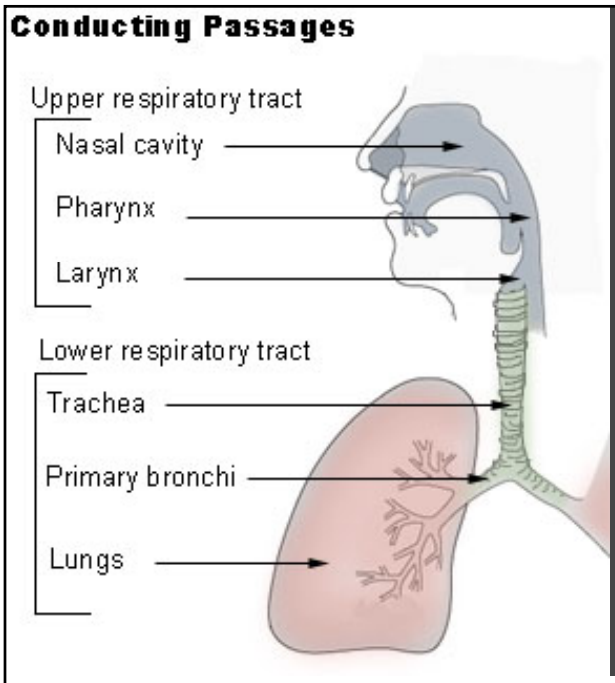


RESPIRATORY LAB

Danil Hammoudi.MD

Introduction:

- a) system includes nasal cavity, pharynx, larynx, trachea, extrapulmonary bronchi, and lungs
  b) passage for and conditioning of air (moisten, warm, and filtering)
  c) site of O2 and CO2 exchange

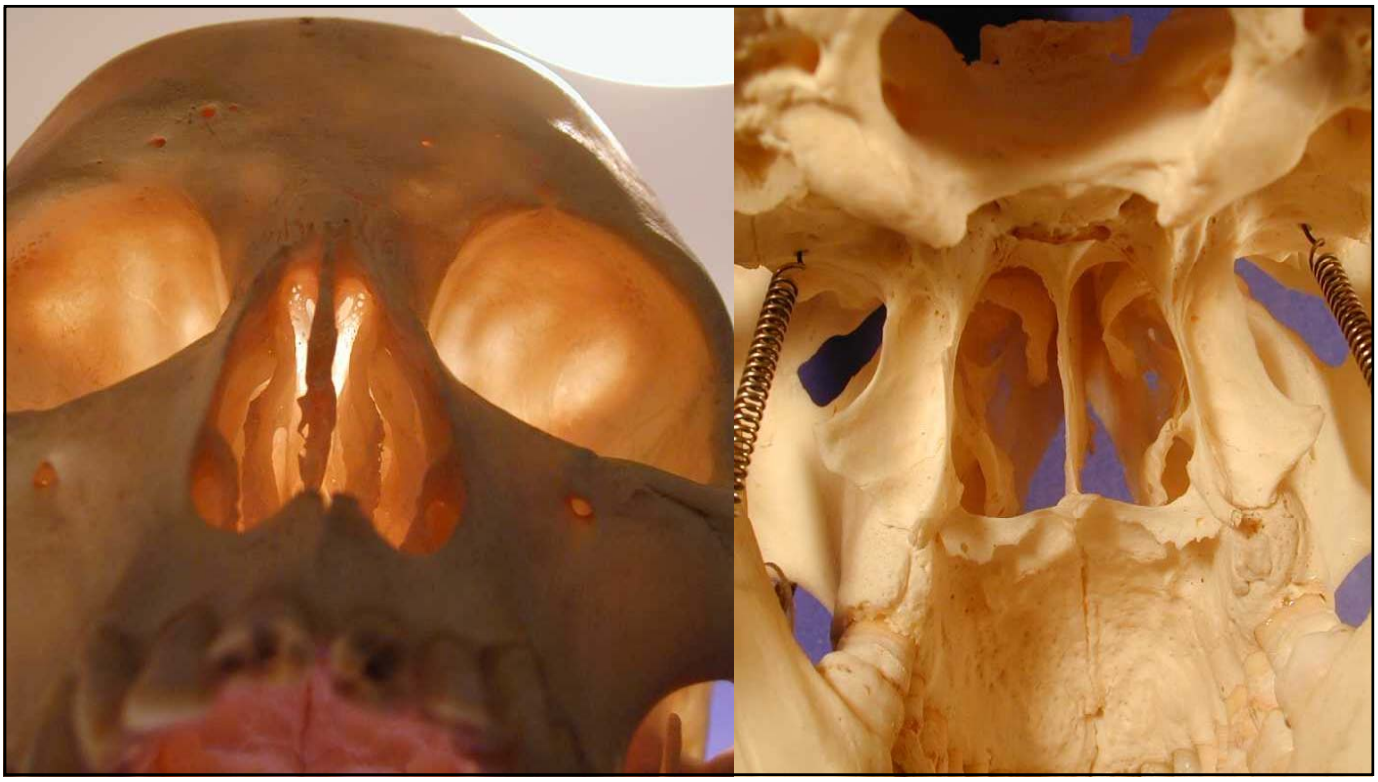
(factoids: loose ca 600 ml H20/day, cough air velocity at 100mph)

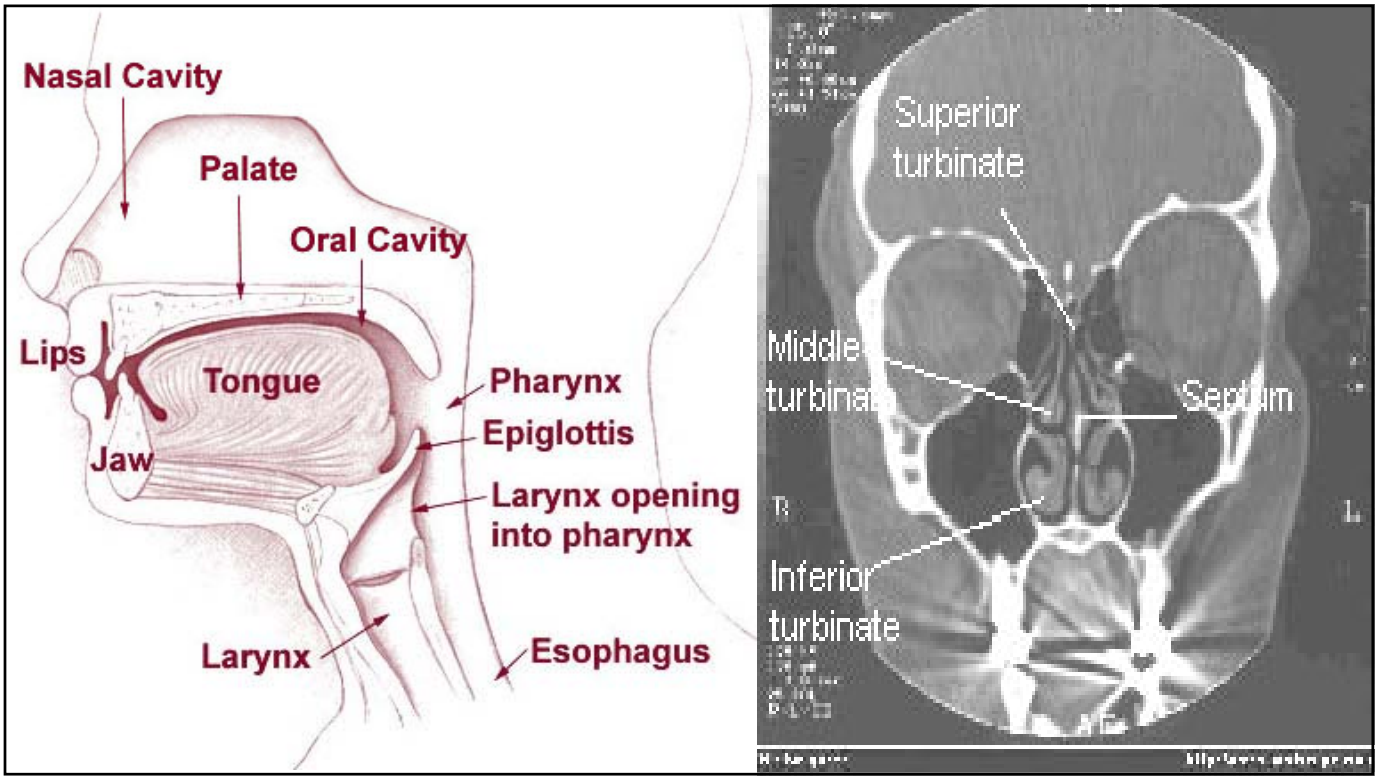
NASAL CAVITY ANATOMY

- KEY WORDS:
  - NASAL CAVITIES, NARES, SINUSES
  - NASAL SEPTUM, NASAL CONCHAE, SUP, INF AND MID NASAL CONCHAE
  - SEPTAL CARTILAGE
  - PERPENDICULAR PLATES OF THE ETHMOID BONE, SPHENOID BONE
  - VOMER , HARD PLATE ,
  - PALATINE PROCESSES OF THE MAXILLARY BONE
  - HORIZONTAL PLATES OF THE PALATINE BONES
  - POST NASAL APERTURES

NASAL CAVITY ANATOMY

- The nasal cavity conditions the air to be received by the areas of the respiratory tract and nose.
- Owing to the large surface area provided by the conchae, the air passing through the nasal cavity is warmed or cooled to within 1 degree of body temperature.
- In addition,
  - the air is humidified,
  - and dust and other particulate matter is removed by vibrissae, short, thick hairs, present in the vestibule.
  - The cilia of the respiratory epithelium move the particulate matter towards the pharynx where it is swallowed.




Nasal Cavity
Palate
Oral Cavity
Lips
Tongue
Jaw
Pharynx
Epiglottis
Larynx opening into pharynx
Larynx
Esophagus
Superior turbinate
Middle turbinate
Septum
Inferior turbinate

Borders

•The lateral wall of the nasal cavity is mainly made up by the maxilla, however there is a deficiency that is compensated by: the perpendicular plate of the palatine bone, the medial pterygoid plate, the labyrinth of the ethmoid and the inferior concha.

•The nasal cavity is enclosed by the nasal bone above.

•The floor of the nasal cavity, which forms the roof of the mouth, is made up by the bones of the hard palate: the horizontal plate of the palatine bone posteriorly and the palatine process of the maxilla anteriorly.

•To the front of the nasal cavity is the nose, while the back is continuous with the pharynx.

•The paranasal sinuses are connected to the nasal cavity through small orifices called ostia.

•The nasal cavity is divided in two by a vertical fin called the nasal septum.

•On the sides of the nasal cavity are three horizontal outgrowths called turbinates or *conchae* (singular "concha").

• These turbinates disrupt the airflow, directing air toward the olfactory epithelium on the surface of the turbinates and the septum.

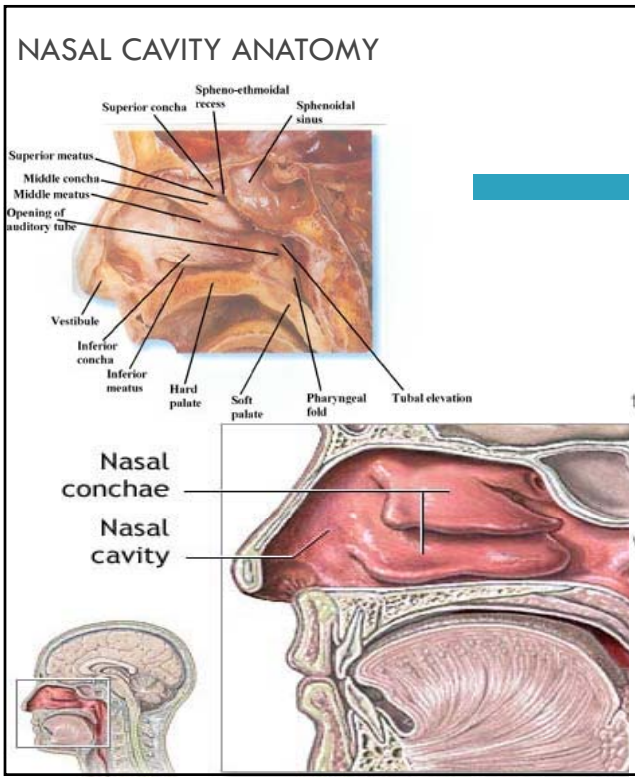
•The vomeronasal organ is located at the back of the septum and has a role in pheromone detection.

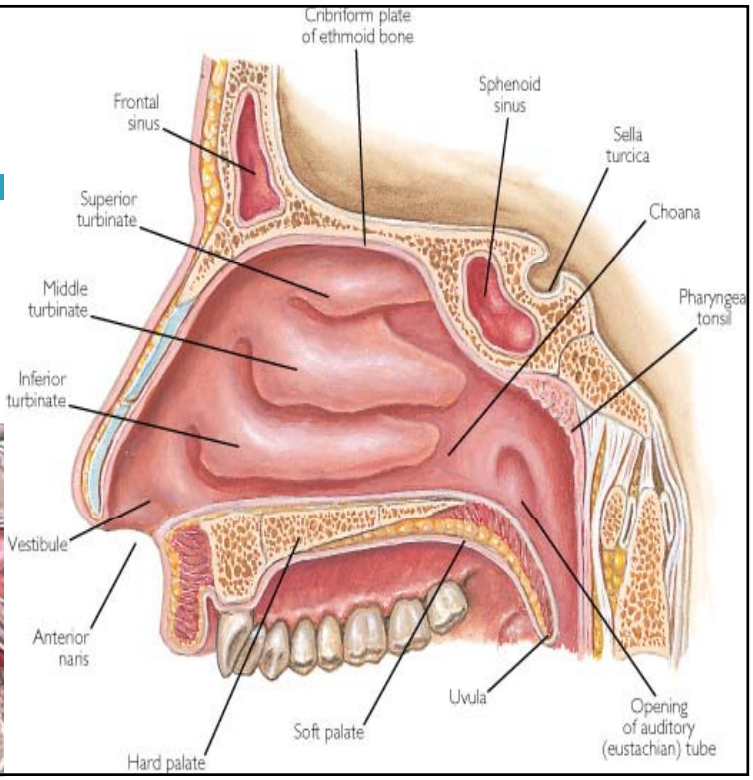
The nasal cavity is divided into two segments:
•the respiratory segment
•and the olfactory segment.

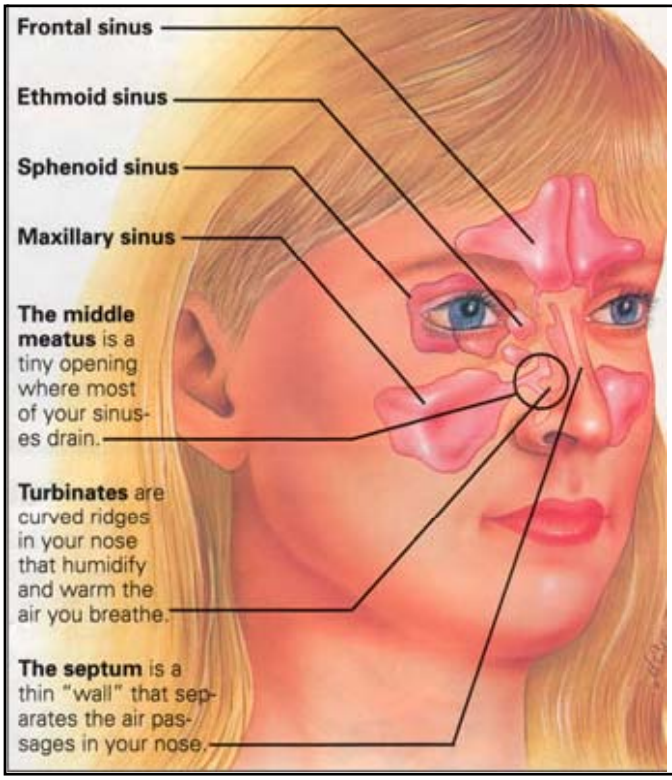
•The respiratory segment is lined with ciliated **pseudostratified columnar epithelium** (also called respiratory epithelium).
•The conchae are located in this region.
•The olfactory segment is lined with a specialized type of pseudostratified columnar epithelium, known as olfactory epithelium, which contains receptors for the sense of the smell.

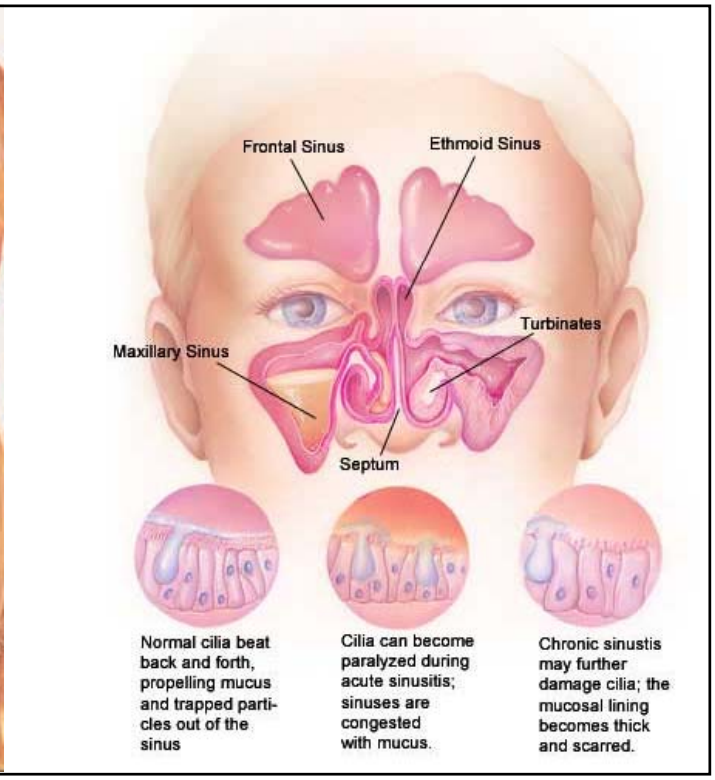
•This segment is located along the dorsal roof of the nasal cavity.

NASAL CAVITY ANATOMY









The respiratory segment has a very vascularized lamina propria allowing the venous plexuses of the conchal mucosa to :

•engorge with blood,
•restricting airflow
•and causing air to be directed to the other side of the nose.

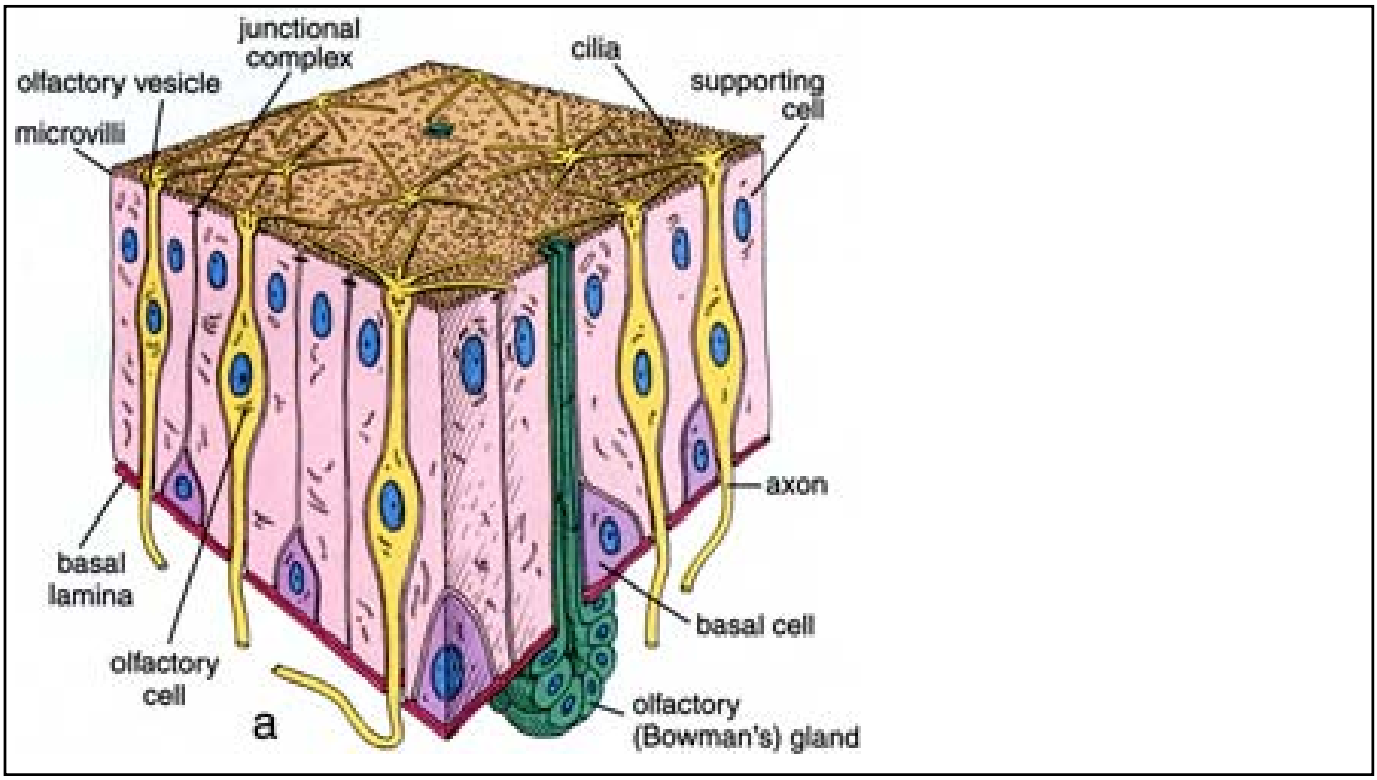
This cycle occurs approximately every 20-30 minutes

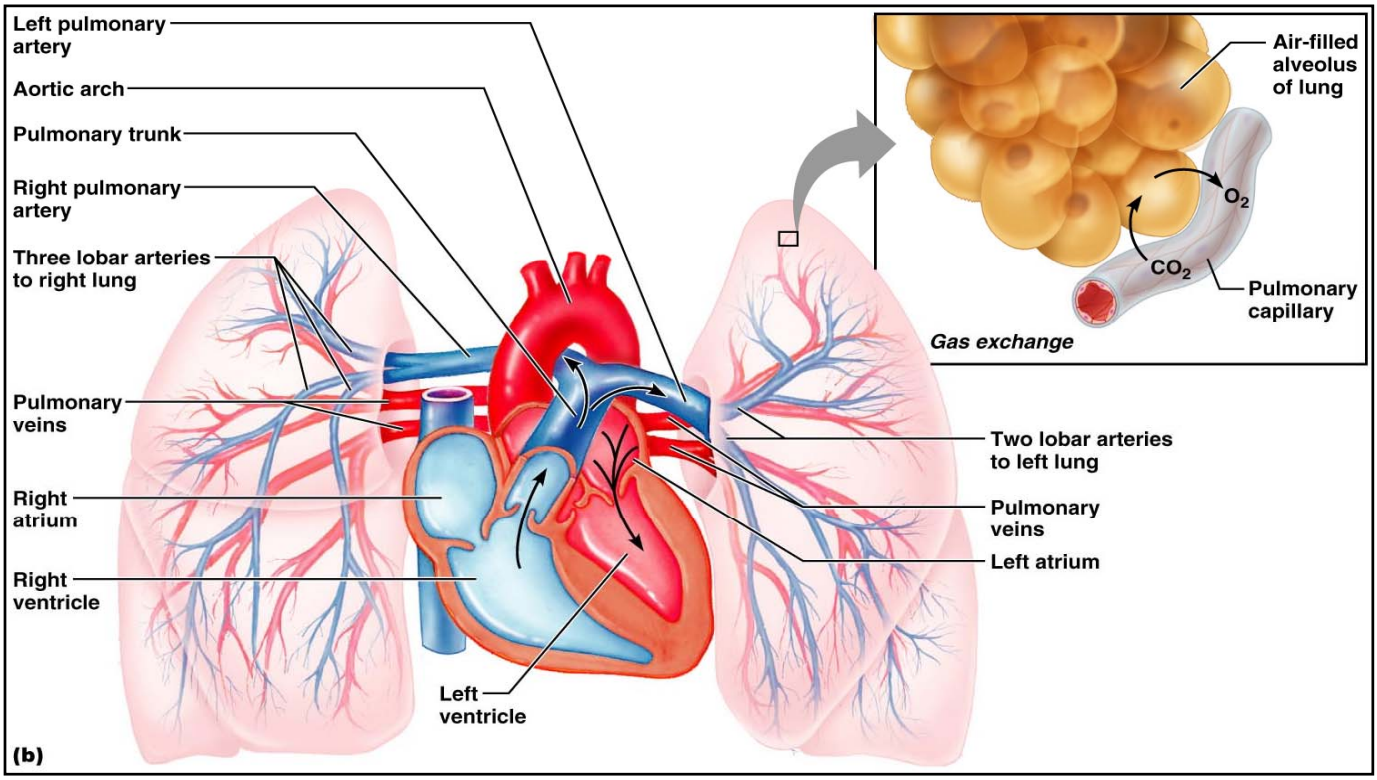
Histological sections appear yellowish-brown due to the presence of lipofuscin pigments.

Olfactory mucosal cell types include:
•bipolar neurons,
•supporting (sustentacular) cells,
•basal cells,
•and Bowman's glands.

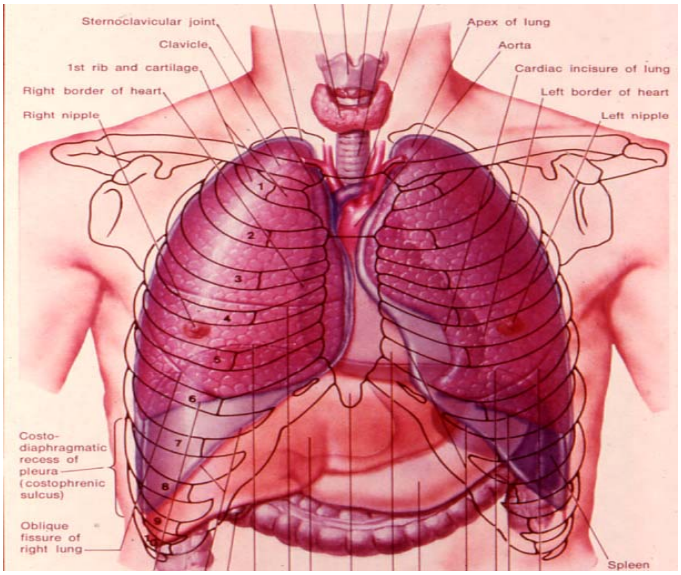
The axons of the bipolar neurons form the olfactory nerve (cranial nerve I) which enters the brain through the cribiform plate.

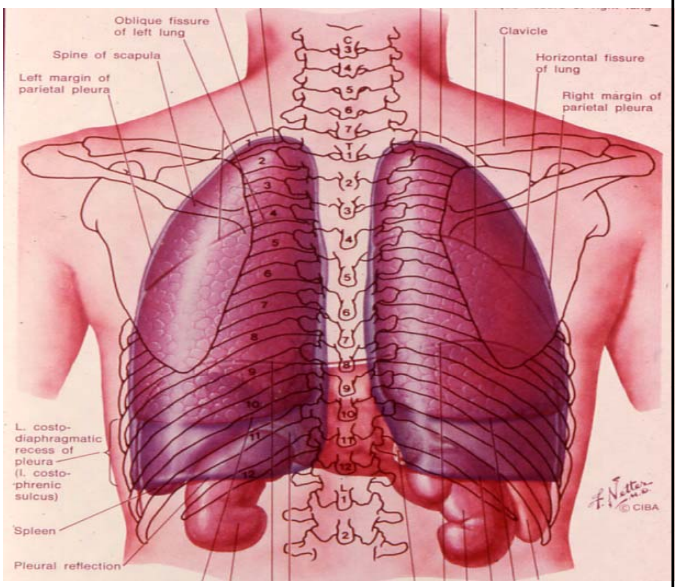
Bowman's glands are serous glands in the lamina propria, whose secretions trap and dissolve odoriferous substances.
he nasal cavity also can be called the nostril.

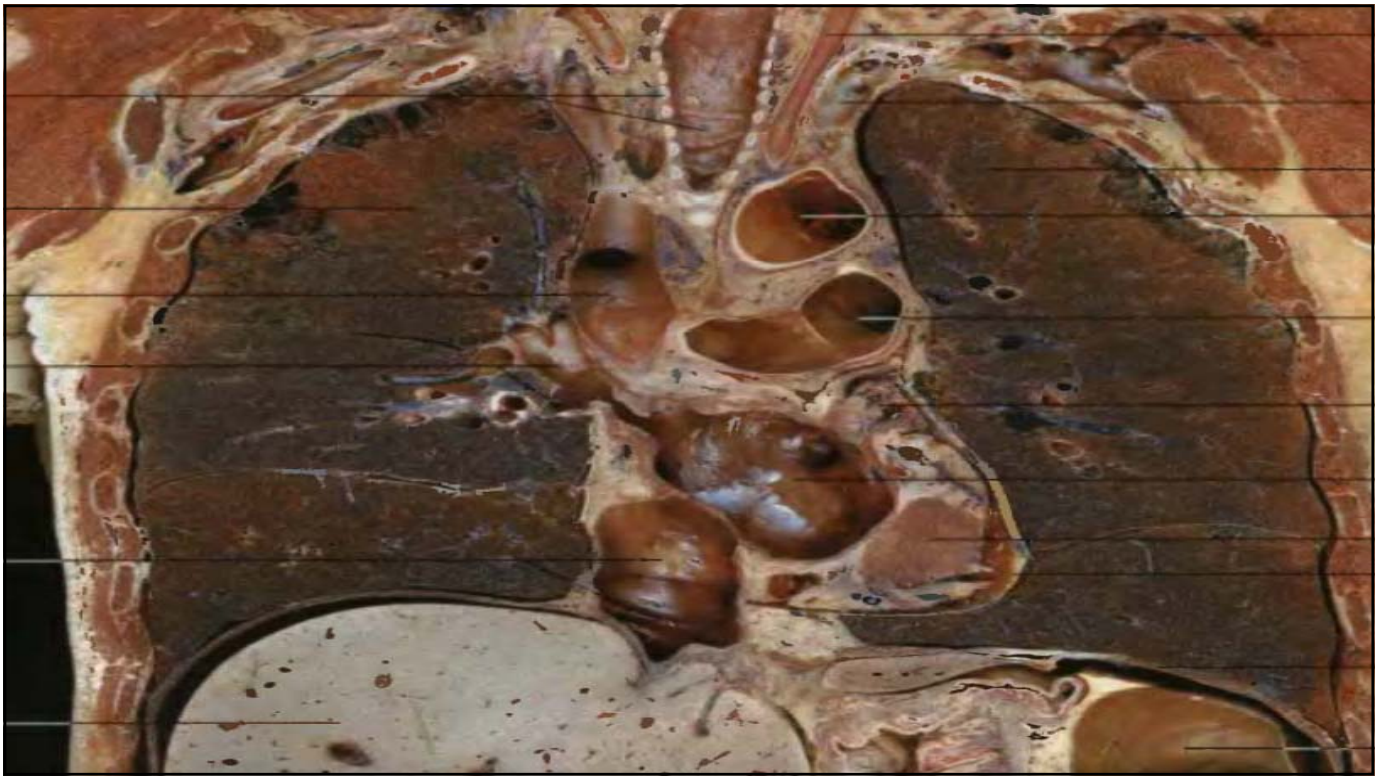

junctional complex
olfactory vesicle
microvilli
cilia
supporting cell
axon
basal lamina
basal cell
olfactory cell
olfactory (Bowman's) gland
a


Left pulmonary artery
Aortic arch
Pulmonary trunk
Right pulmonary artery
Three lobar arteries to right lung
Pulmonary veins
Right atrium
Right ventricle
Left ventricle
Two lobar arteries to left lung
Pulmonary veins
Left atrium
Air-filled alveolus of lung
O_2
CO_2
Pulmonary capillary
Gas exchange
(b)

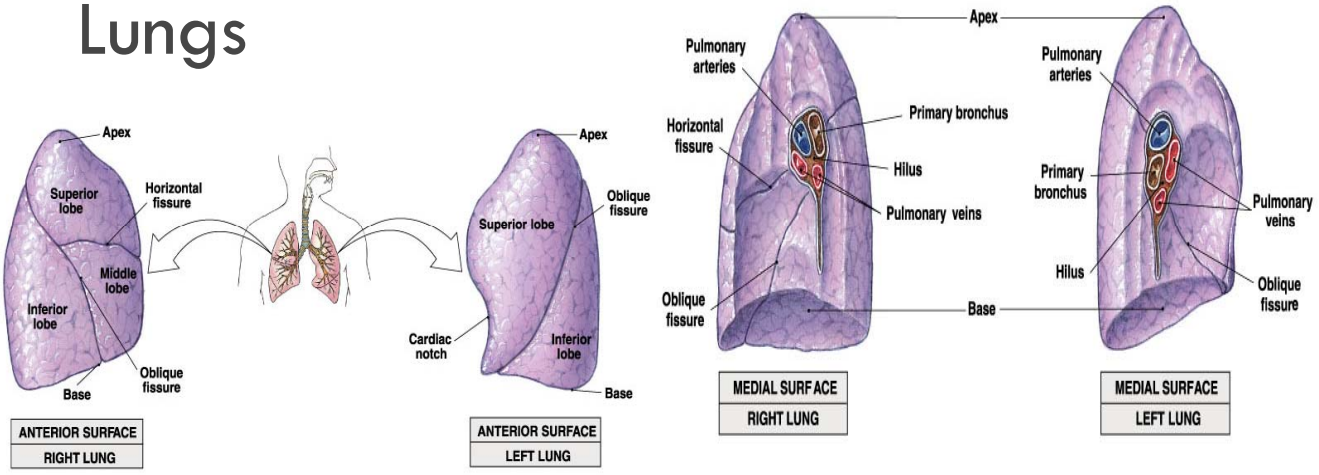
The lungs lie within the pleural space: parietal pleura lines the thorax; visceral pleura surrounds the lungs.







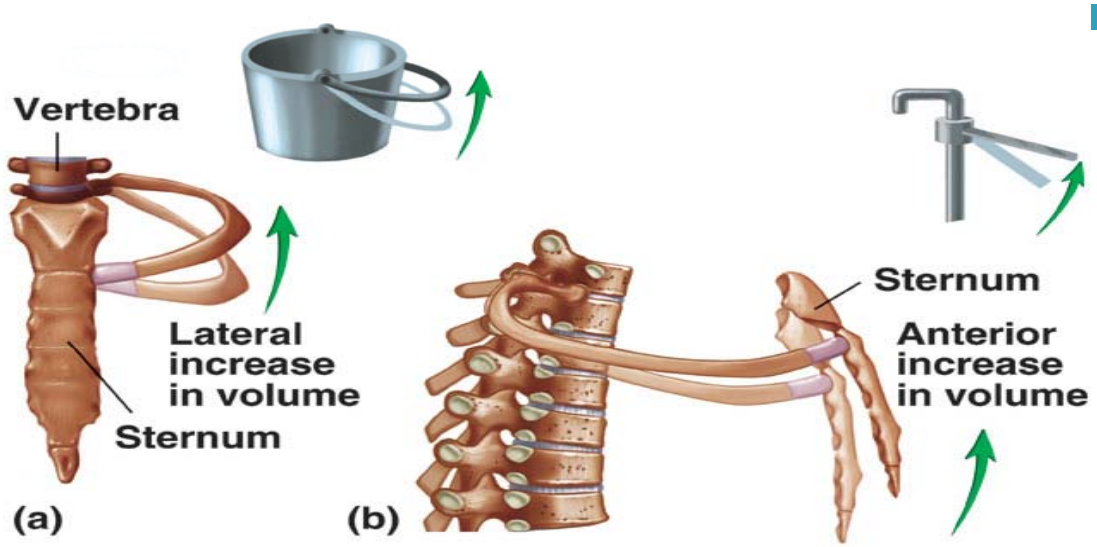
Lungs

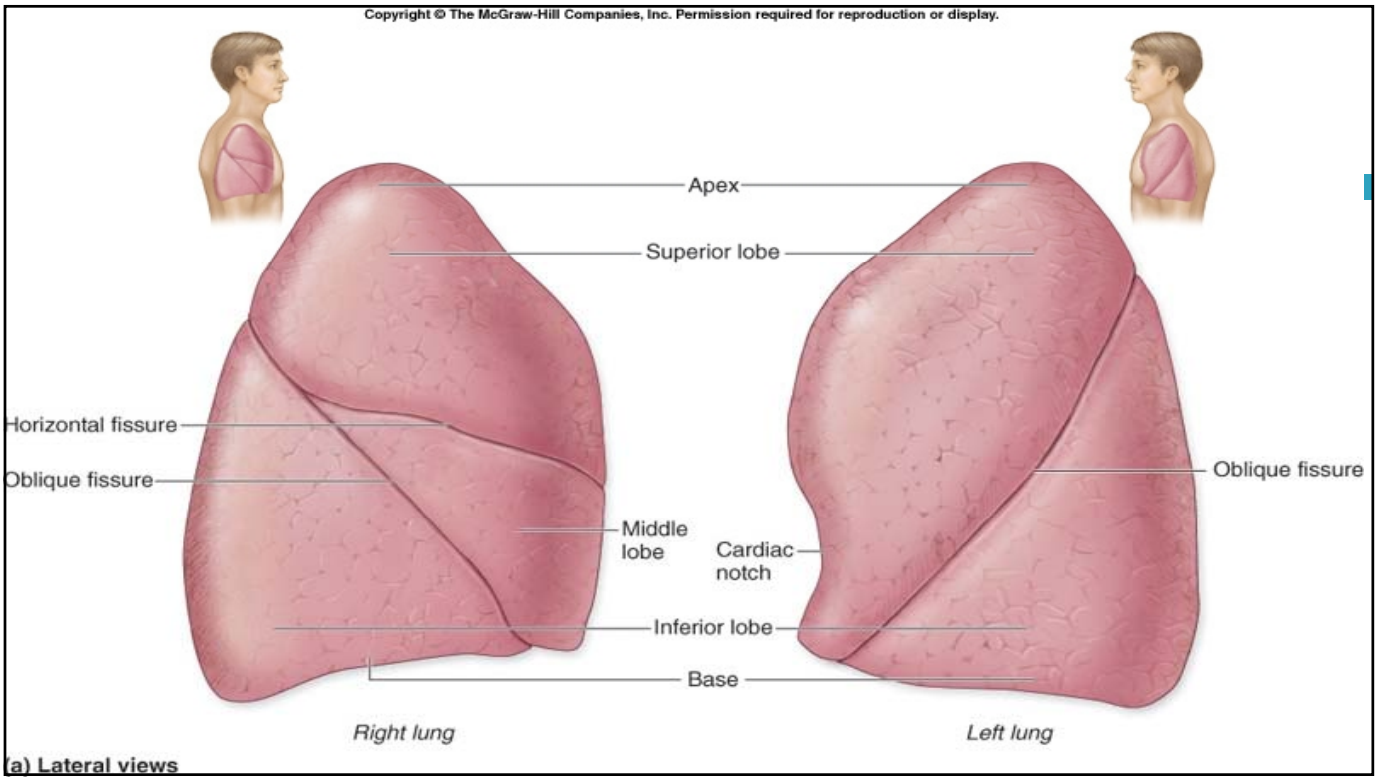


- Two lungs: Principal organs of respiration
  - Right lung: Three lobes
  - Left lung: Two lobes
- Divisions
  - Lobes, bronchopulmonary segments, lobules

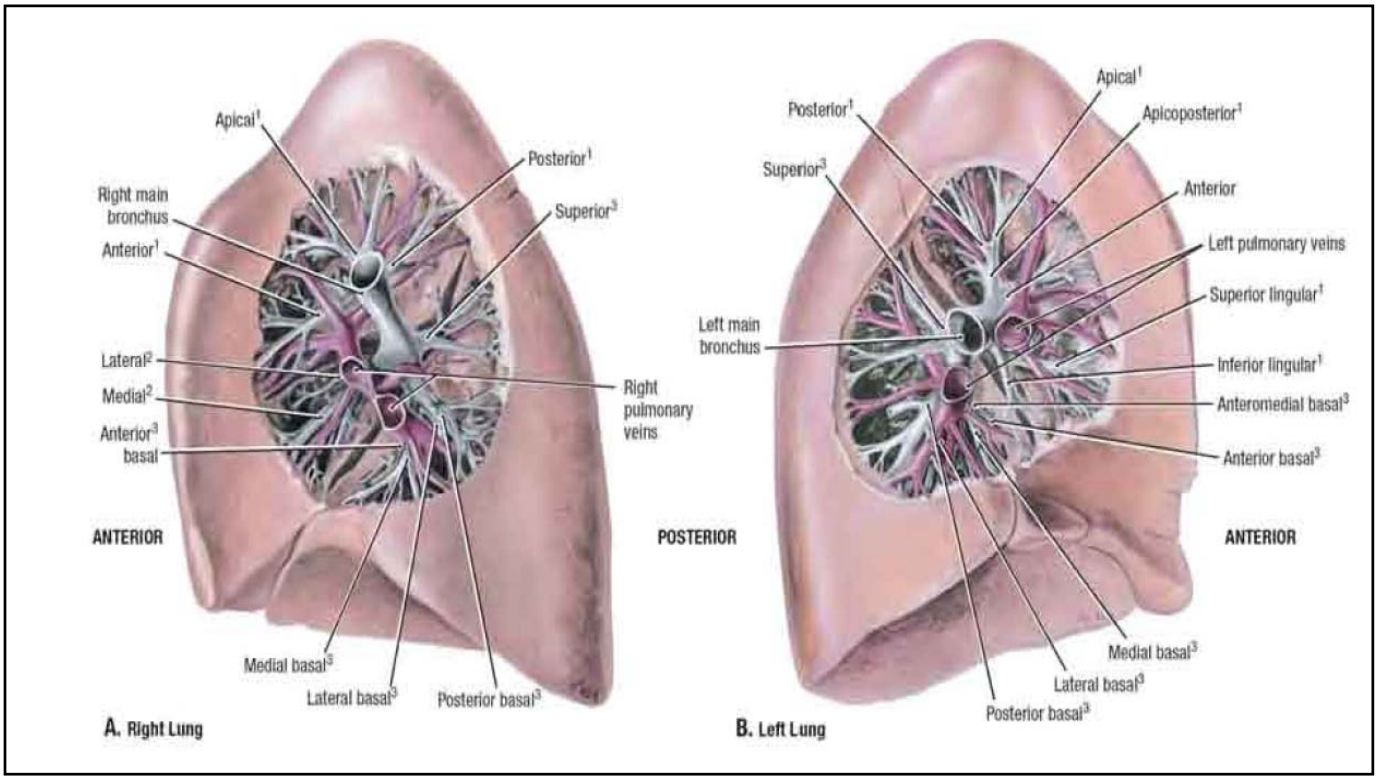
1. **groove for azygos vein; vein arches over root of right lung to enter superior vena cava**
2. **horizontal fissure of right lung; right lung has two fissures, left has one**
3. **groove for thoracic aorta**
4. **oblique fissure of left lung**

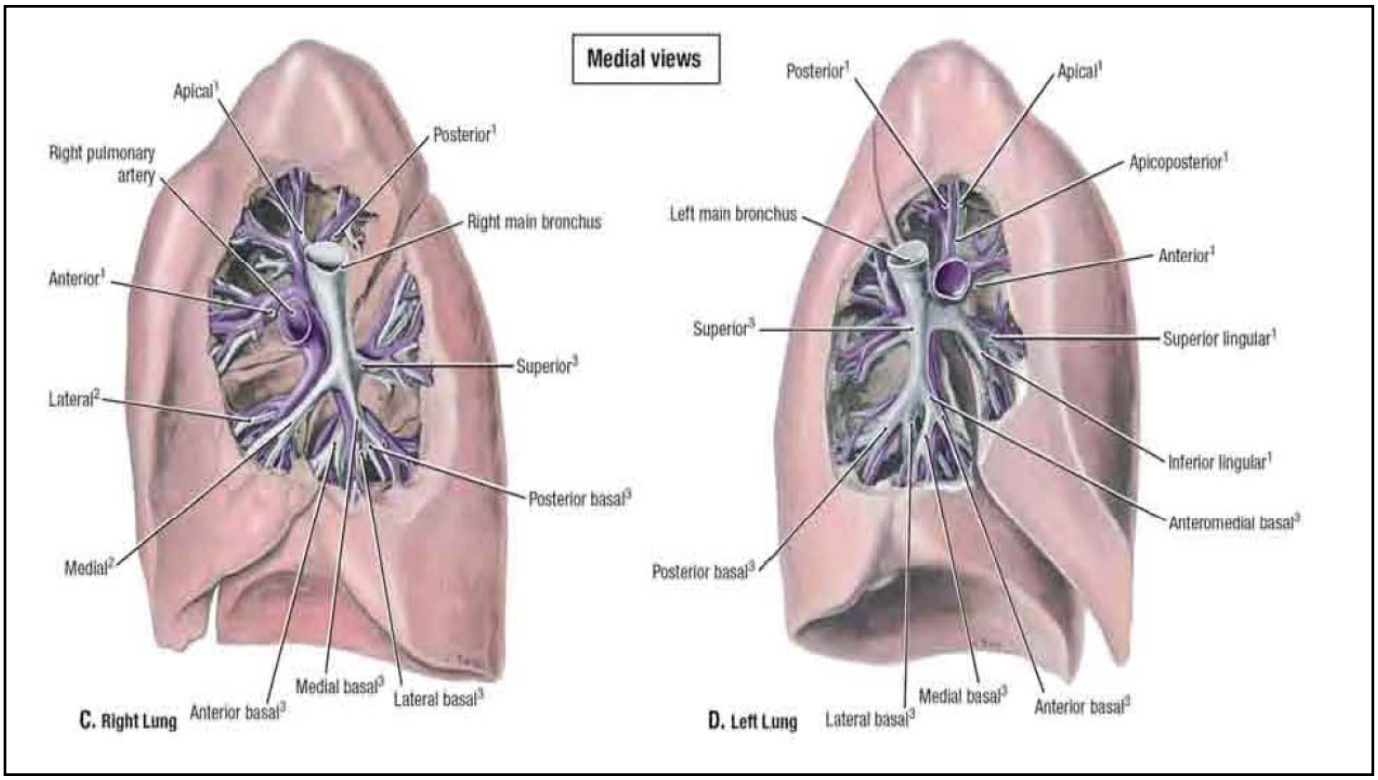
Thoracic Volume

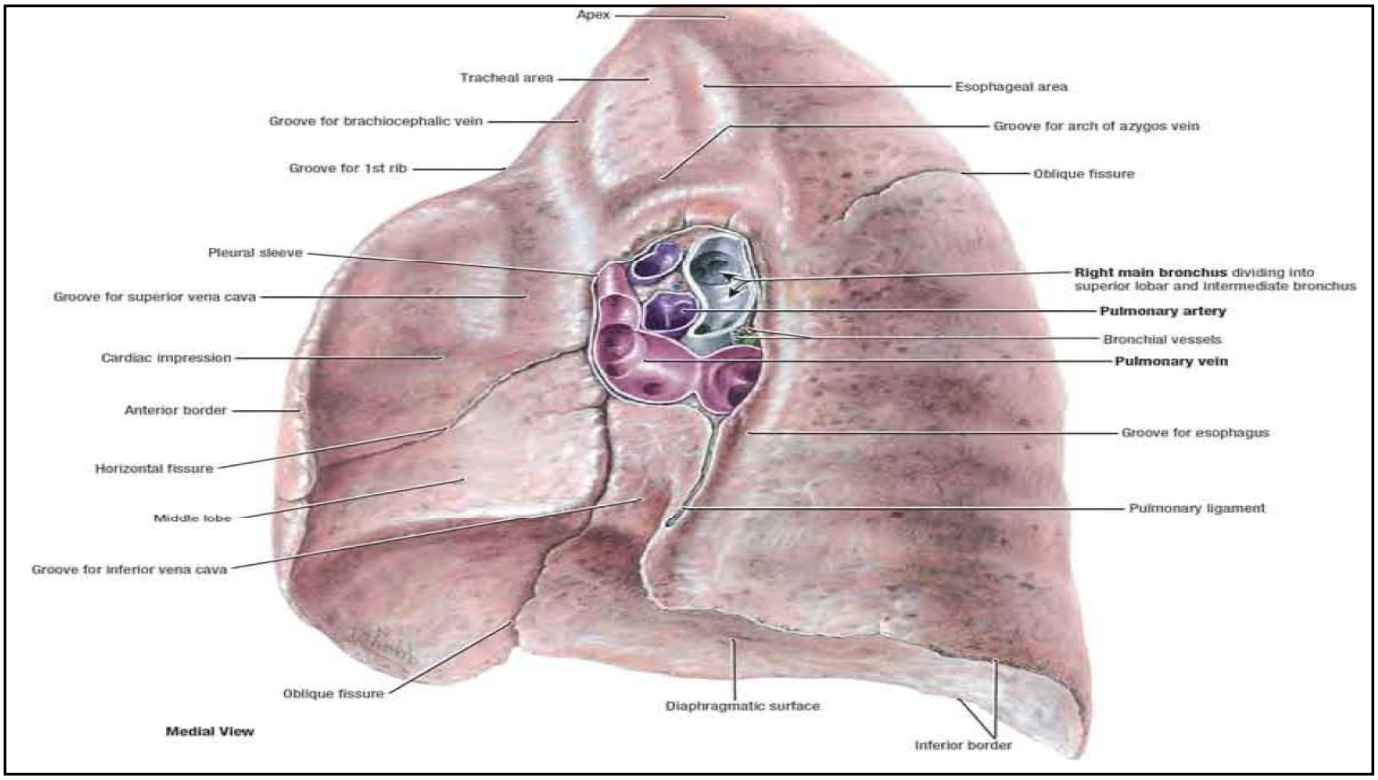


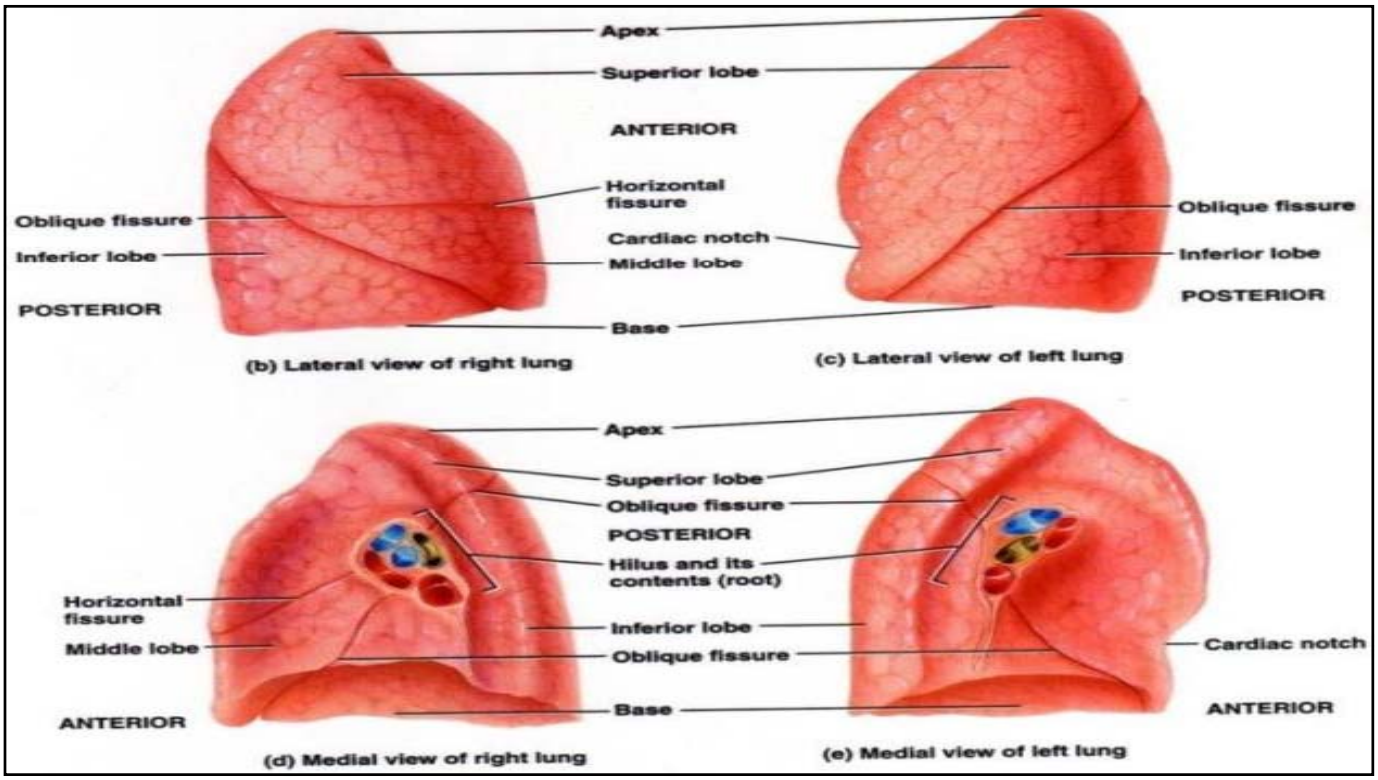


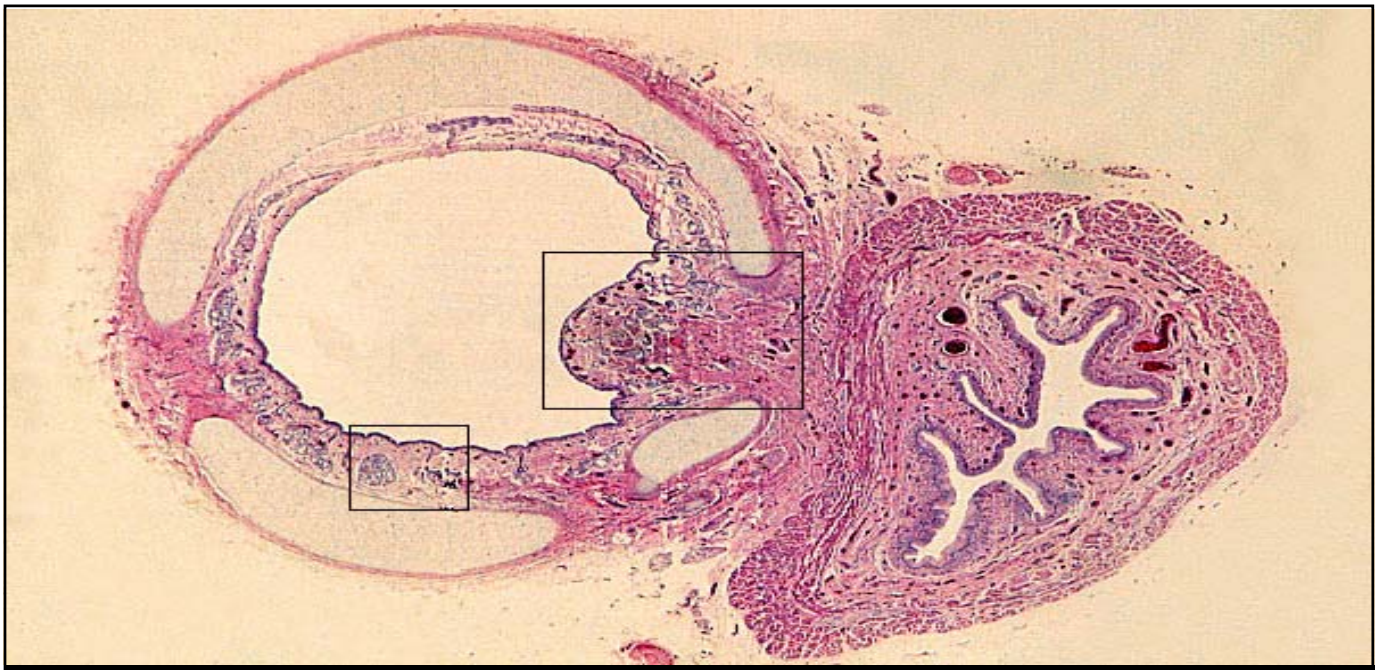
(a) Lateral views



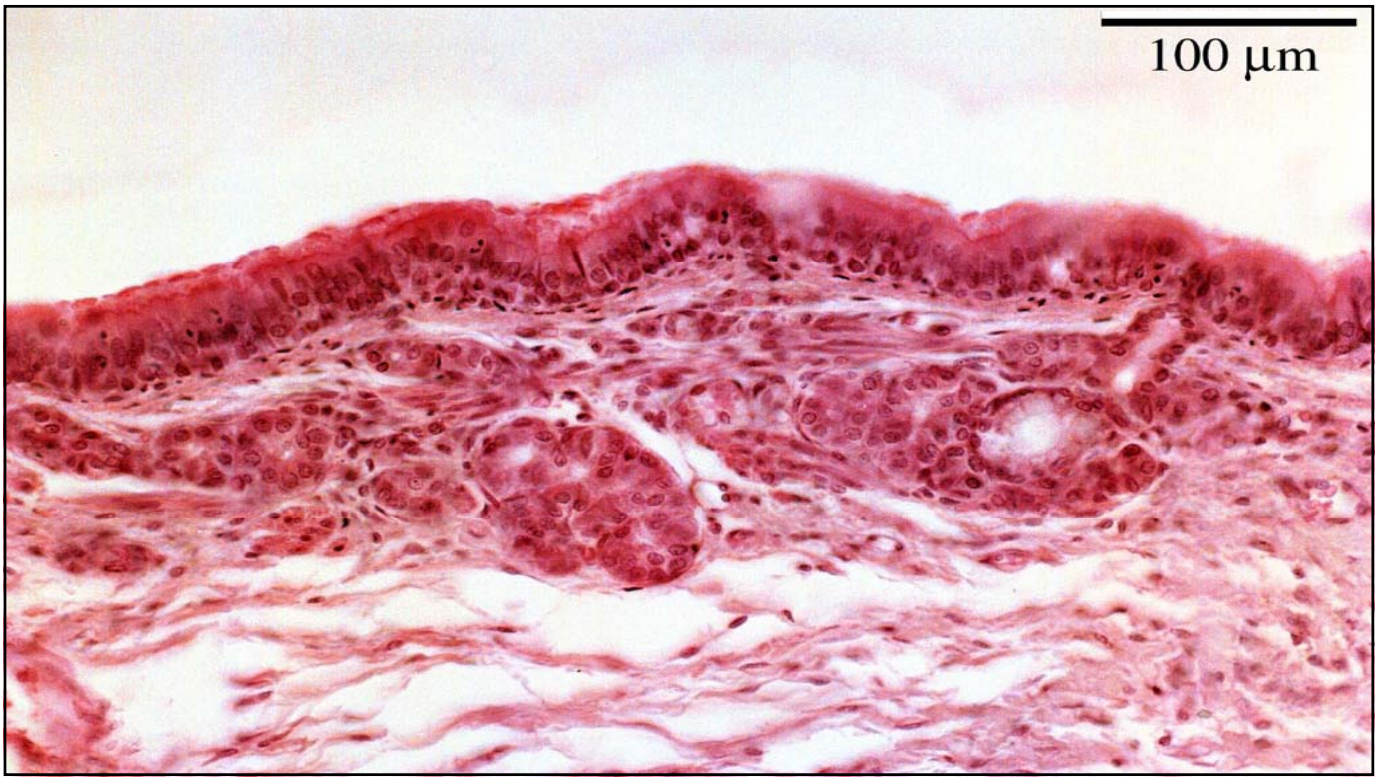

Medial views
Apical[1]
Posterior[1]
Right pulmonary artery
Right main bronchus
Anterior[1]
Superior[3]
Lateral[2]
Posterior basal[3]
Medial[2]
Anterior basal[3]
Medial basal[3]
Lateral basal[3]
C. Right Lung
Posterior[1]
Apical[1]
Apicoposterior[1]
Left main bronchus
Anterior[1]
Superior[3]
Superior lingular[1]
Inferior lingular[1]
Anteromedial basal[3]
Posterior basal[3]
Lateral basal[3]
Medial basal[3]
Anterior basal[3]
D. Left Lung

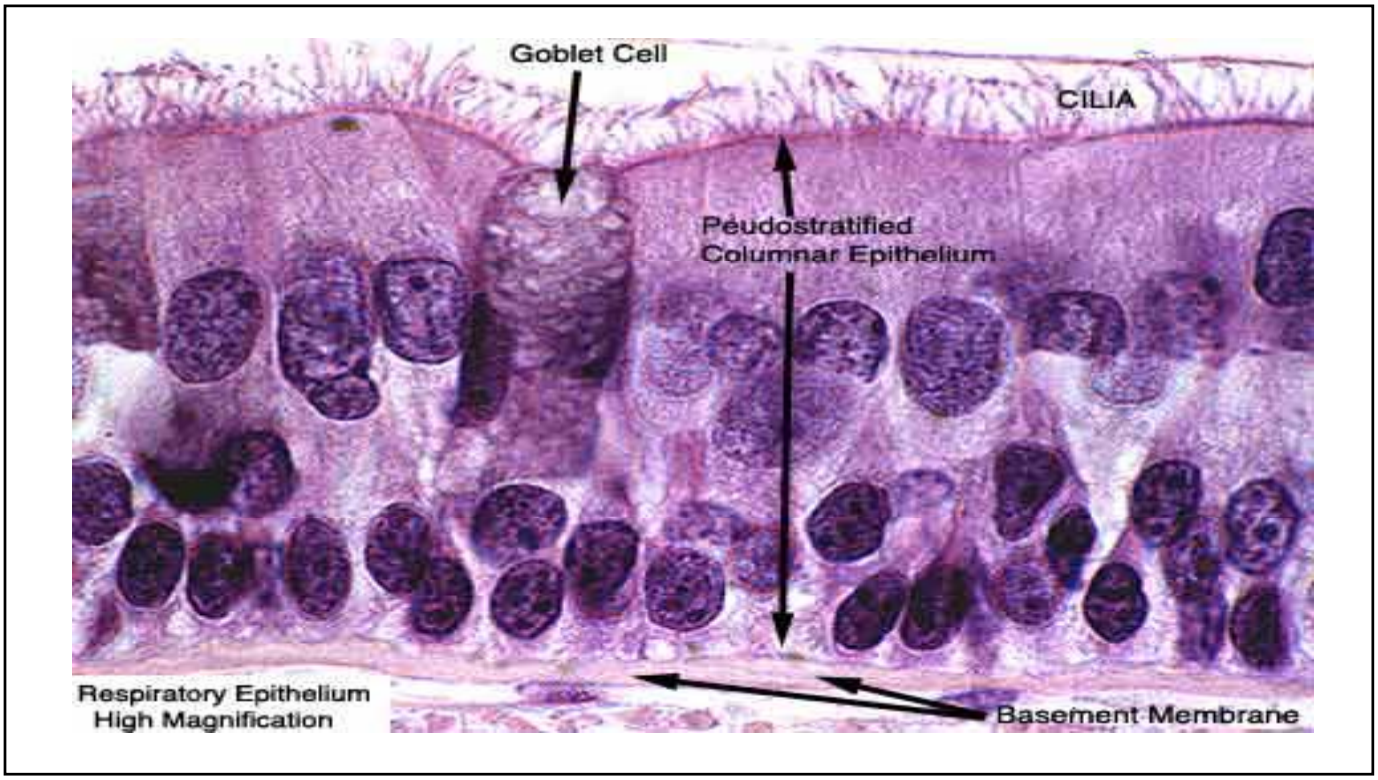

Apex
Tracheal area
Esophageal area
Groove for brachiocephalic vein
Groove for arch of azygos vein
Groove for 1st rib
Oblique fissure
Pleural sleeve
Right main bronchus dividing into superior lobar and intermediate bronchus
Groove for superior vena cava
Pulmonary artery
Bronchial vessels
Cardiac impression
Pulmonary vein
Anterior border
Groove for esophagus
Horizontal fissure
Middle lobe
Pulmonary ligament
Groove for inferior vena cava
Oblique fissure
Diaphragmatic surface
Inferior border
Medial View

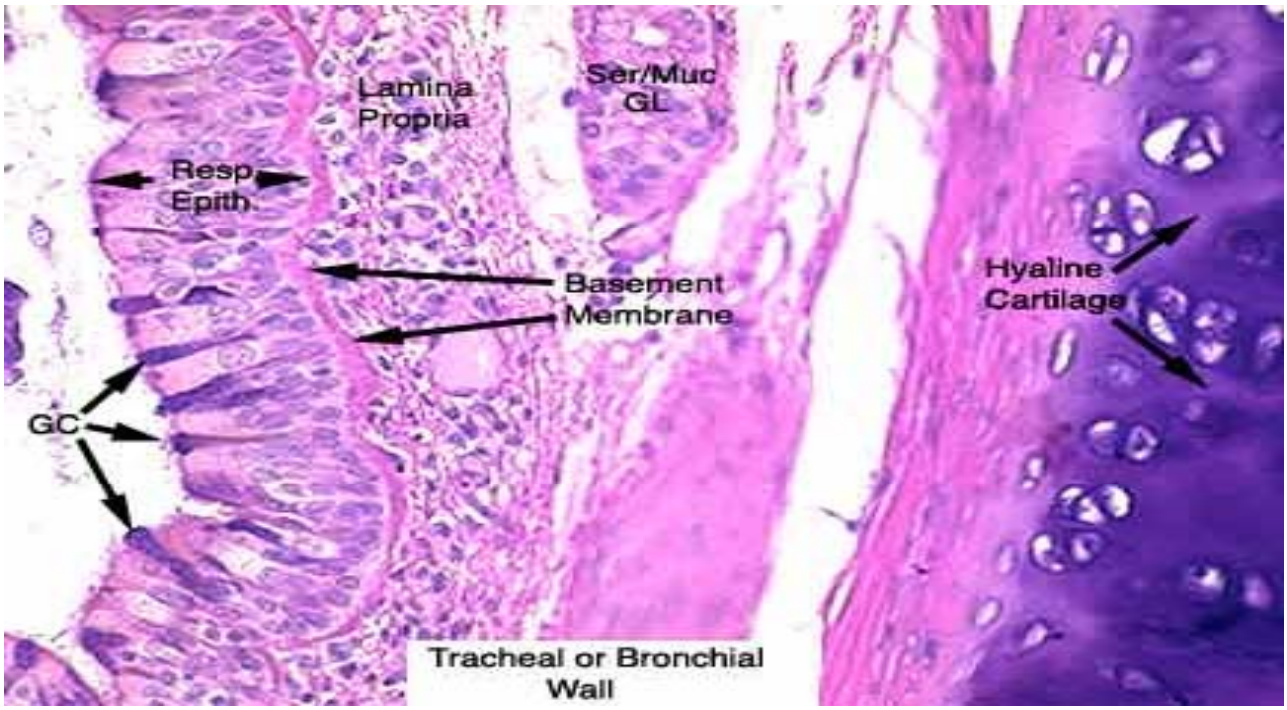


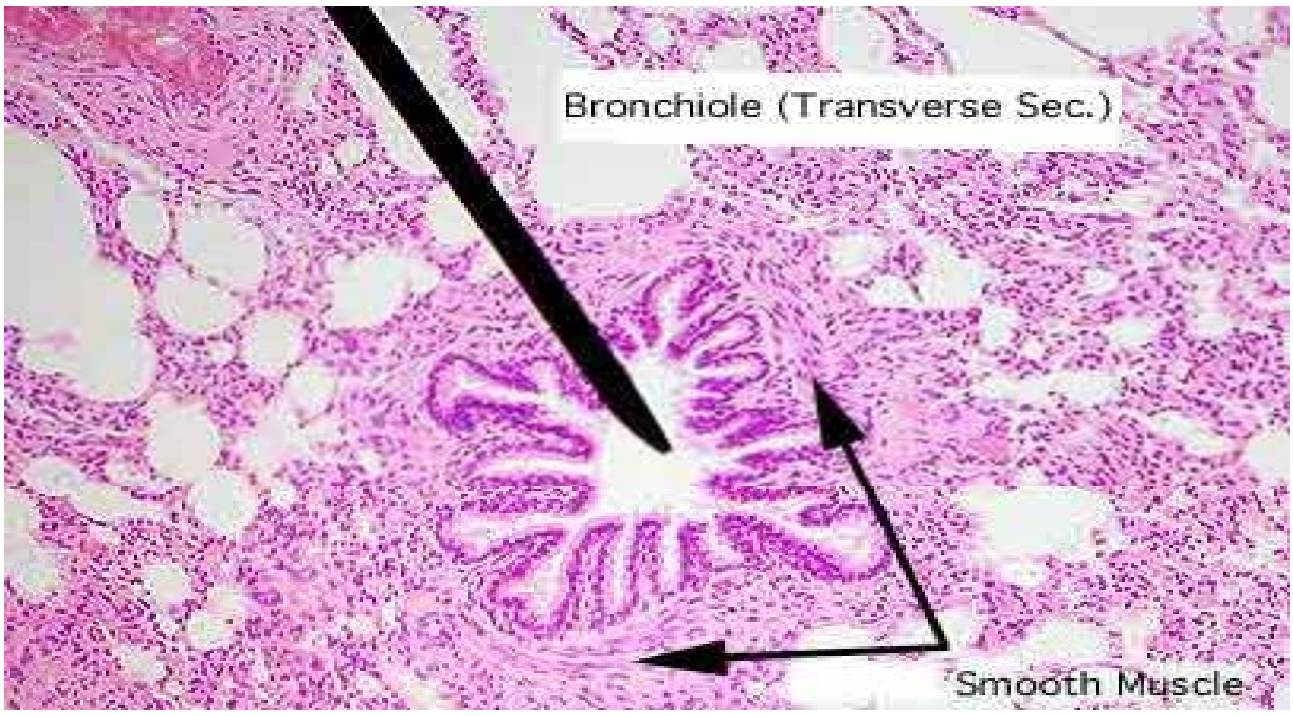


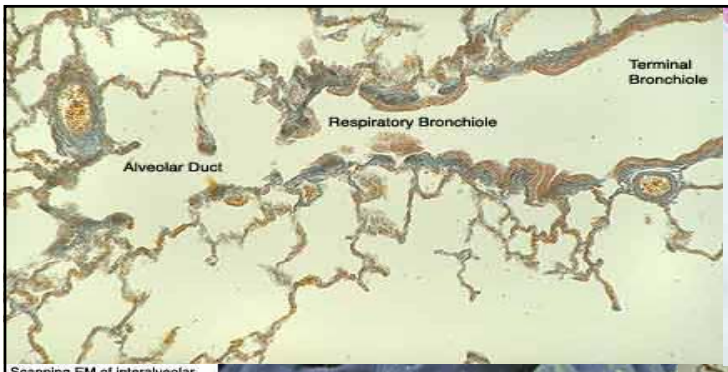
TRACHEA/ ESOPHAGUS

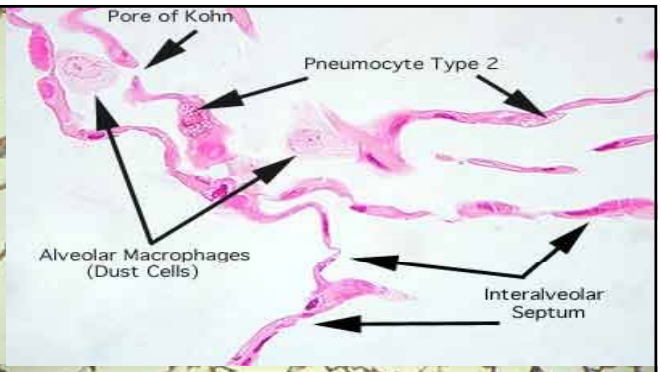

100 µm

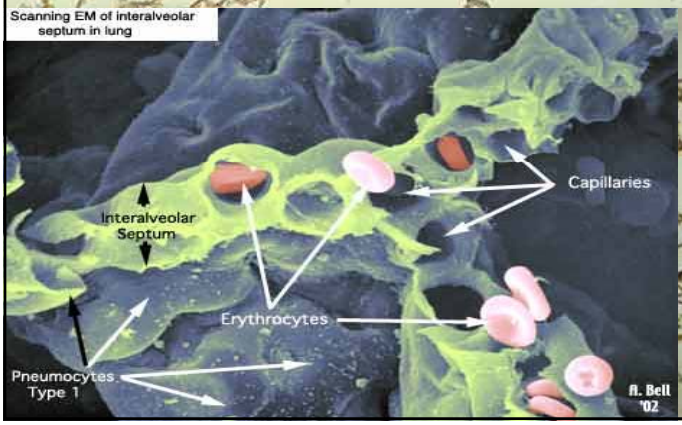

Goblet Cell
CILIA
Pseudostratified
Columnar Epithelium
Respiratory Epithelium
High Magnification
Basement Membrane

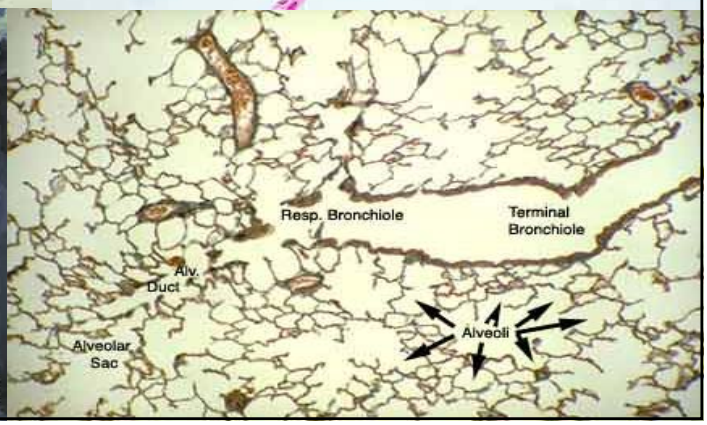

Lamina Propria
Ser/Muc GL
Resp Epith
Basement Membrane
Hyaline Cartilage
GC
Tracheal or Bronchial Wall

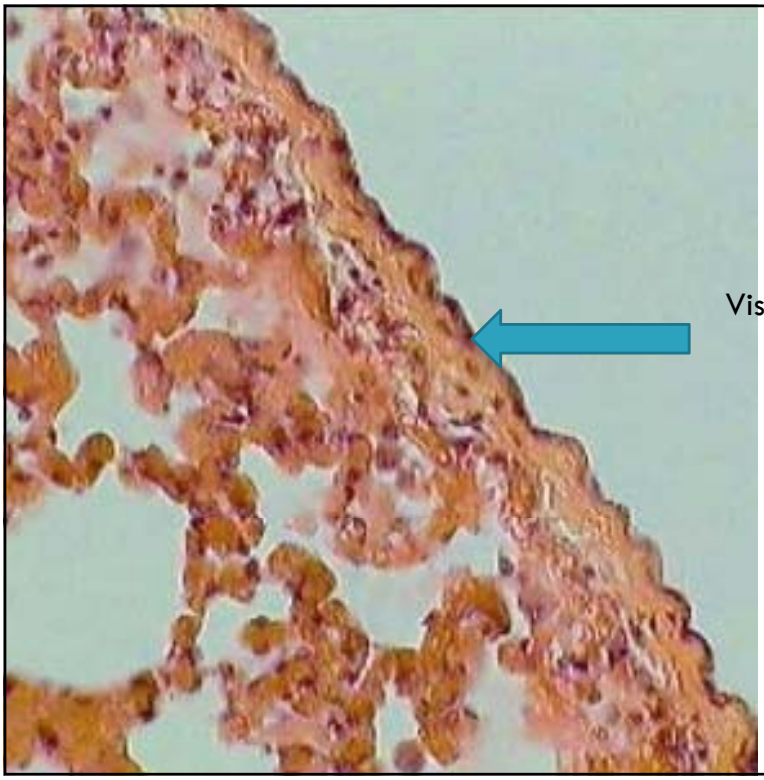

Bronchiole (Transverse Sec.)
Smooth Muscle



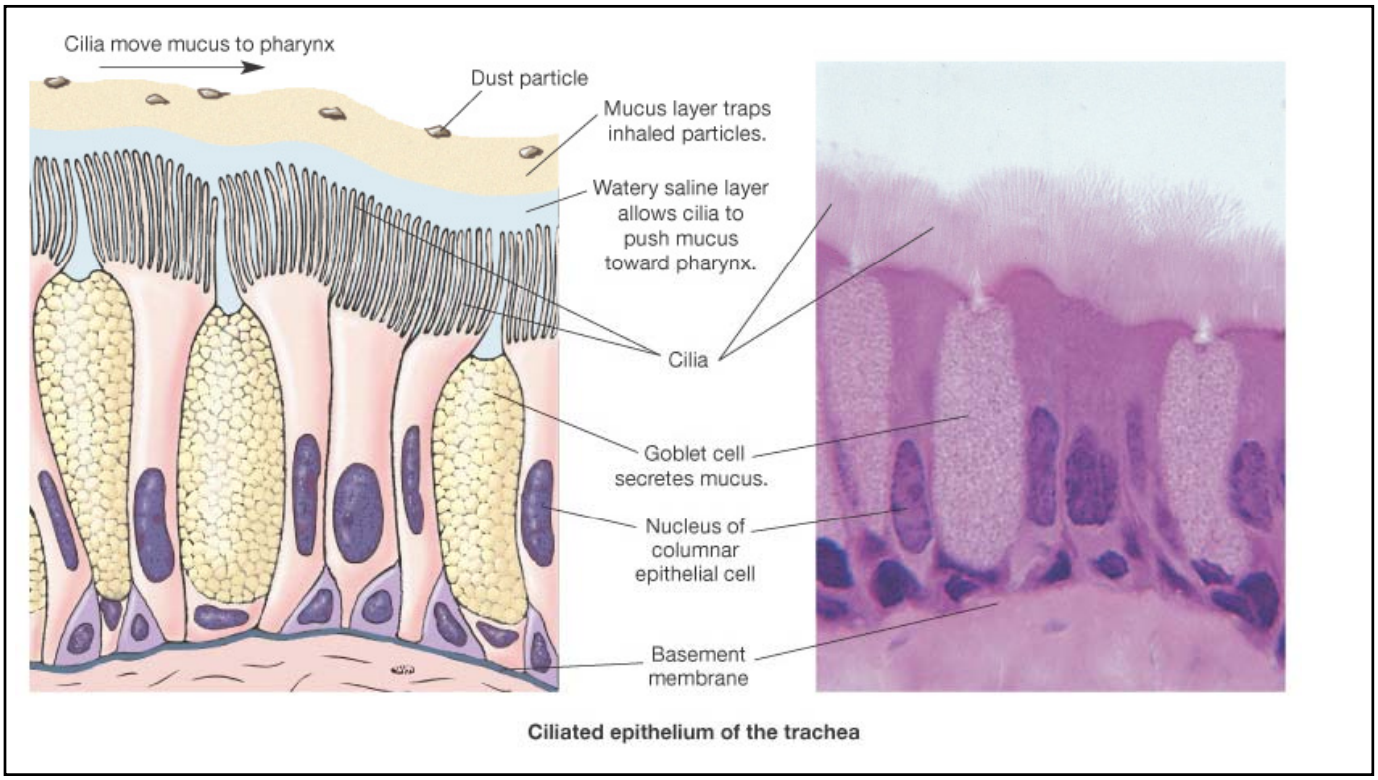




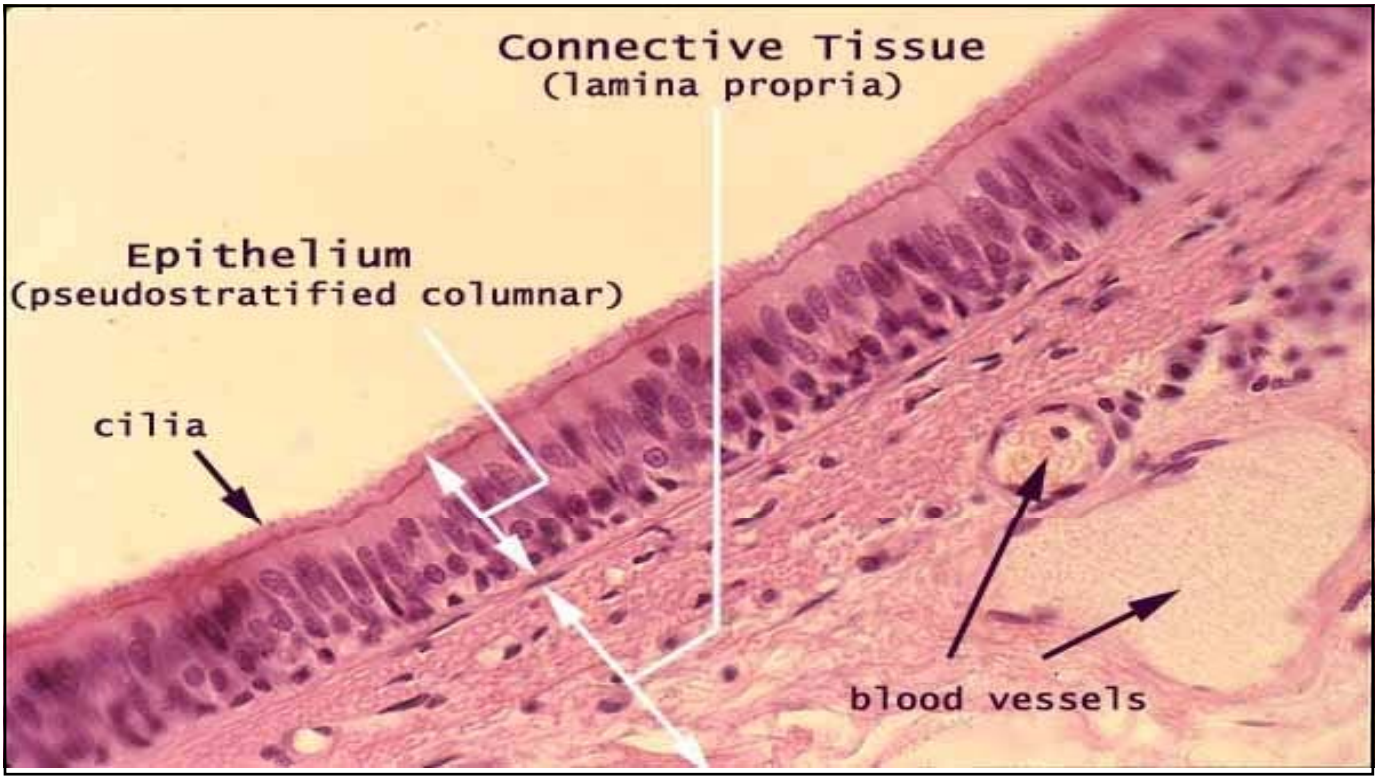


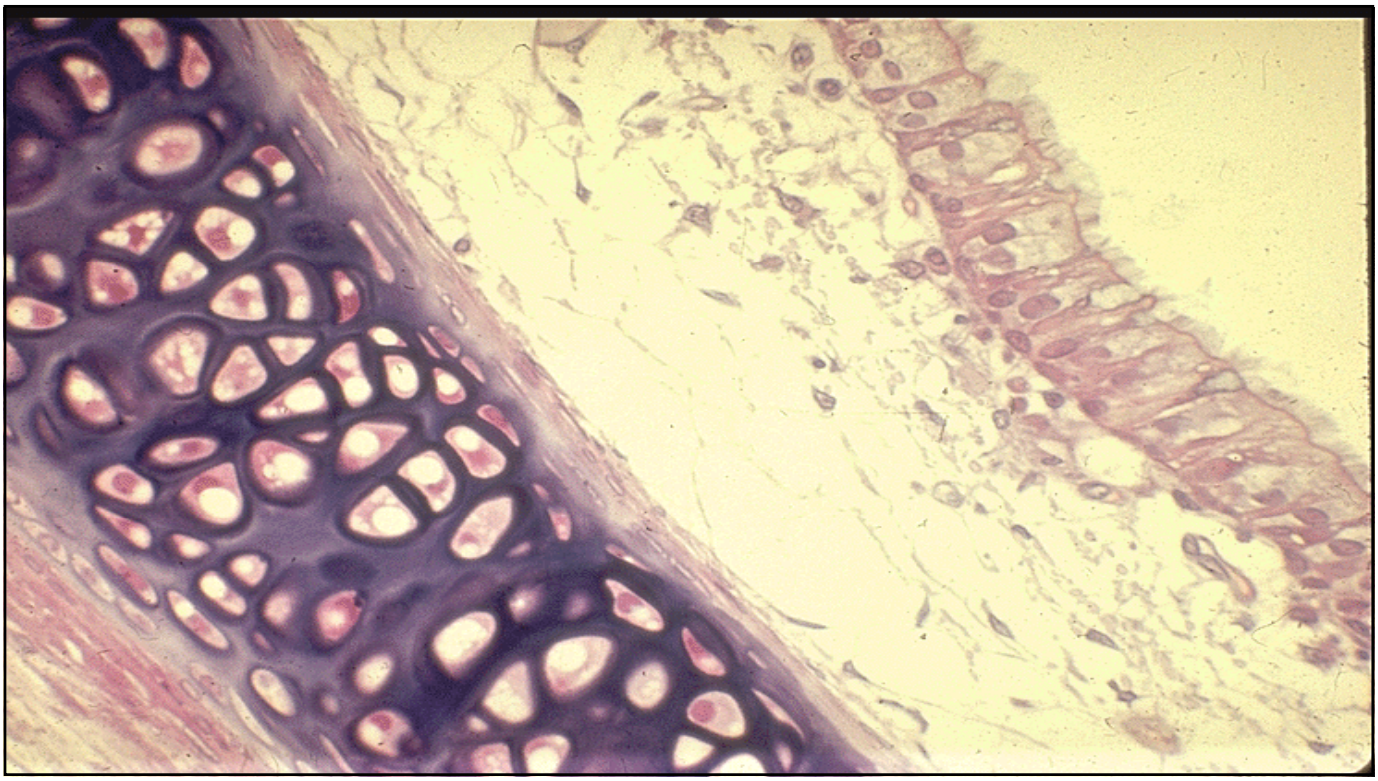


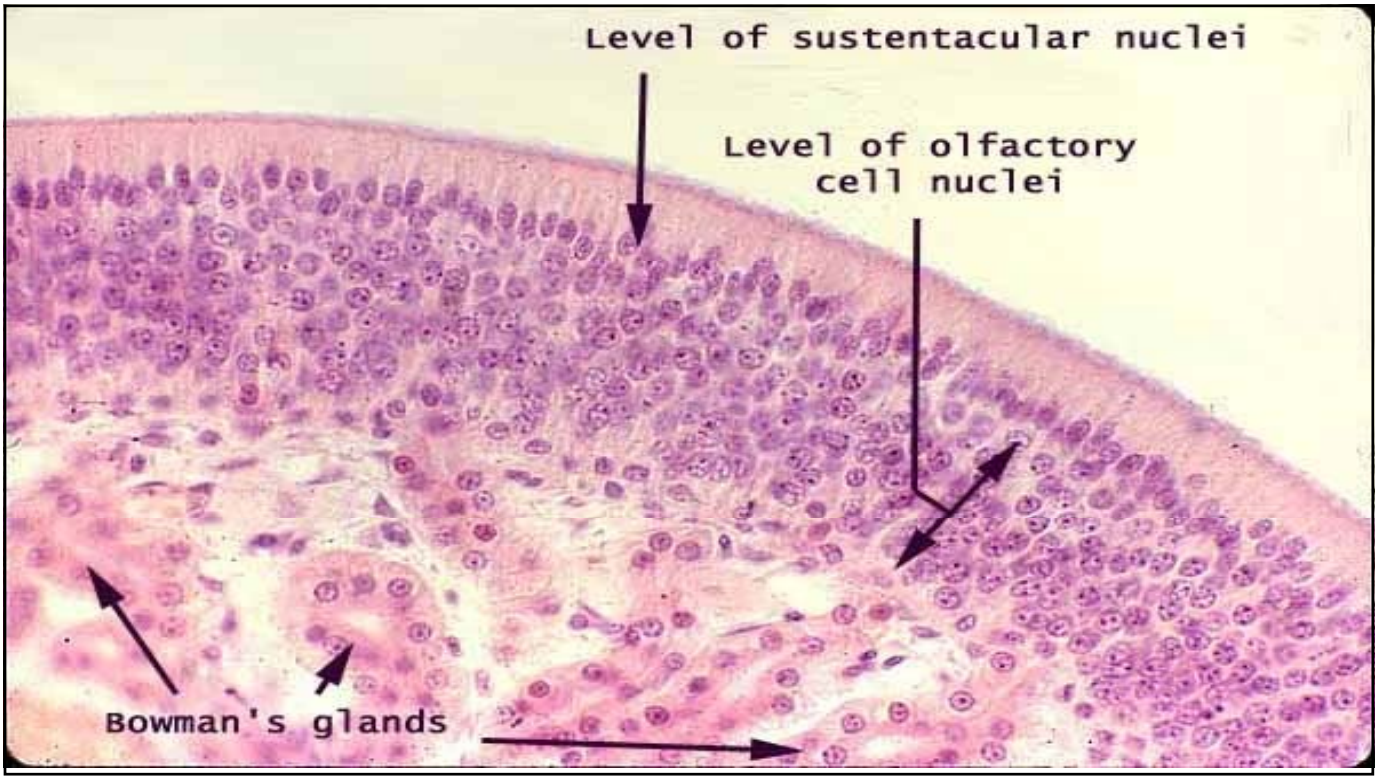
Visceral pleura



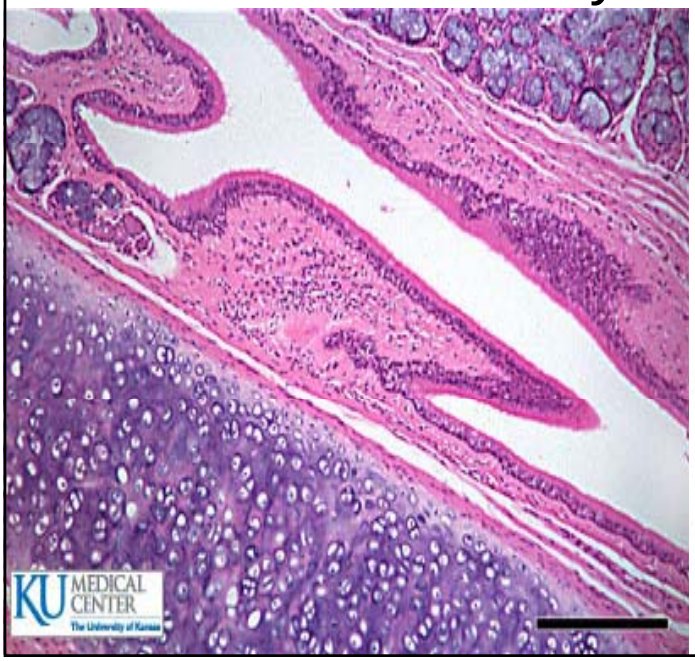
Ciliated epithelium of the trachea

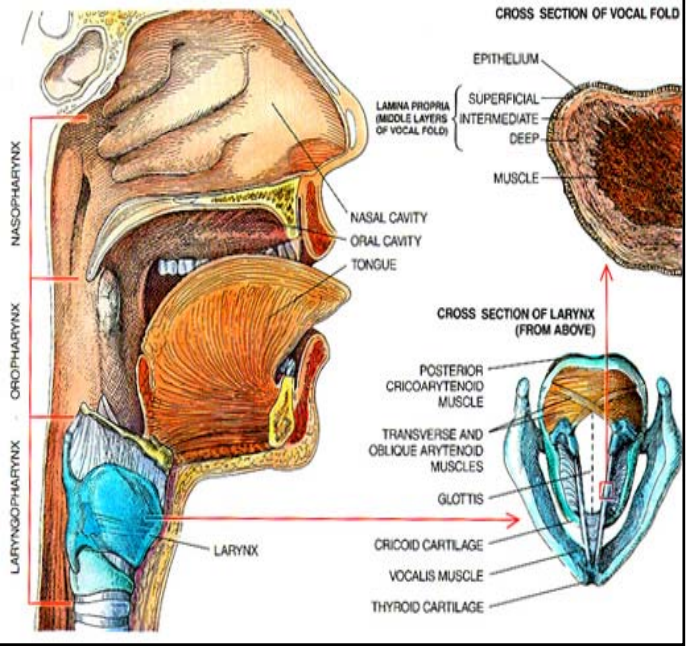


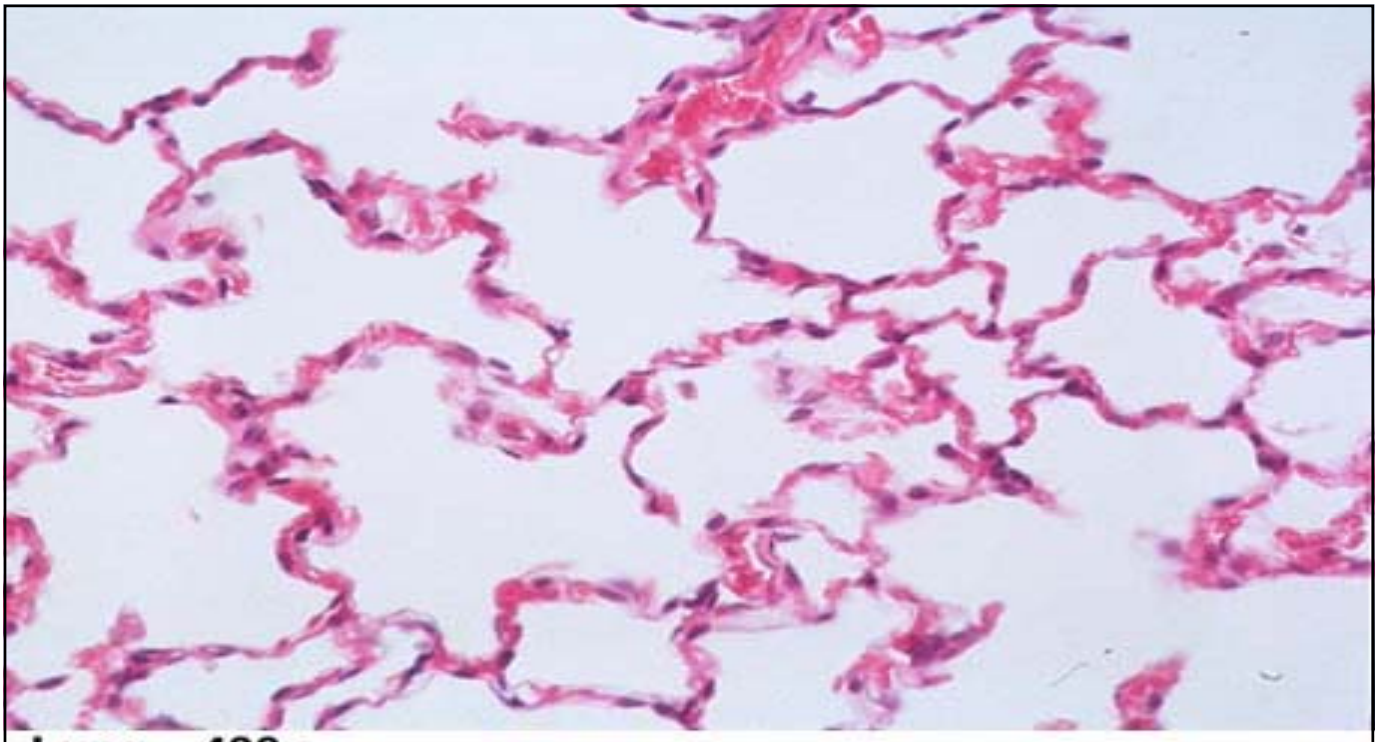



Level of sustentacular nuclei
Level of olfactory cell nuclei
Bowman's glands

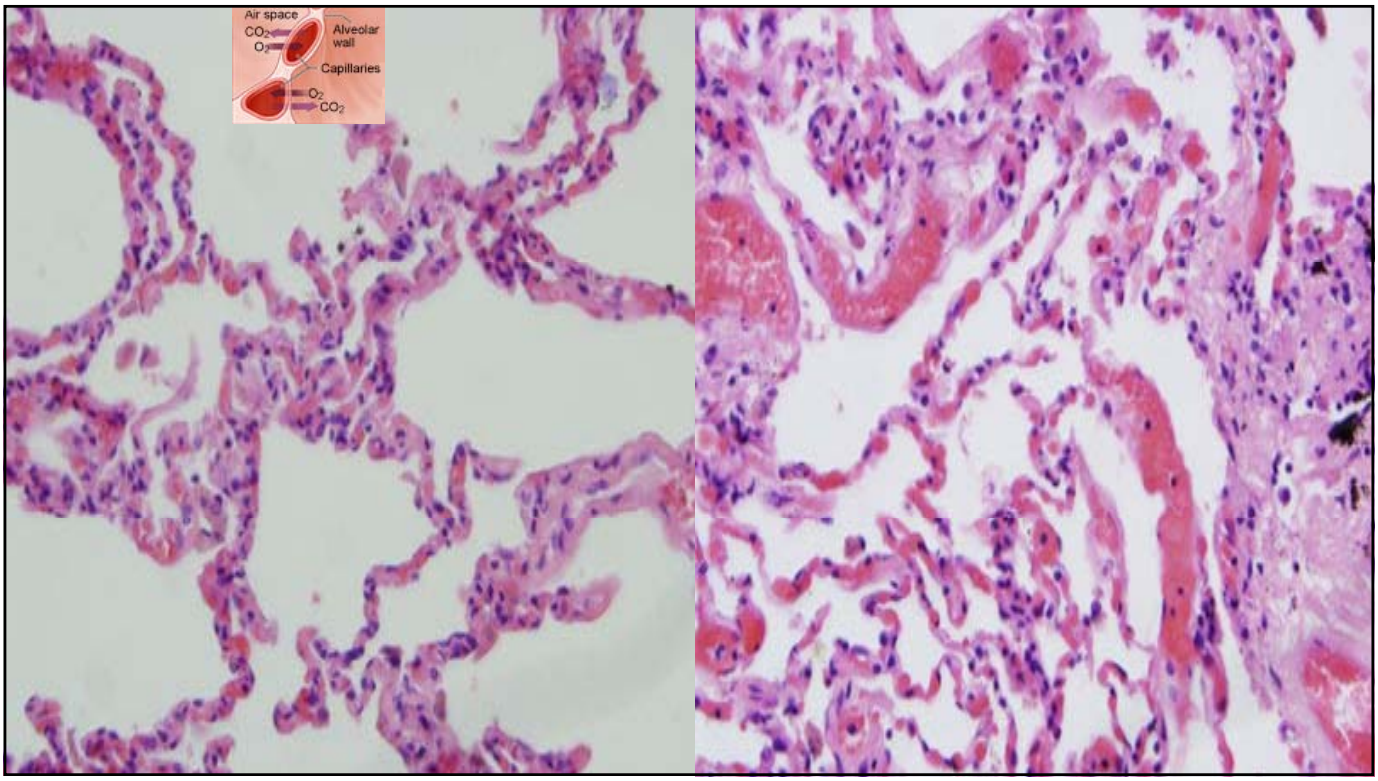
Larynx

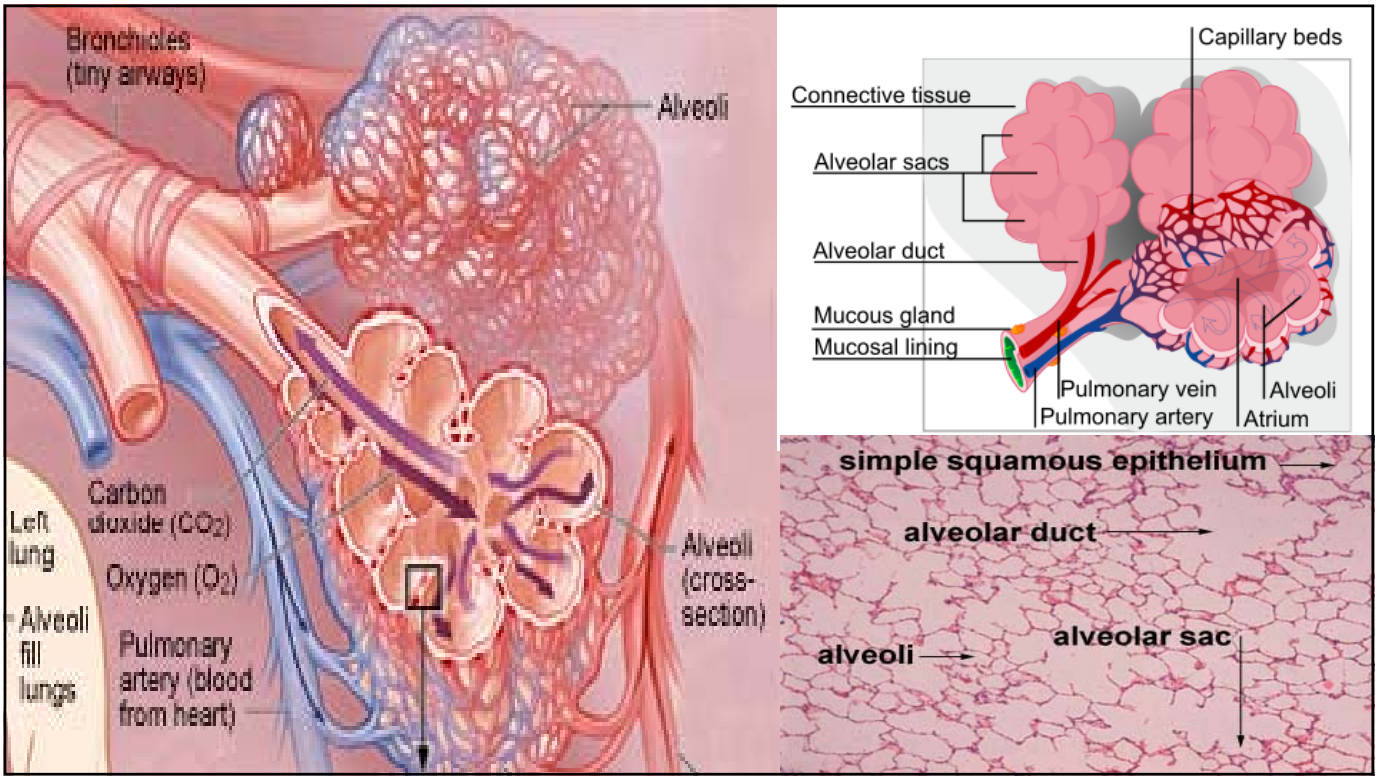


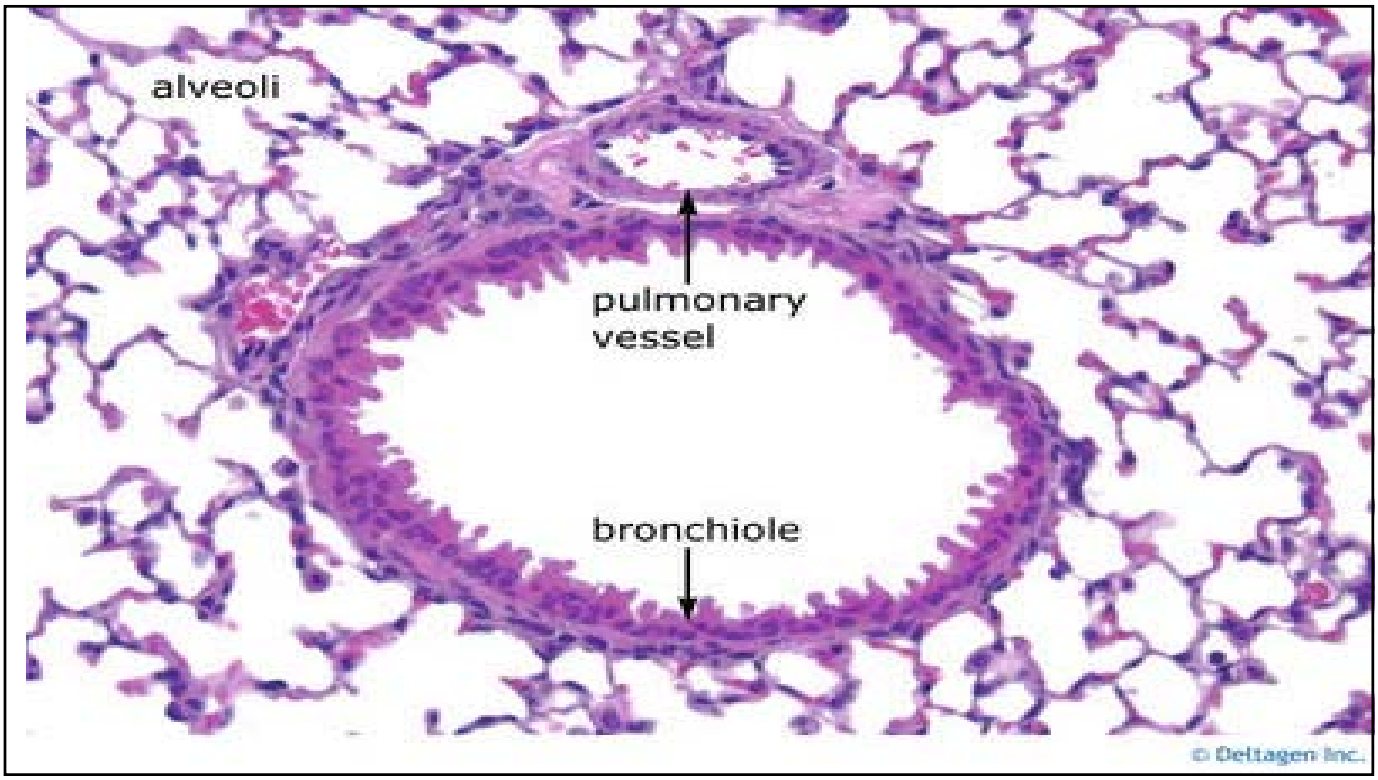




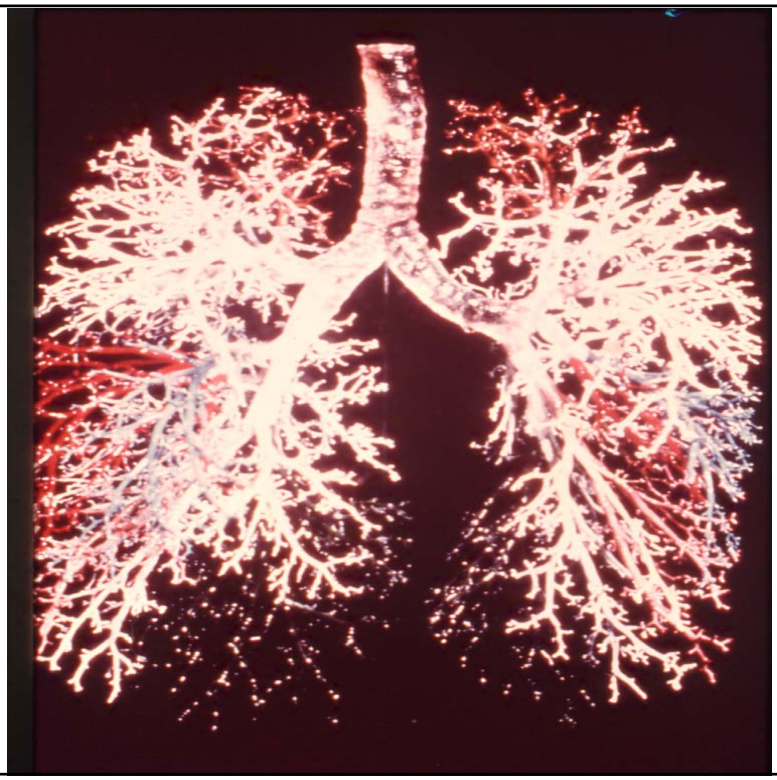
Lung 400x

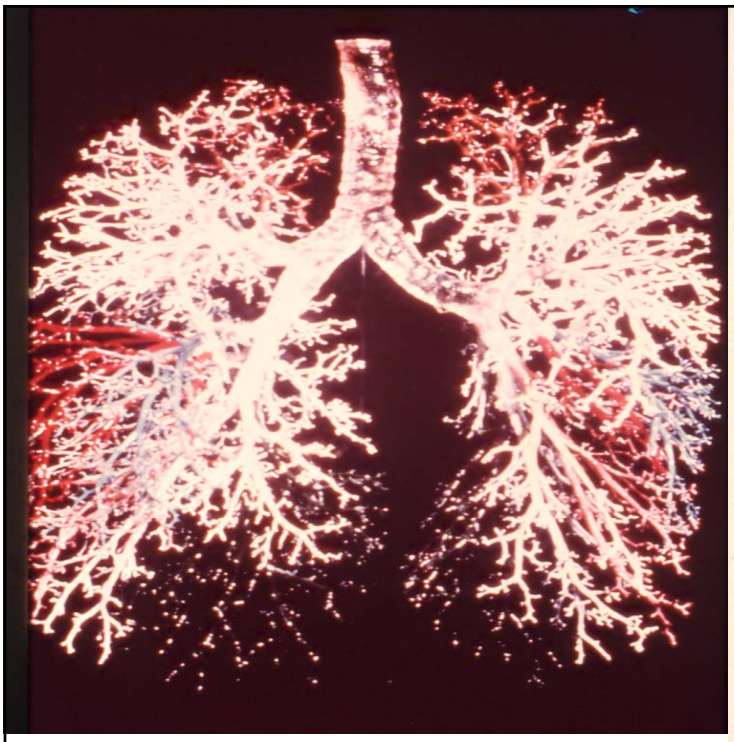

Air space
Alveolar wall
Capillaries

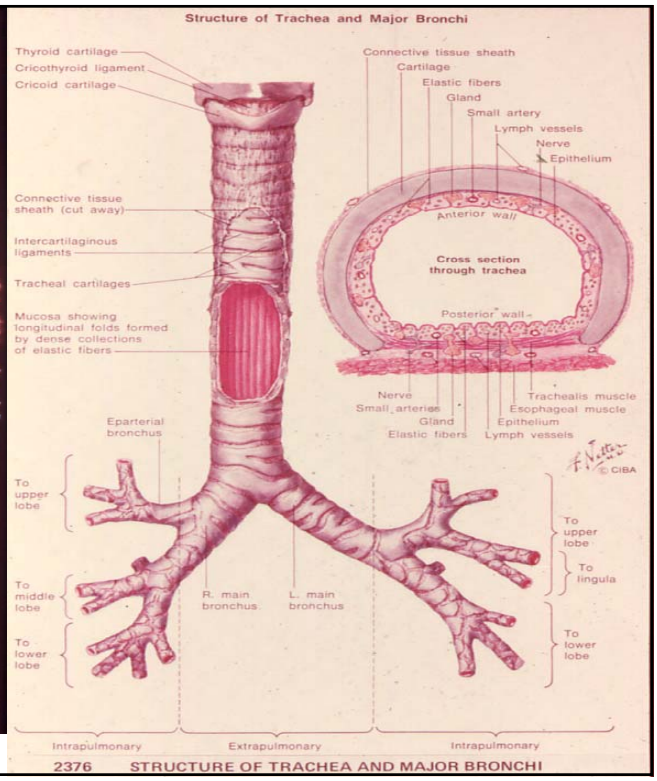

Bronchioles (tiny airways)
Alveoli
Carbon dioxide (CO_2)
Oxygen (O_2)
Left lung
Alveoli fill lungs
Pulmonary artery (blood from heart)
Alveoli (cross-section)
Capillary beds
Connective tissue
Alveolar sacs
Alveolar duct
Mucous gland
Mucosal lining
Pulmonary vein
Pulmonary artery
Alveoli
Atrium
simple squamous epithelium
alveolar duct
alveolar sac
alveoli

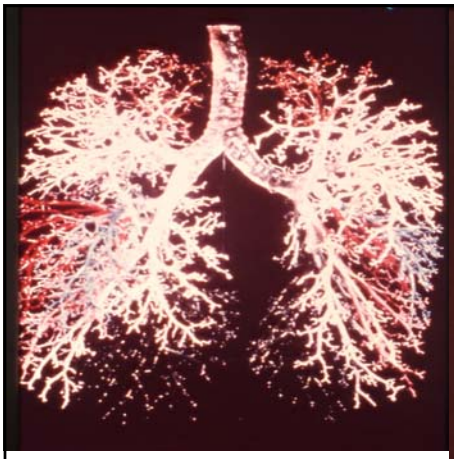


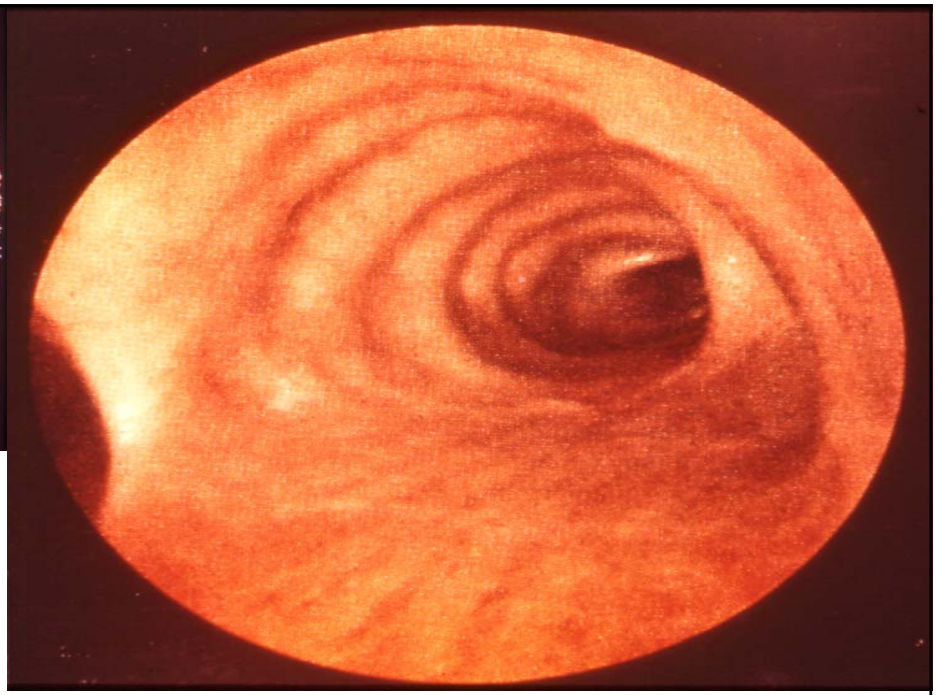
The Tracheo-bronchial Tree

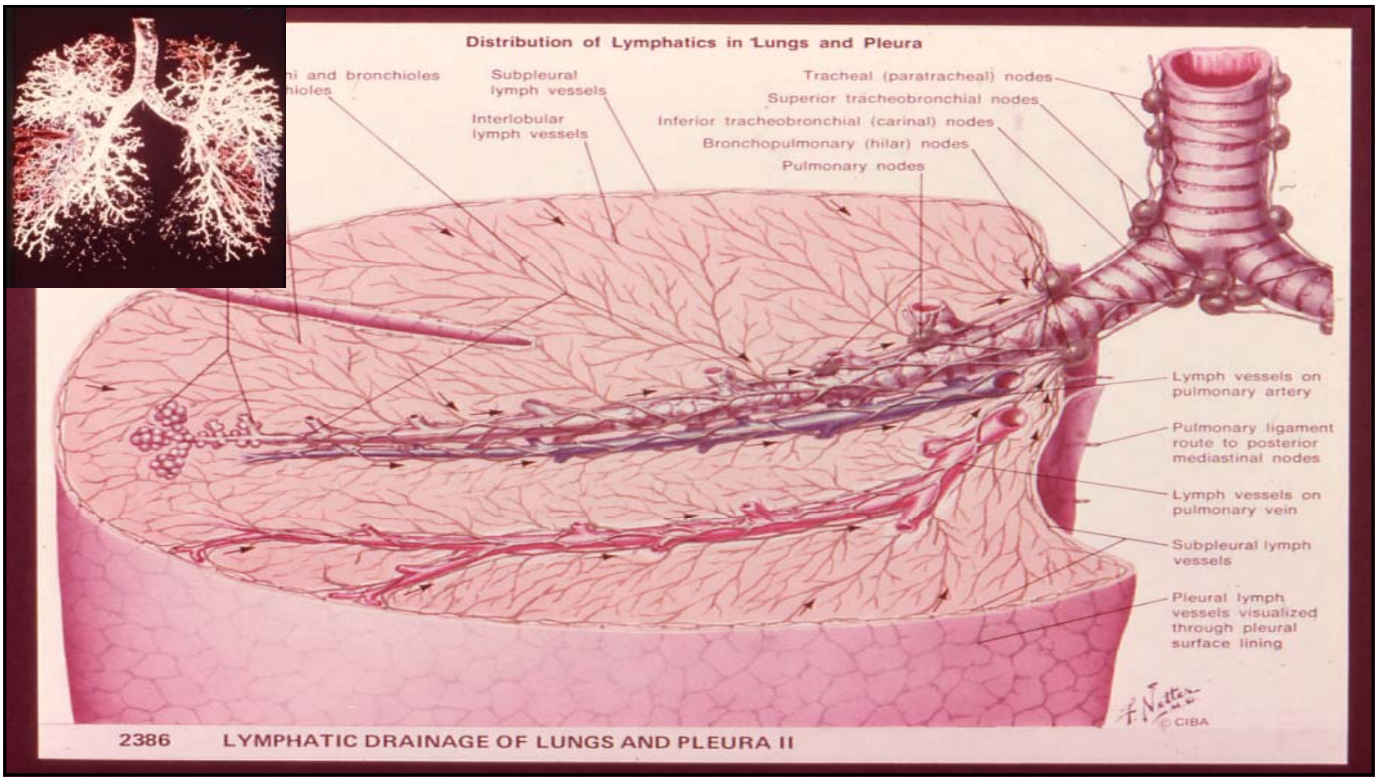


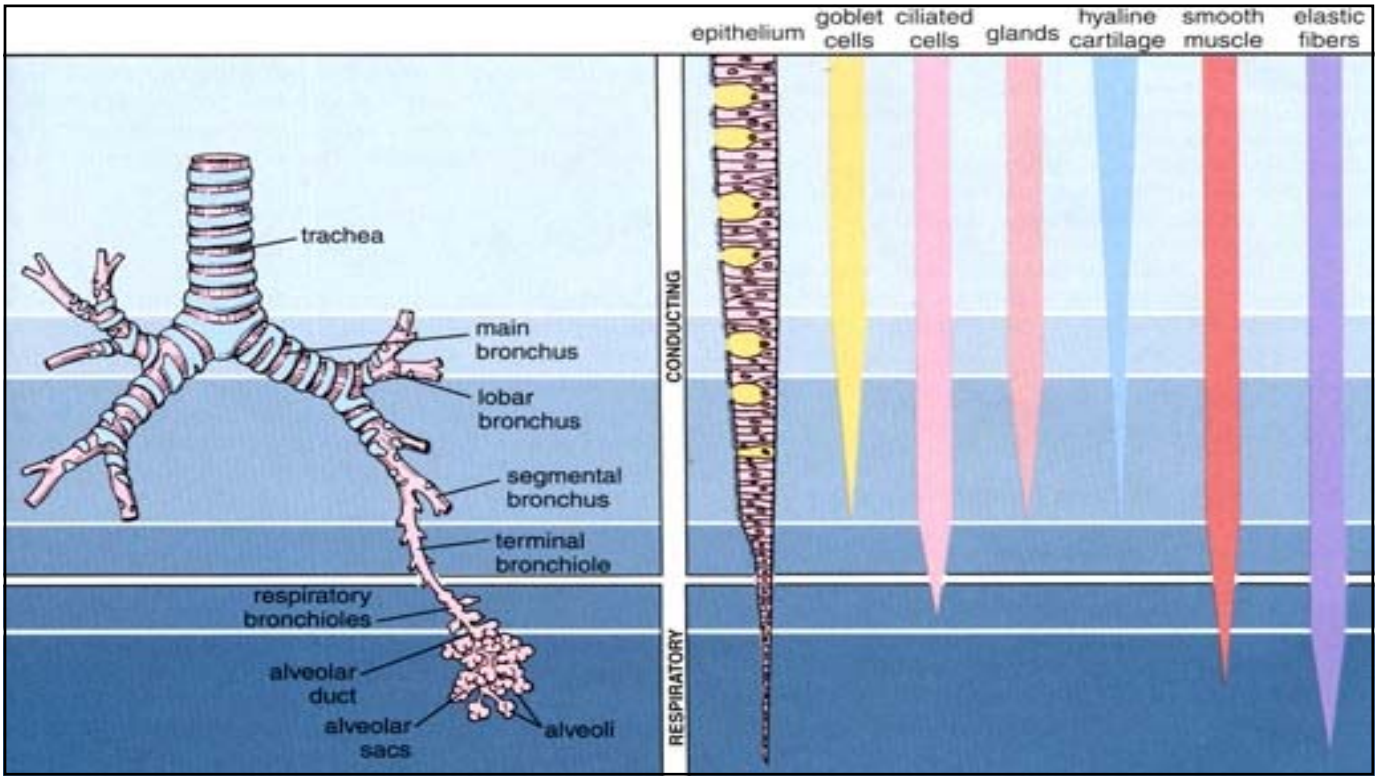


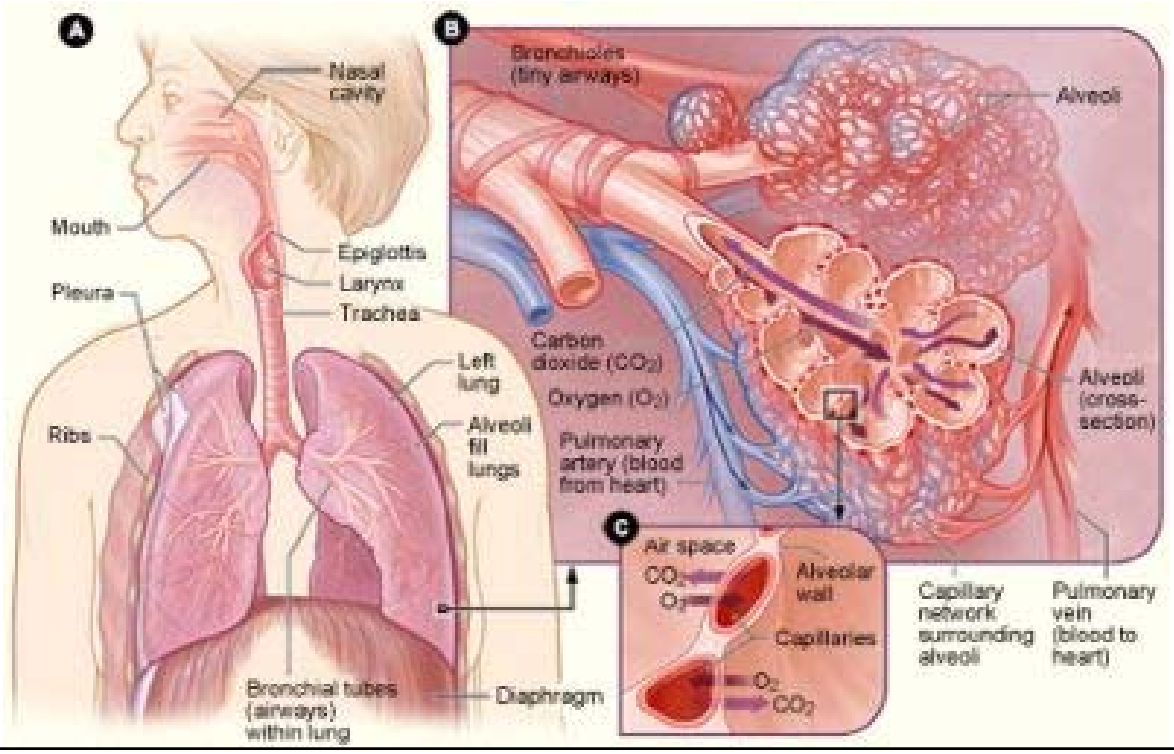

Structure of Trachea and Major Bronchi
Thyroid cartilage
Cricothyroid ligament
Cricoid cartilage
Connective tissue sheath (cut away)
Intercartilaginous ligaments
Tracheal cartilages
Mucosa showing longitudinal folds formed by dense collections of elastic fibers
Connective tissue sheath
Cartilage
Elastic fibers
Gland
Small artery
Lymph vessels
Nerve
Epithelium
Anterior wall
Cross section through trachea
Posterior wall
Nerve
Small arteries
Gland
Elastic fibers
Trachealis muscle
Esophageal muscle
Epithelium
Lymph vessels
CIBA
Eparterial bronchus
To upper lobe
To middle lobe
To lower lobe
R. main bronchus
L. main bronchus
To upper lobe
To lingula
To lower lobe
Intrapulmonary
Extrapulmonary
Intrapulmonary
2376 STRUCTURE OF TRACHEA AND MAJOR BRONCHI






Distribution of Lymphatics in Lungs and Pleura
and bronchioles
Subpleural lymph vessels
Interlobular lymph vessels
Tracheal (paratracheal) nodes
Superior tracheobronchial nodes
Inferior tracheobronchial (carinal) nodes
Bronchopulmonary (hilar) nodes
Pulmonary nodes
Lymph vessels on pulmonary artery
Pulmonary ligament route to posterior mediastinal nodes
Lymph vessels on pulmonary vein
Subpleural lymph vessels
Pleural lymph vessels visualized through pleural surface lining
CIBA
2386 LYMPHATIC DRAINAGE OF LUNGS AND PLEURA II


epithelium
goblet cells
ciliated cells
glands
hyaline cartilage
smooth muscle
elastic fibers
trachea
main bronchus
lobar bronchus
segmental bronchus
terminal bronchiole
respiratory bronchioles
alveolar duct
alveolar sacs
alveoli
CONDUCTING
RESPIRATORY


A
Nasal cavity
Mouth
Epiglottis
Larynx
Trachea
Pleura
Left lung
Alveoli fill lungs
Ribs
Bronchial tubes (airways) within lung
Diaphragm
B
Bronchioles (tiny airways)
Alveoli
Carbon dioxide (CO_2)
Oxygen (O_2)
Pulmonary artery (blood from heart)
Alveoli (cross-section)
C
Air space
CO_2
O_2
Alveolar wall
Capillaries
O_2
CO_2
Capillary network surrounding alveoli
Pulmonary vein (blood to heart)