two lobes
- Concavity on medial surface = cardiac notch
- Bronchi enter the lungs at the hilus



- Right lung: 3 lobes
 - Upper lobe
 → Horizontal fissure
 - Middle lobe
 → Oblique fissure
 - Lower lobe
- Left lung: 2 lobes
 - Upper lobe
 → Oblique fissure
 - Lower lobe

Each lobe is served by a lobar (secondary) bronchus



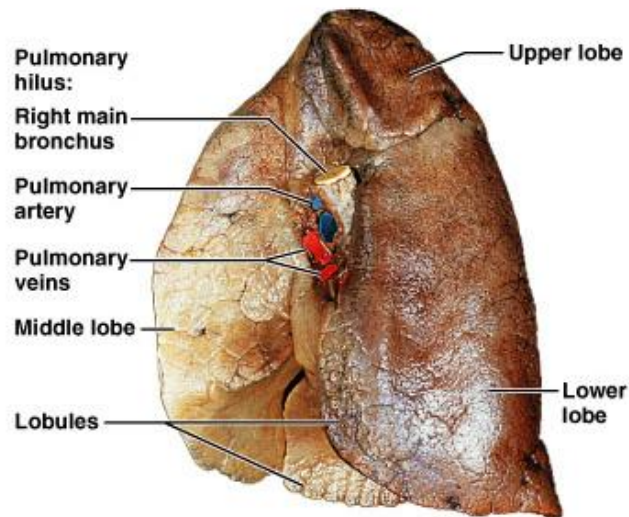
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- Each lobe is made up of ***bronchopulmonary segments*** separated by dense connective tissue
 - Bronchopulmonary means both bronchial tubes and lung alveoli together
 - Bronchopulmonary segment –receiving air from a segmental (tertiary) bronchus
 - Limit spread of infection

- **Hilus or (hilum)**

- Indentation on mediastinal (medial) surface
- Place where blood vessels, bronchi, lymph vessel, and nerves enter and exit the lung

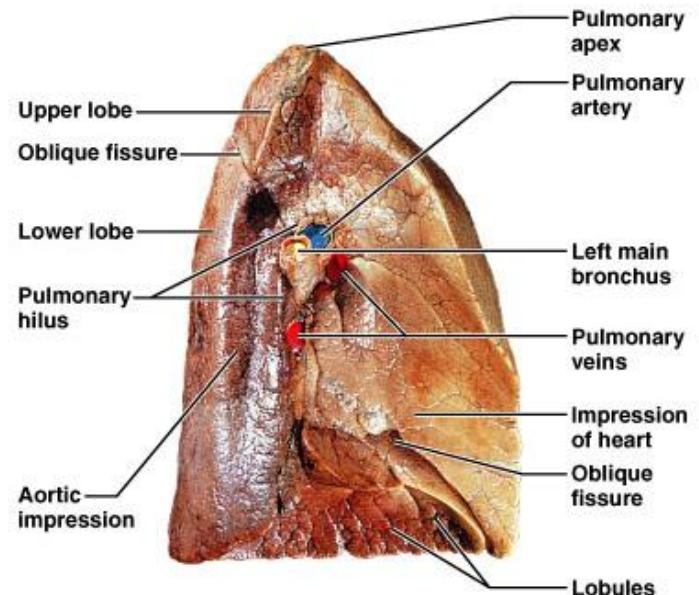
- **Radix (“Root”) of the lung**

- Above structures attaching lung to mediastinum
- Main ones: pulmonary artery and veins and main bronchus



(b)

Medial view R lung

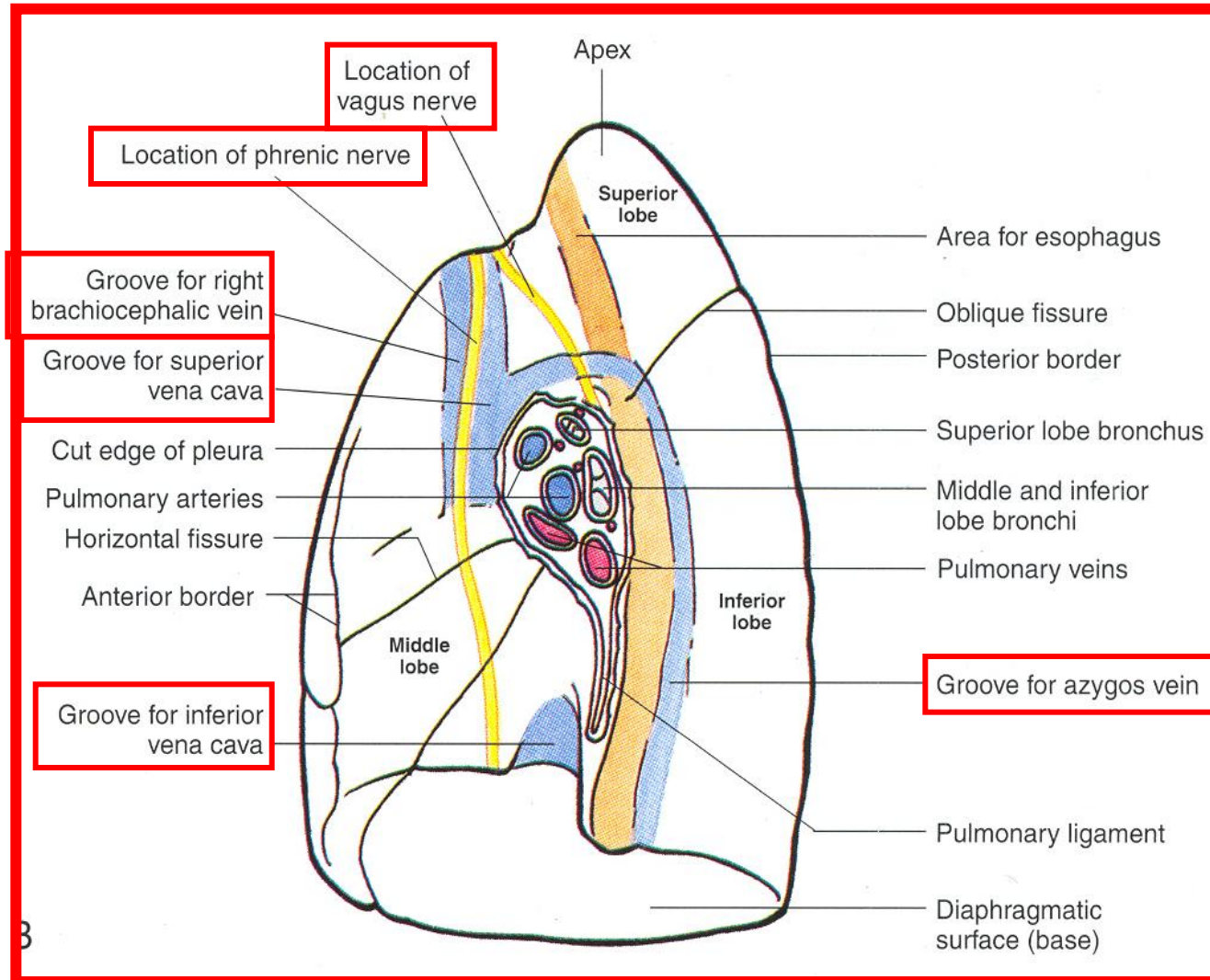


(c)

Medial view of L lung

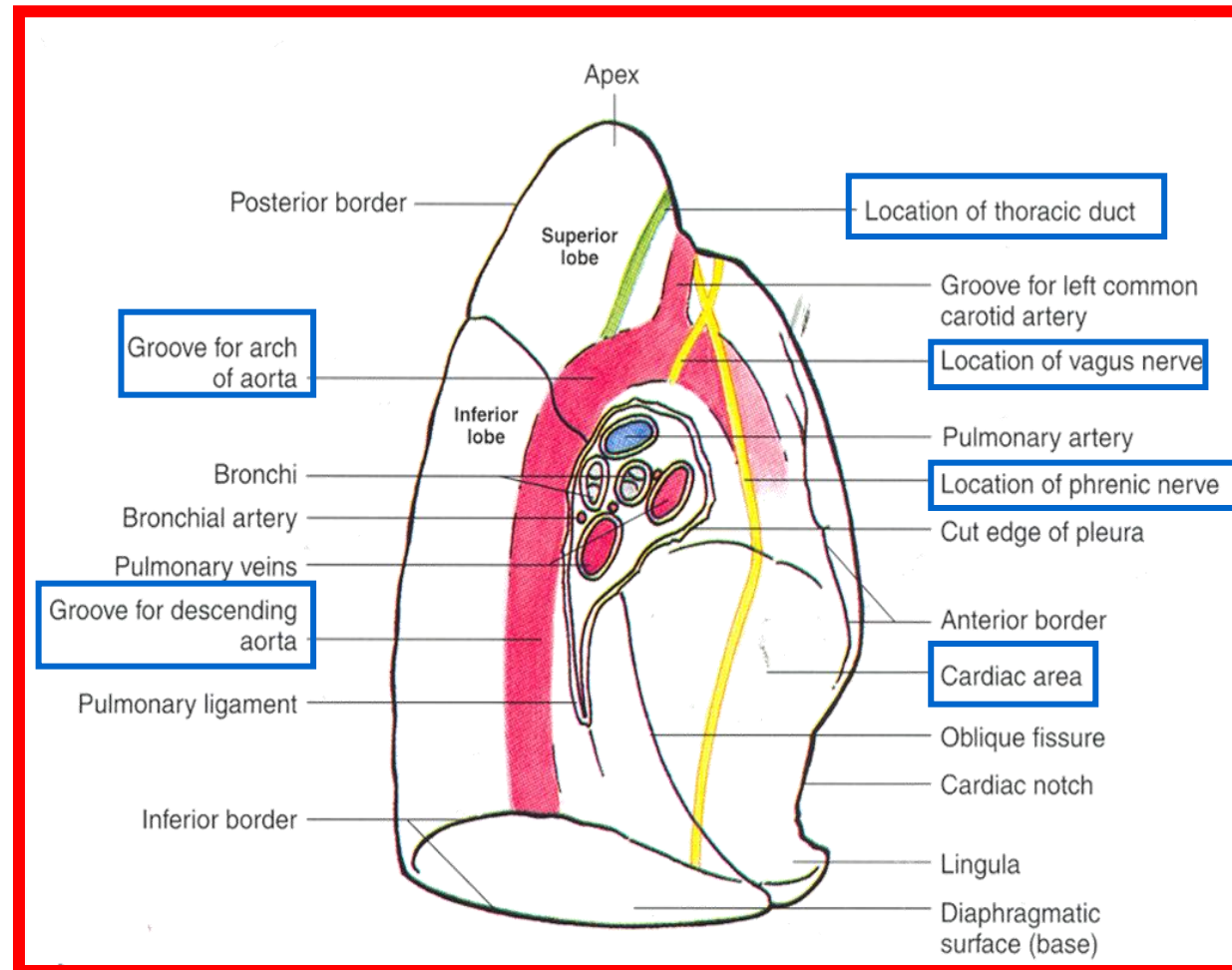
STRUCTURES RELATED TO MEDIASTINAL SURFACE OF RIGHT LUNG

- Right atrium & auricle
- A small part of right ventricle
- Superior vena cava
- Lower part of right brachiocephalic vein
- Azygos vein
- Oesophagus
- Inferior vena cava
- Trachea
- Right vagus nerve
- Right phrenic nerve



STRUCTURES RELATED TO MEDIASTINAL SURFACE OF LEFT LUNG

- Left ventricle, auricle, infundibulum & adjoining part of right ventricle
- Pulmonary trunk
- Arch of aorta
- Descending thoracic aorta
- Left subclavian artery
- Thoracic duct
- Oesophagus
- Left brachiocephalic vein
- Left vagus nerve
- Left phrenic nerve
- Left recurrent laryngeal nerve



DIFFERENCES BETWEEN RIGHT & LEFT LUNGS

RIGHT LUNG

- **Has 2 fissures, 3 lobes**
- **Anterior border straight notch**
- **Larger, heavier (700g)**
- **Shorter, broader**

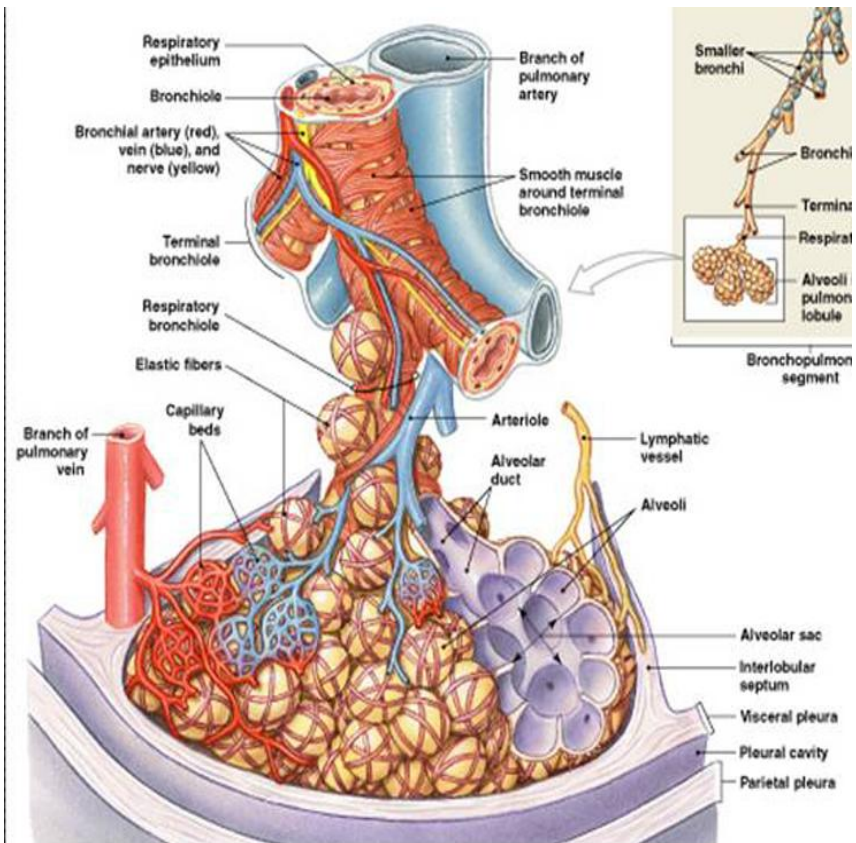
LEFT LUNG

1. **1 fissure, 2 lobes**
2. **Anterior border interrupted by cardiac notch**
3. **Smaller, lighter (600g)**
4. **Longer, narrower**

Blood supply to respiratory surfaces

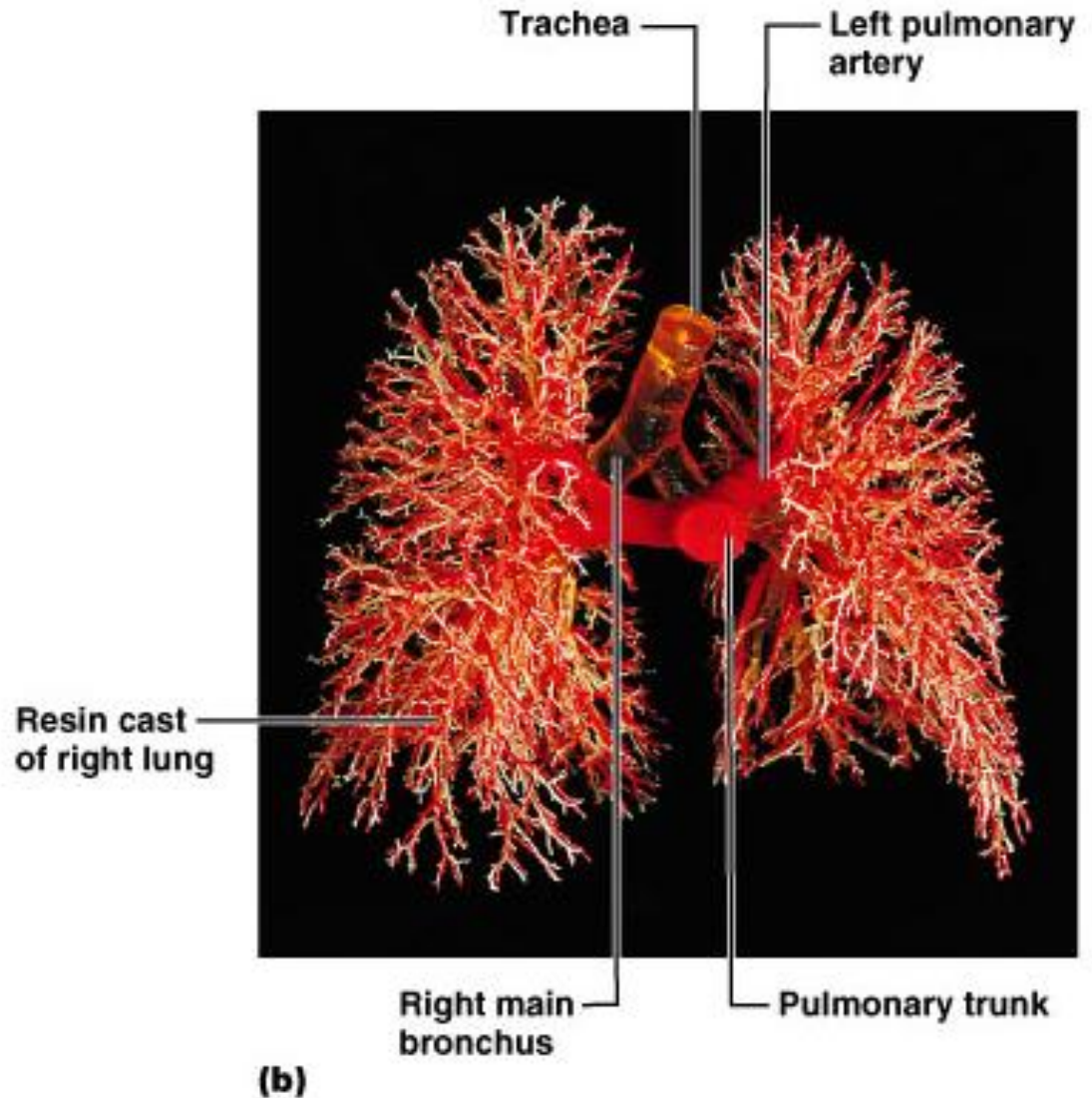
Each lobule receives an arteriole and a venule

1. respiratory exchange surfaces receive blood:
 - from arteries of pulmonary circuit
2. a capillary network surrounds each alveolus:
 - as part of the respiratory membrane
3. blood from alveolar capillaries:
 - passes through pulmonary venules and veins
 - returns to left atrium



- Pulmonary arteries bring oxygen-poor blood to the lungs for oxygenation
 - They branch along with the bronchial tree
 - The smallest feed into the pulmonary capillary network around the alveoli
- Pulmonary veins carry oxygenated blood from the alveoli of the lungs to the heart
- Blood supply
 - Lungs get their own blood supply from **bronchial arteries and veins**
- Innervation: **pulmonary plexus** on lung root contains sympathetic, parasympathetic and visceral sensory fibers to each lung

Bronchial “tree” and associated Pulmonary arteries

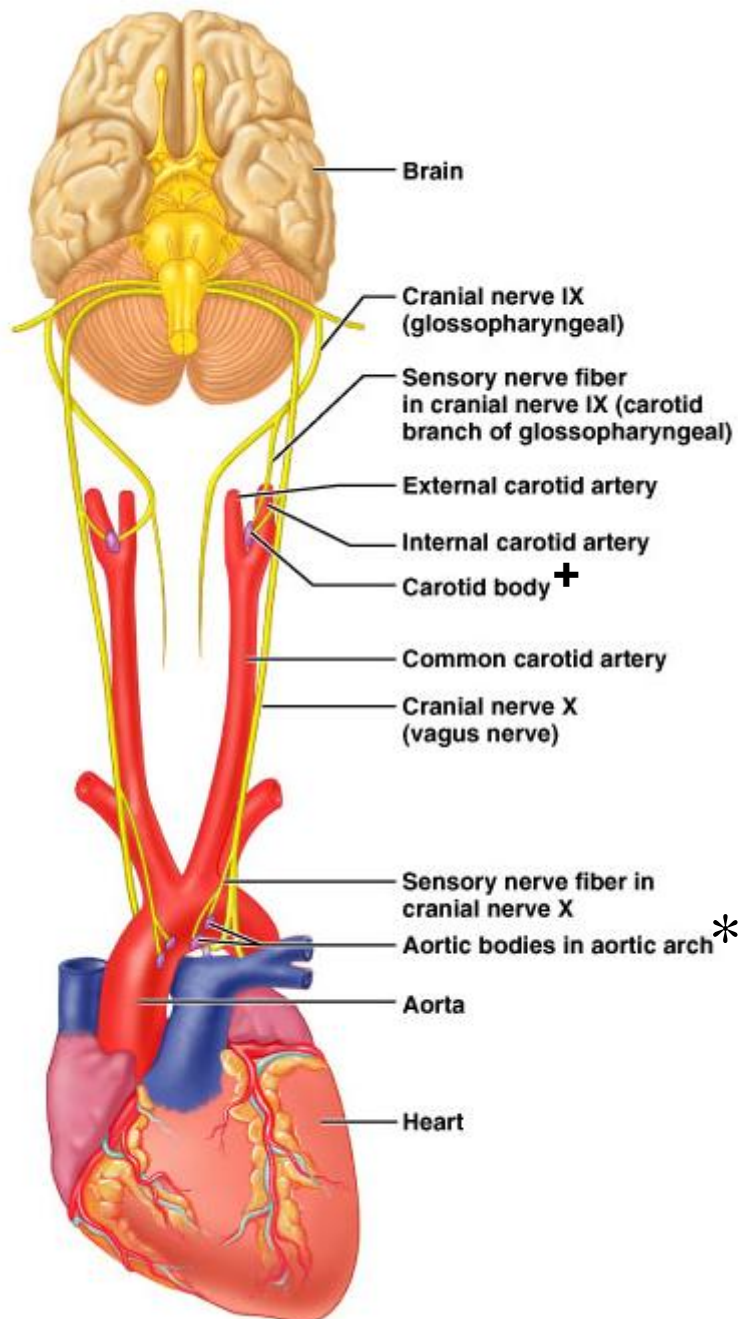


Neural Control of Ventilation

- Reticular formation in medulla
 - Responsible for basic rate and rhythm
 - Can be modified by higher centers
 - Limbic system and hypothalamus, e.g. gasp with certain emotions
 - Cerebral cortex – conscious control
- Chemoreceptors
 - Central – in the medulla
 - Peripheral: see next slide
 - Aortic bodies on the aortic arch
 - **Carotid bodies** at the fork of the carotid artery: monitor O₂ and CO₂ tension in the blood and help regulate respiratory rate and depth

The carotid sinus (dilated area near fork) helps regulate blood pressure and can affect the rate (stimulation during carotid massage can slow an abnormally fast heart rate)

Peripheral chemoreceptors regulating respiration



- Aortic bodies^{*}
 - On aorta
 - Send sensory info to medulla through X (vagus n)
- Carotid bodies⁺
 - At fork of common carotid artery
 - Send info mainly through IX (glossopharyngeal n)