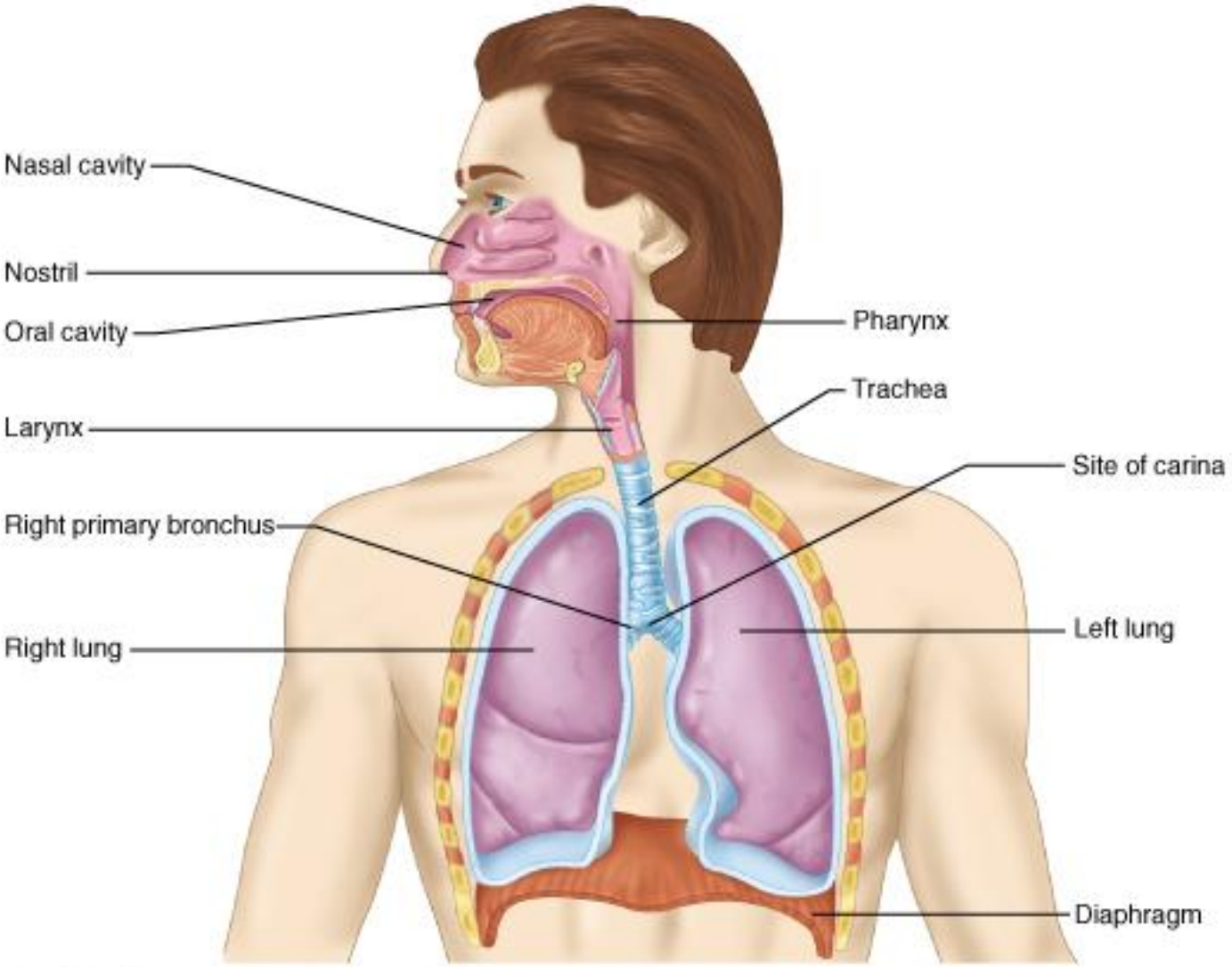
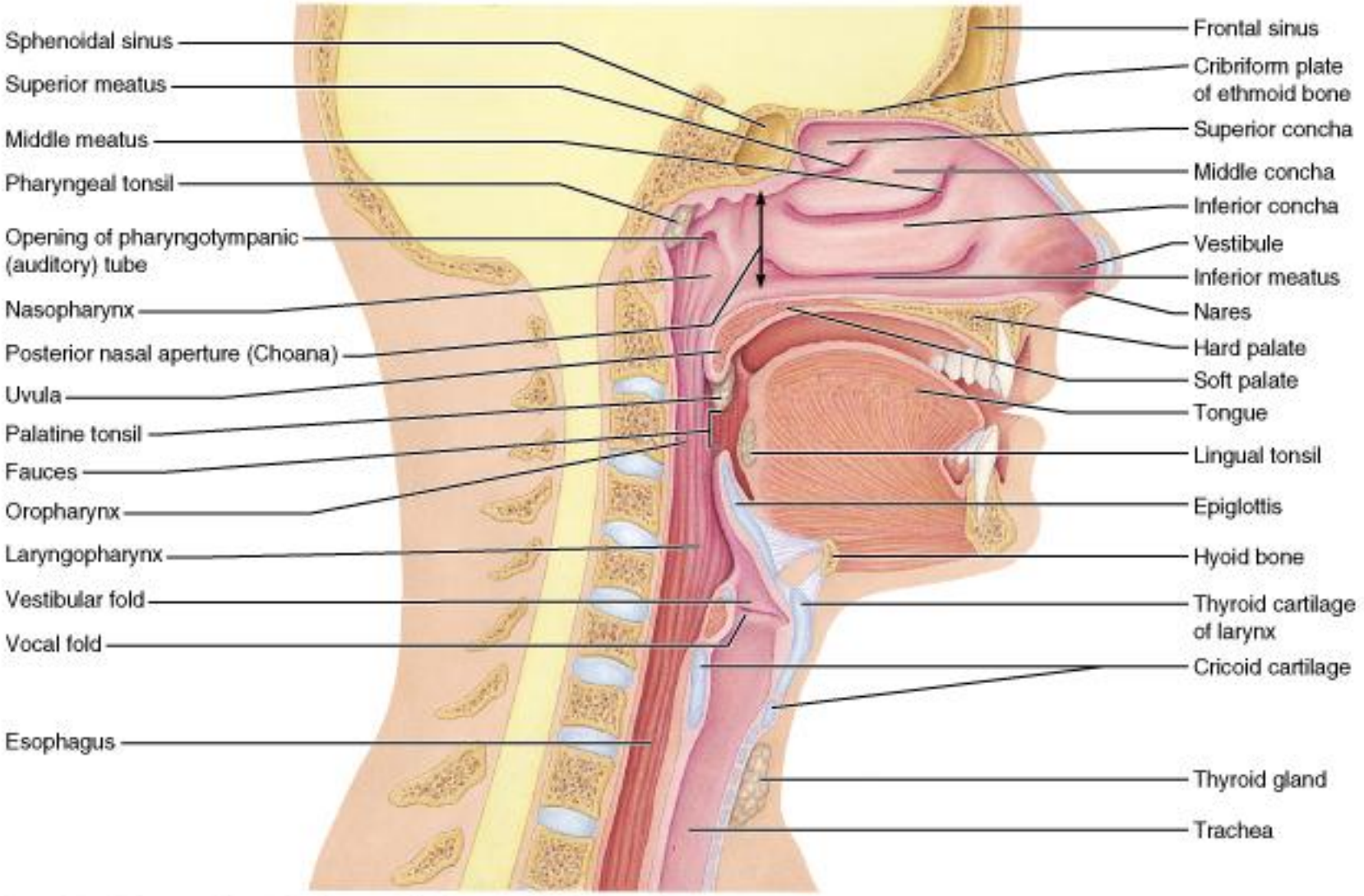
Respiratory System

Exchange O_2 and CO_2 between atmosphere and blood

1) **Conducting passages**
   - Nose/ nasal cavities
   - Pharynx
   - Larynx
   - Trachea
   - Bronchi (within lungs)
   - Bronchioles (within lungs)

2) **Respiratory passages** (within lungs)
   - Respiratory bronchioles
   - Alveolar ducts, sacs
   - Alveoli

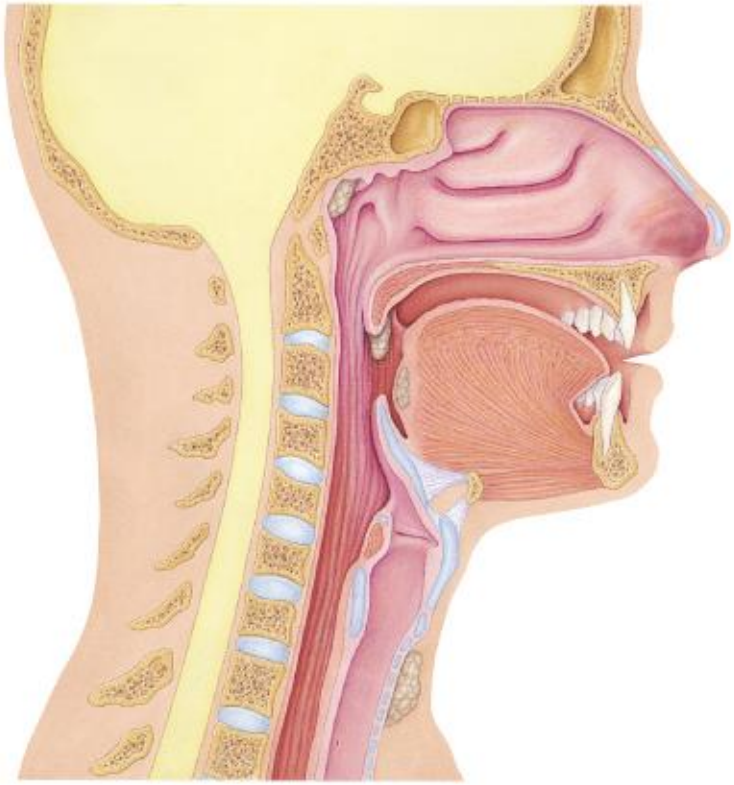




Nose – **Nasal Cavities**

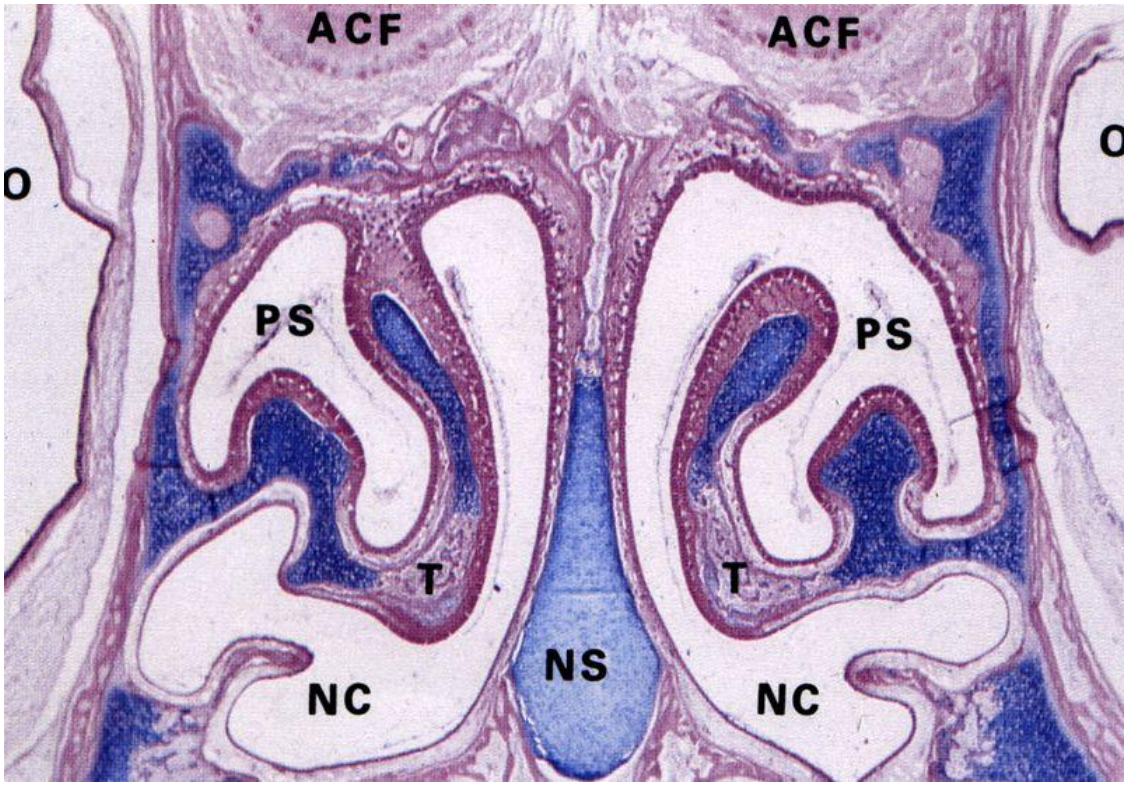
Function

1) Cleanse
2) Warm
3) Humidify air
4) Olfaction



Structure

- Bone
- Cartilage
- **Mucous membrane = mucosa**
  1) Epithelium
  2) Underlying connective tissue

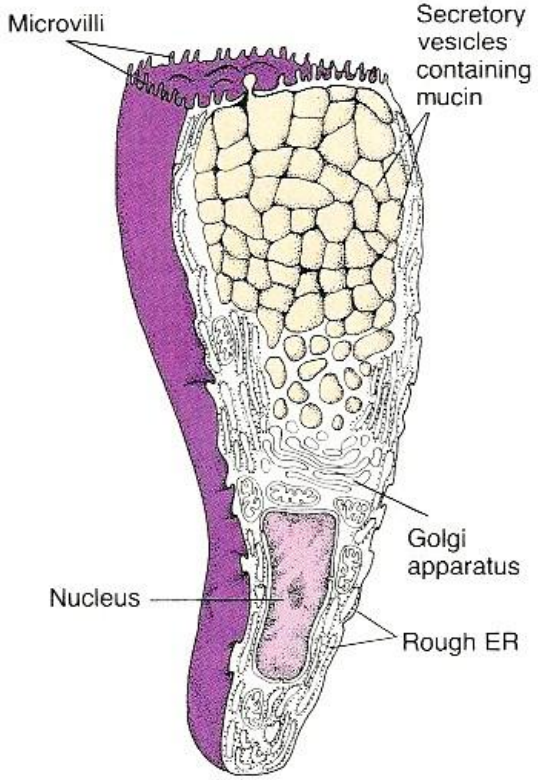


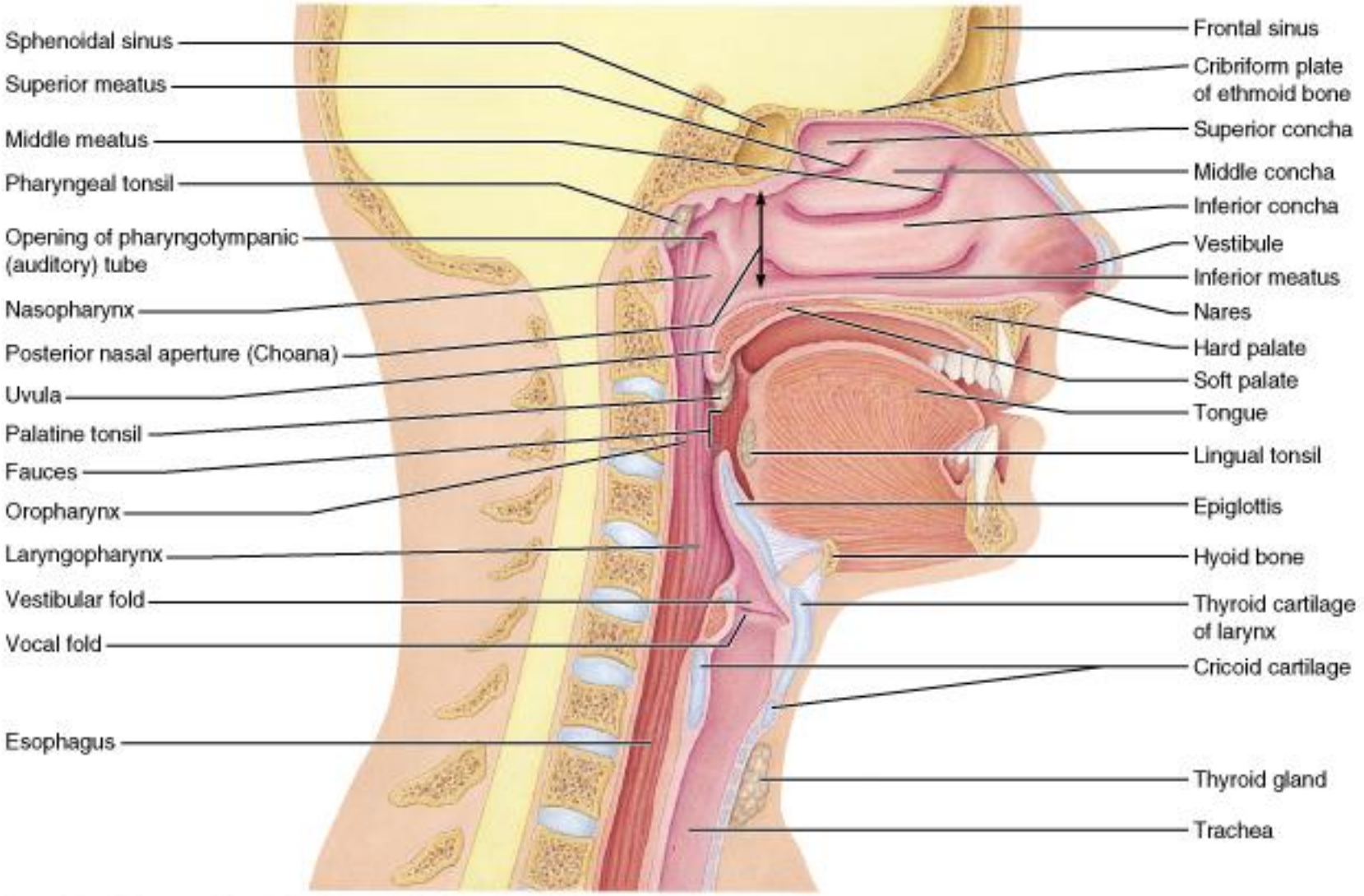
Mucous membrane = mucosa

1) Epithelium

Pseudostratified columnar epithelium with cilia and goblet cells

Goblet cells are mucus secreting cells shaped like goblets due to apical region filled with mucus





Pharynx

Lacks anterior wall; opens to nose, mouth, and larynx anteriorly

1) Nasal (naso-)pharynx
2) Oral (oro-)pharynx
3) Laryngeal (laryngo-)pharynx (hypophaynx)

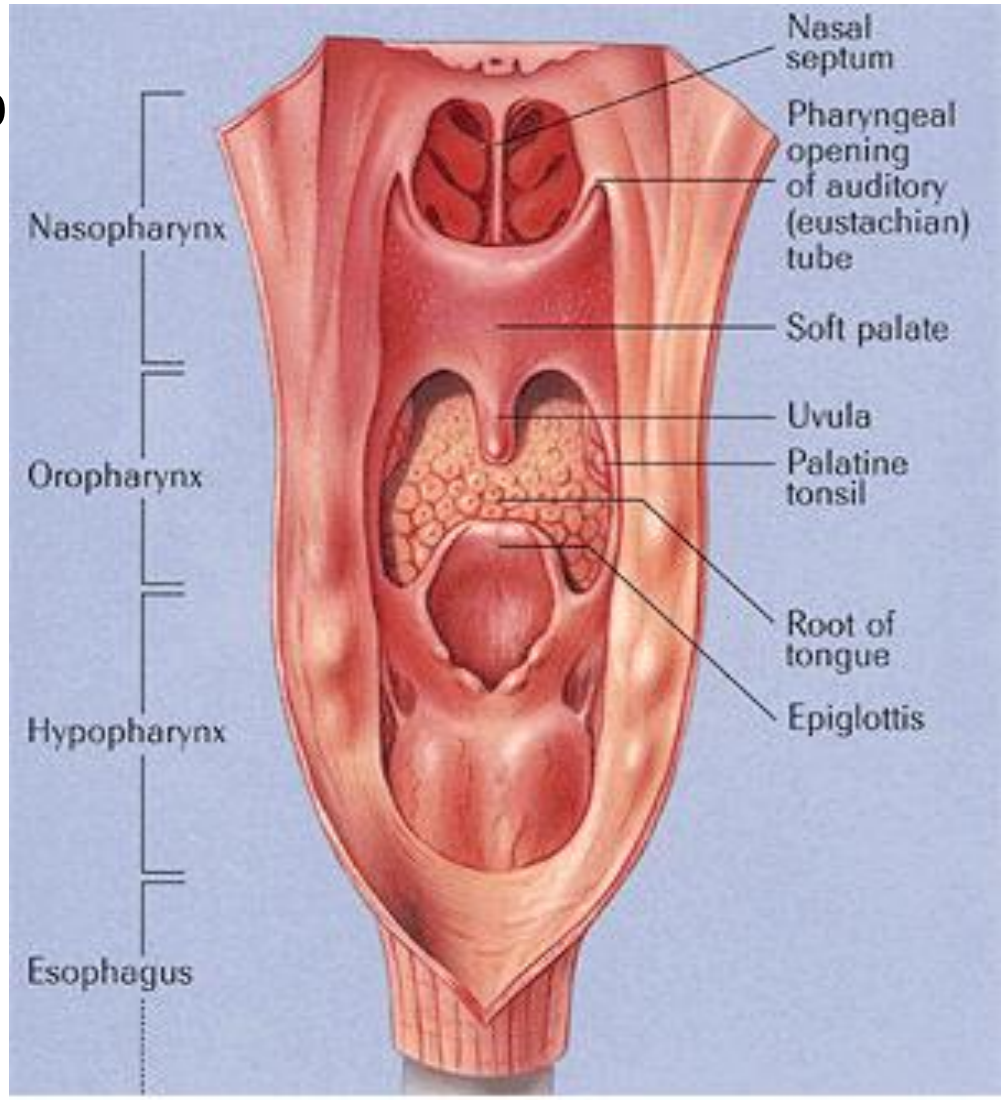
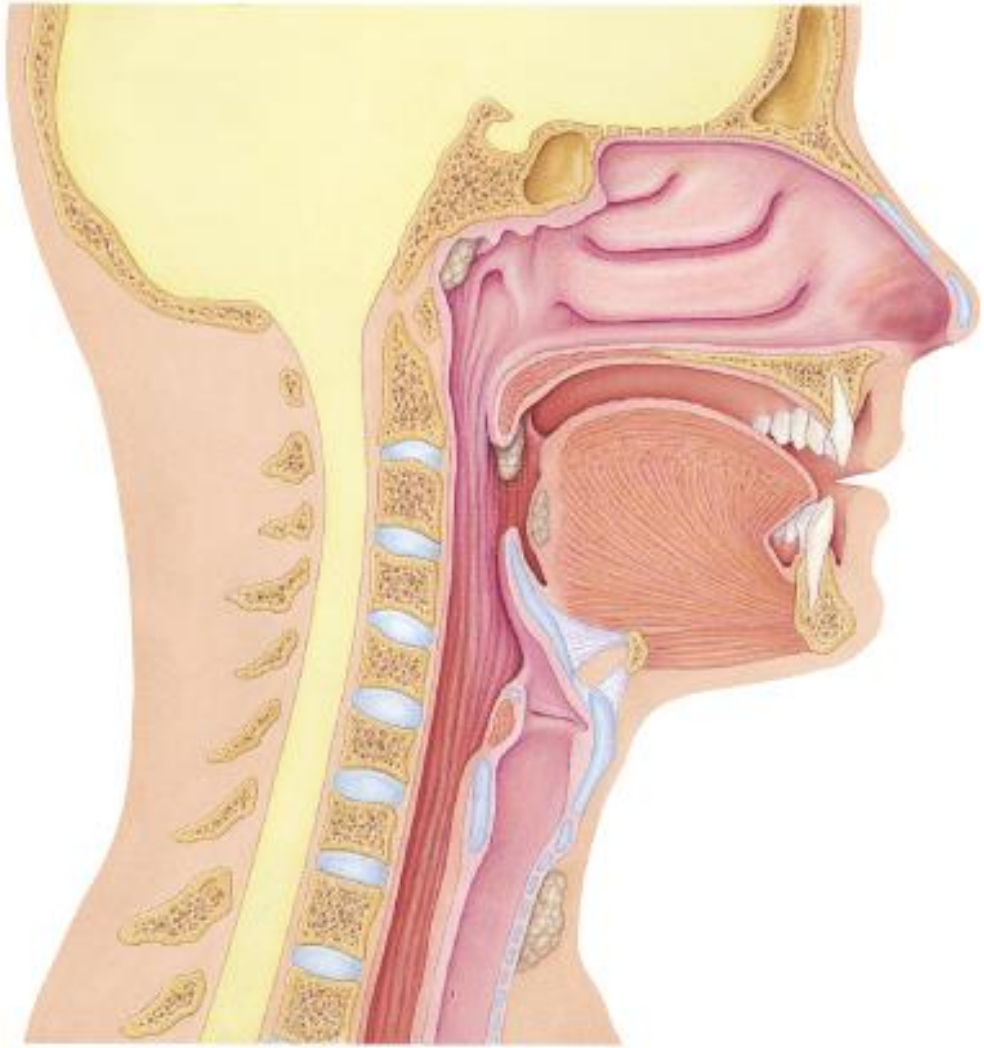
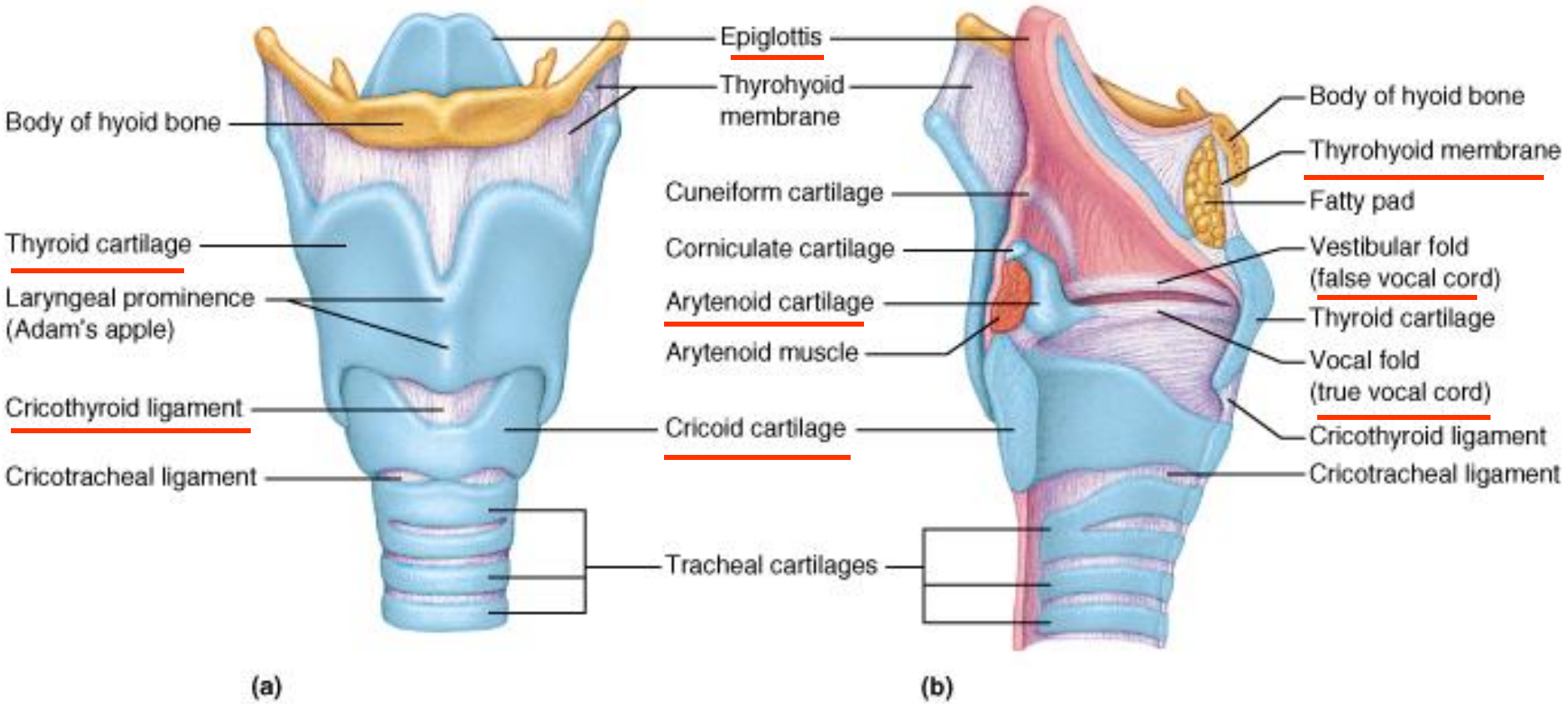


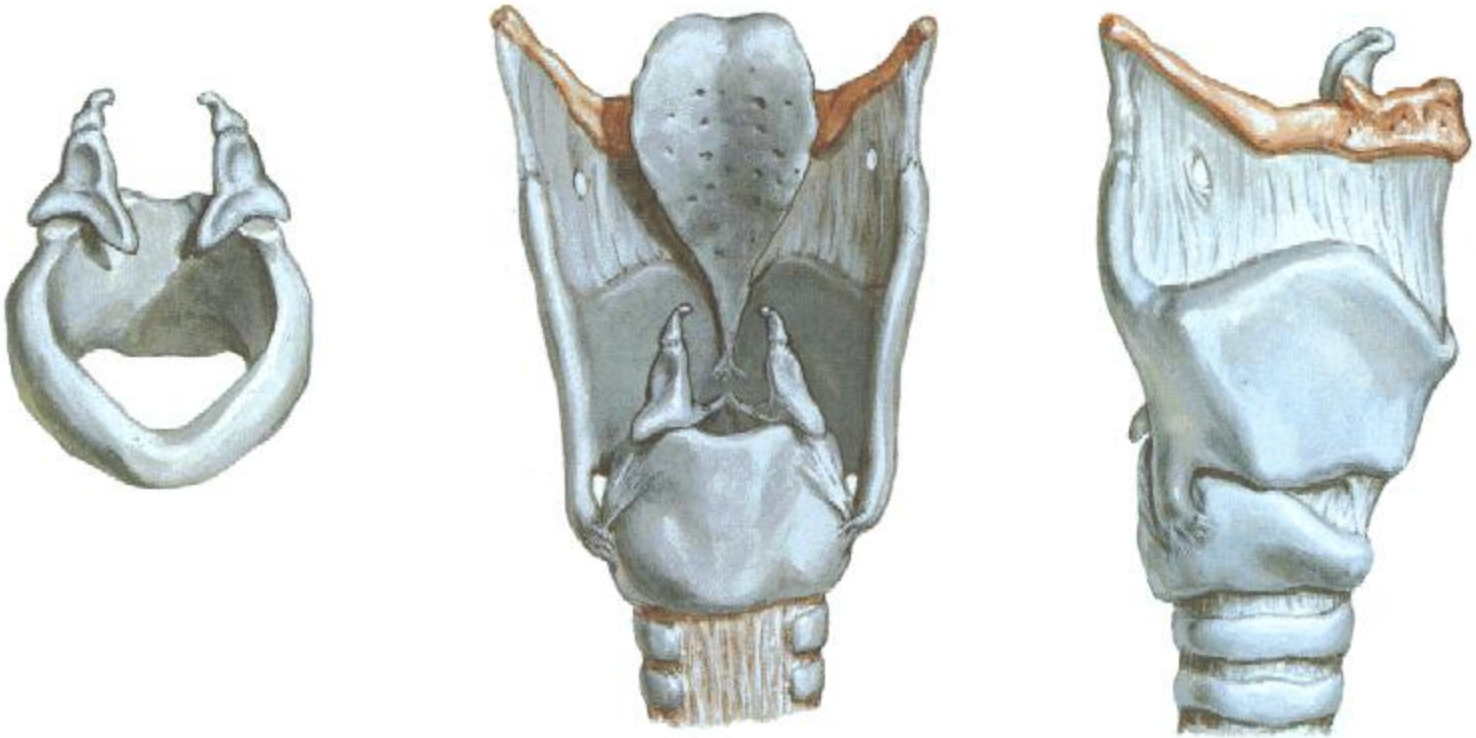
Image made available by a generous grant from Bristol-Myers Squibb



ıcation, Inc., publishing as Benjamin Cummings.

Larynx: Skeleton





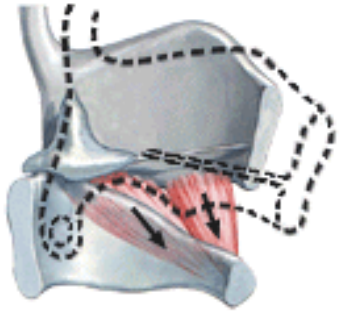
Major Movements of Larynx

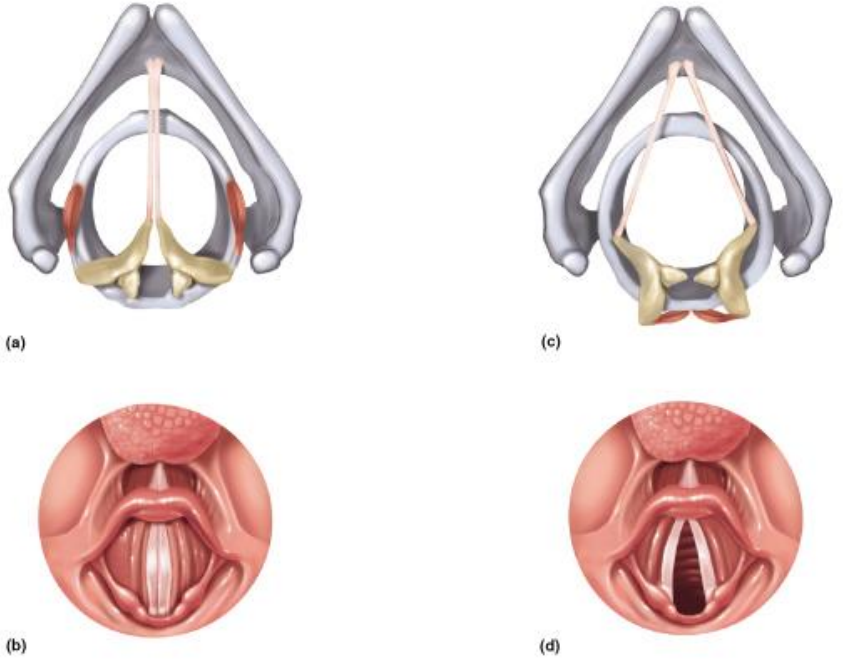
1) **Thyroid cartilage hinges on cricoid cartilage**

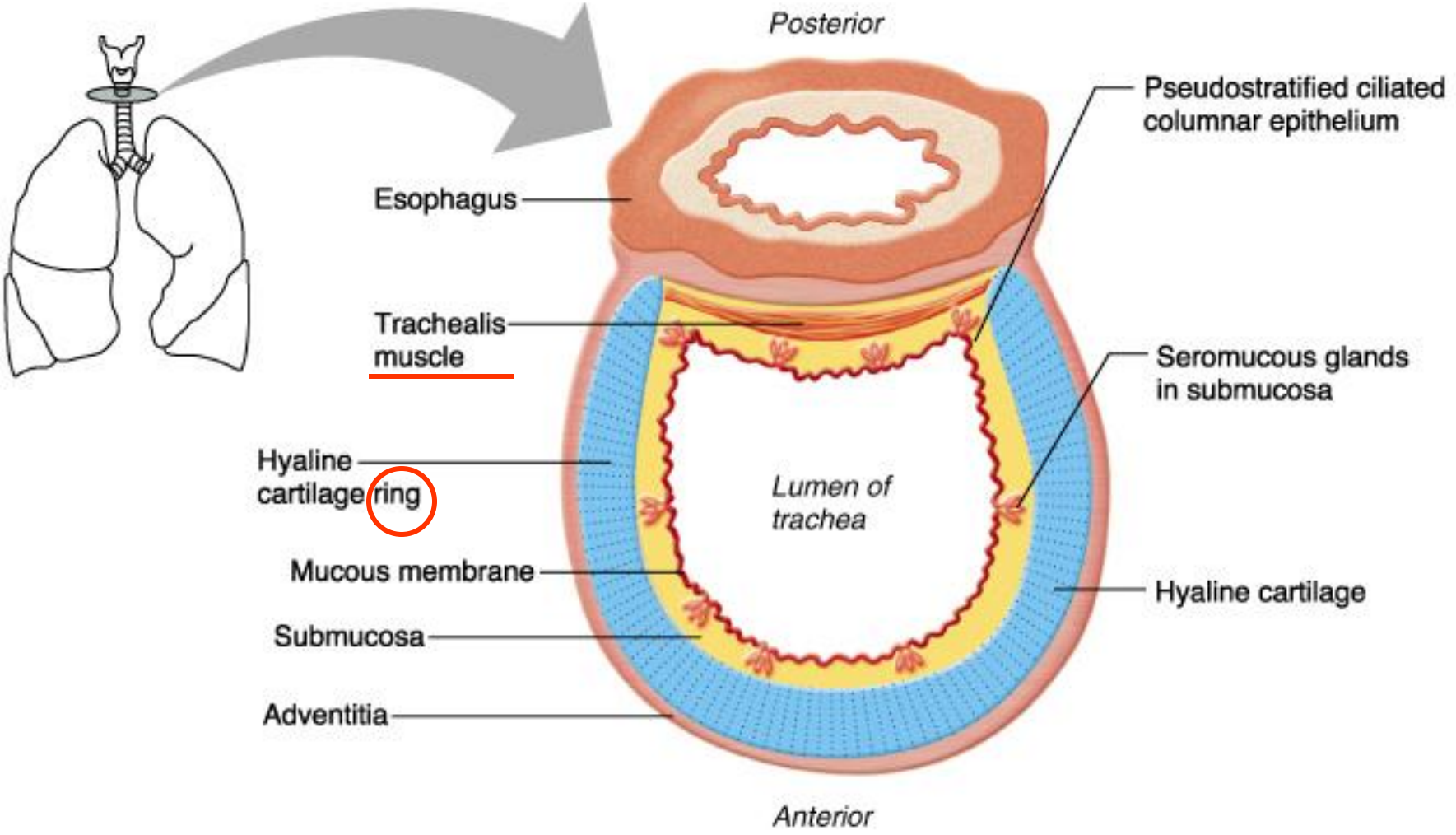
   Tenses or loosens the vocal cords

2) **Arytenoid cartilages pivot on cricoid cartilage**

   Open and close the glottis (space between the vocal cords)







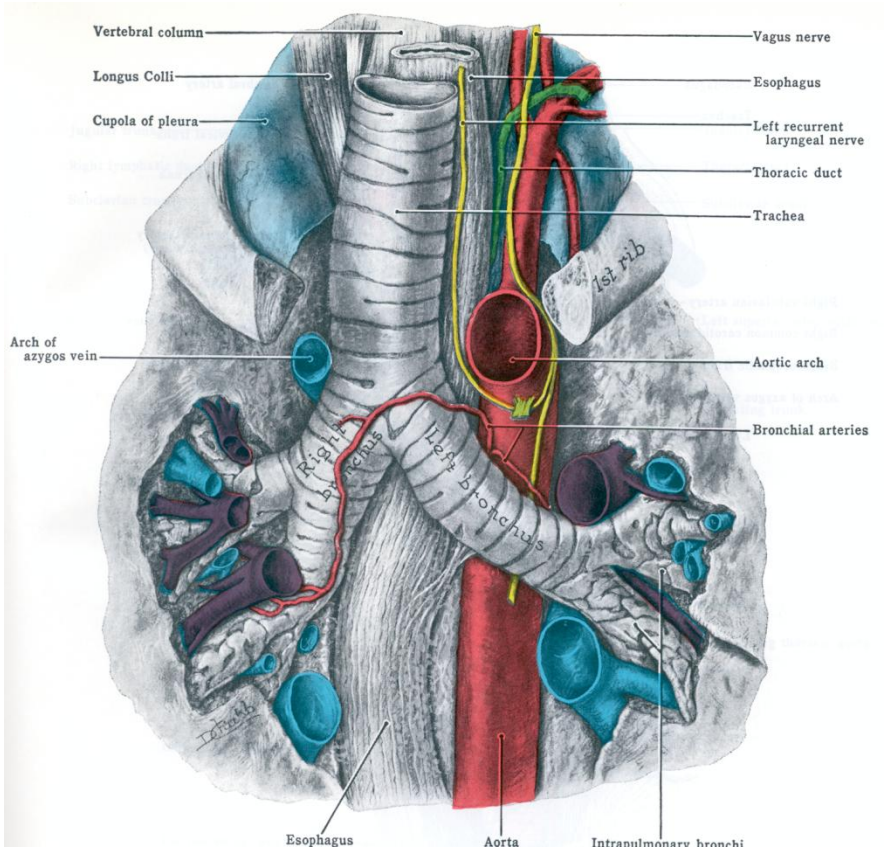
(a)

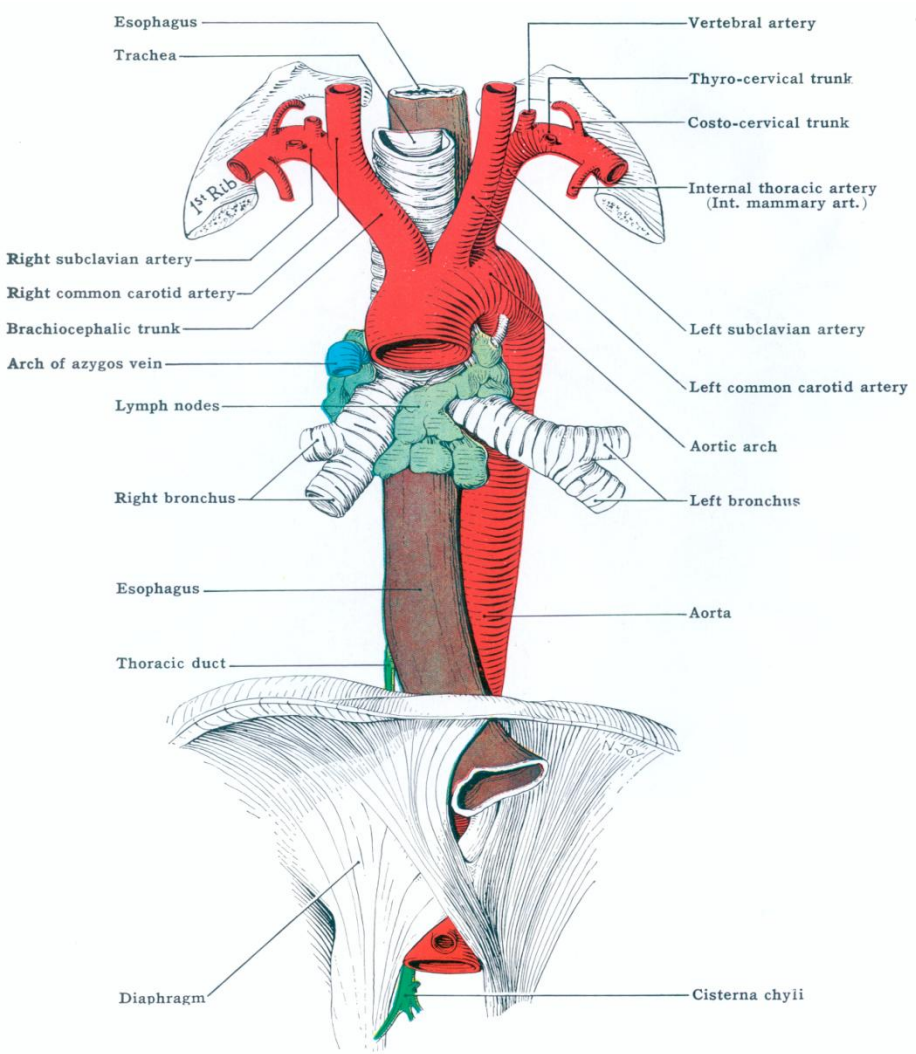
Trachea

10 to 12 cm (4-5”)

C6 to T4

2 to 2 ½ cm diameter





Primary Bronchi

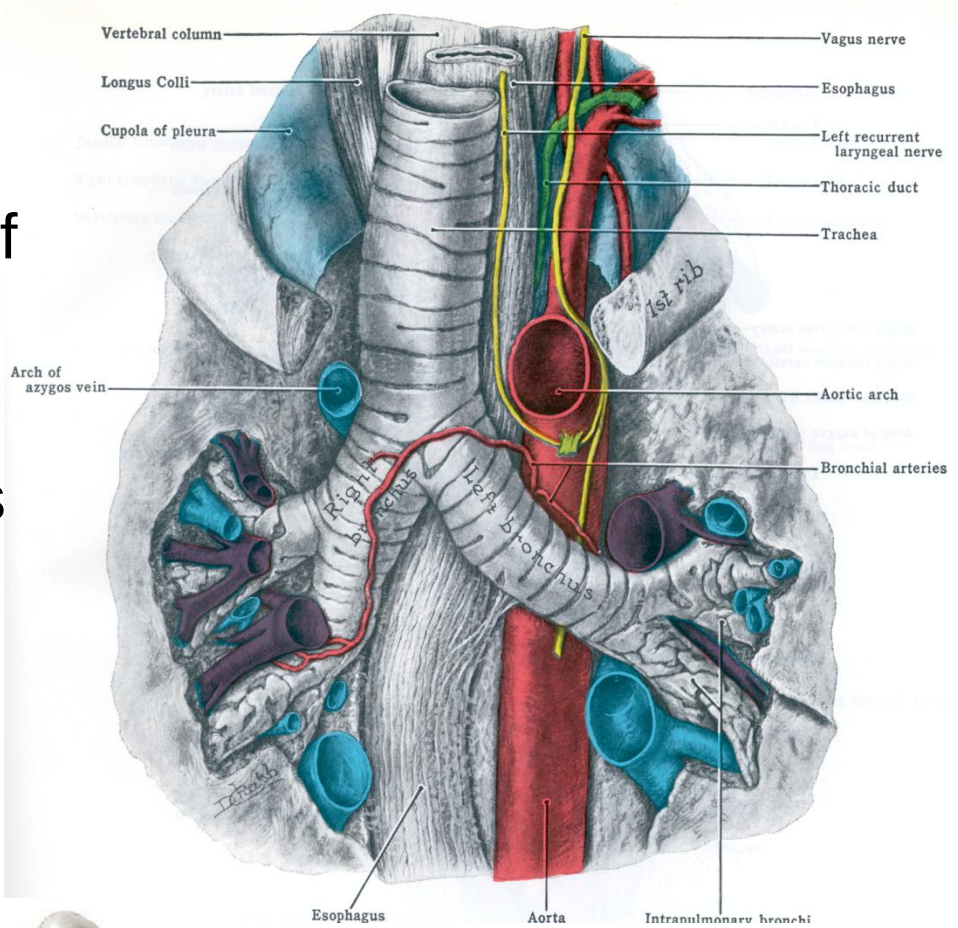
1) Right bronchus is shorter

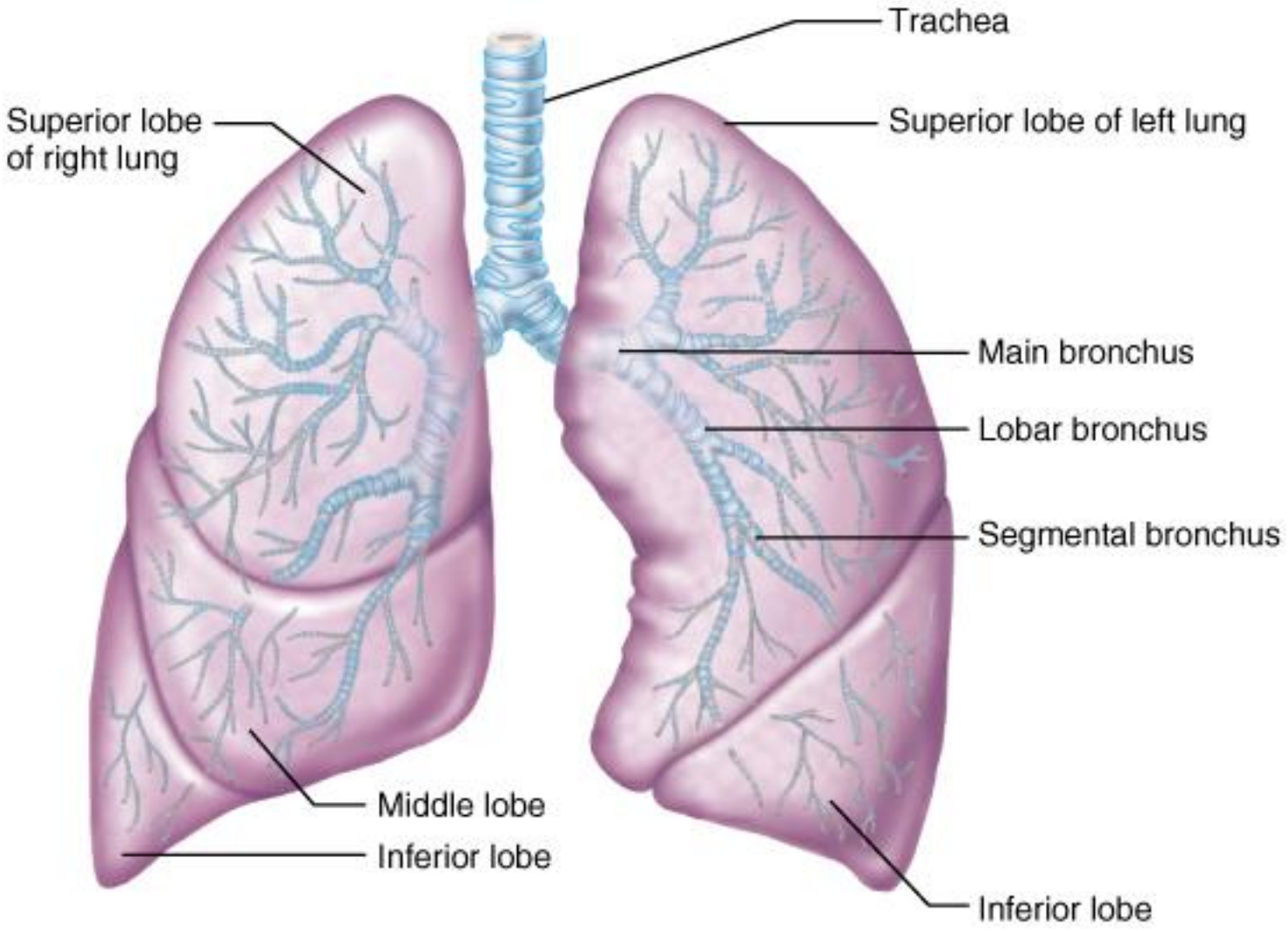
   Trachea is slightly to right of aorta

2) Right bronchus is wider

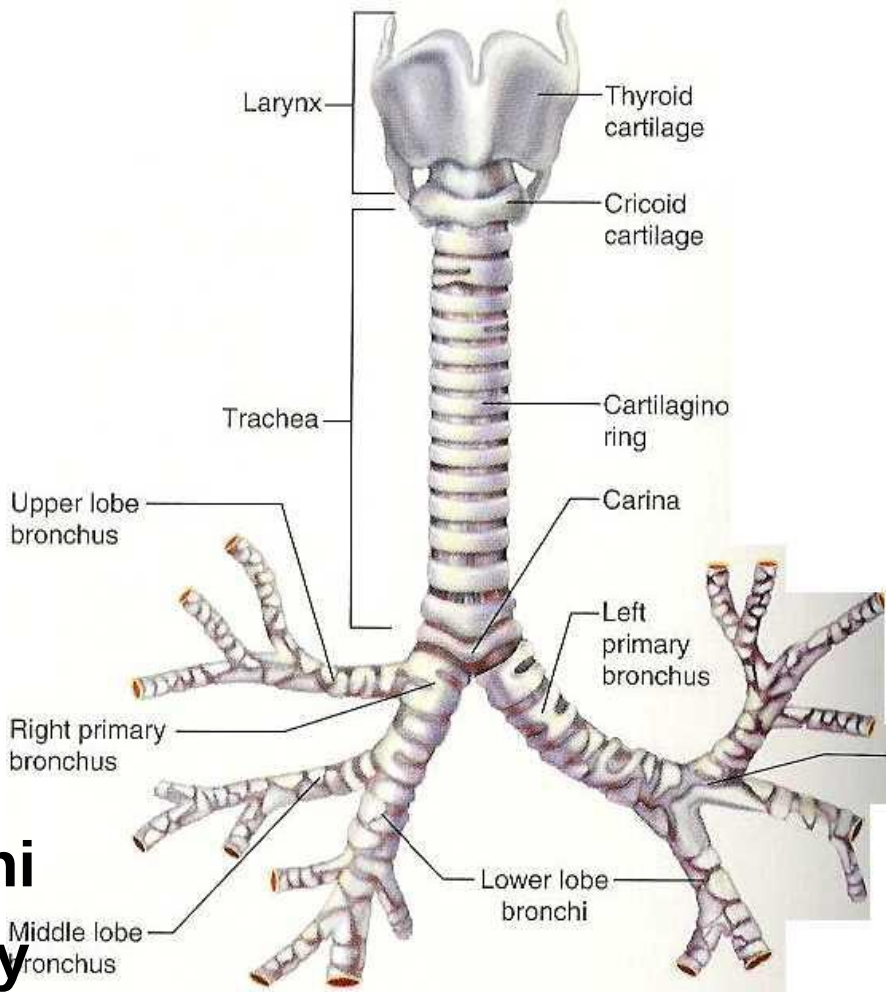
   Right lung is larger (heart is on the left)

3) Right bronchus has more direct path (more vertical)





1) **Primary bronchi**
   - Trachea bifurcates to 2;
     - Right and left
   - One / lung
   - Branch into:
2) **Secondary (lobar) bronchi**
   - One / **lobe** of lung
   - 3 on right, 2 on left
   - Branch into:
3) **Tertiary (segmental) bronchi**
   - One / **bronchopulmonary** segments



Bronchopulmonary Segments

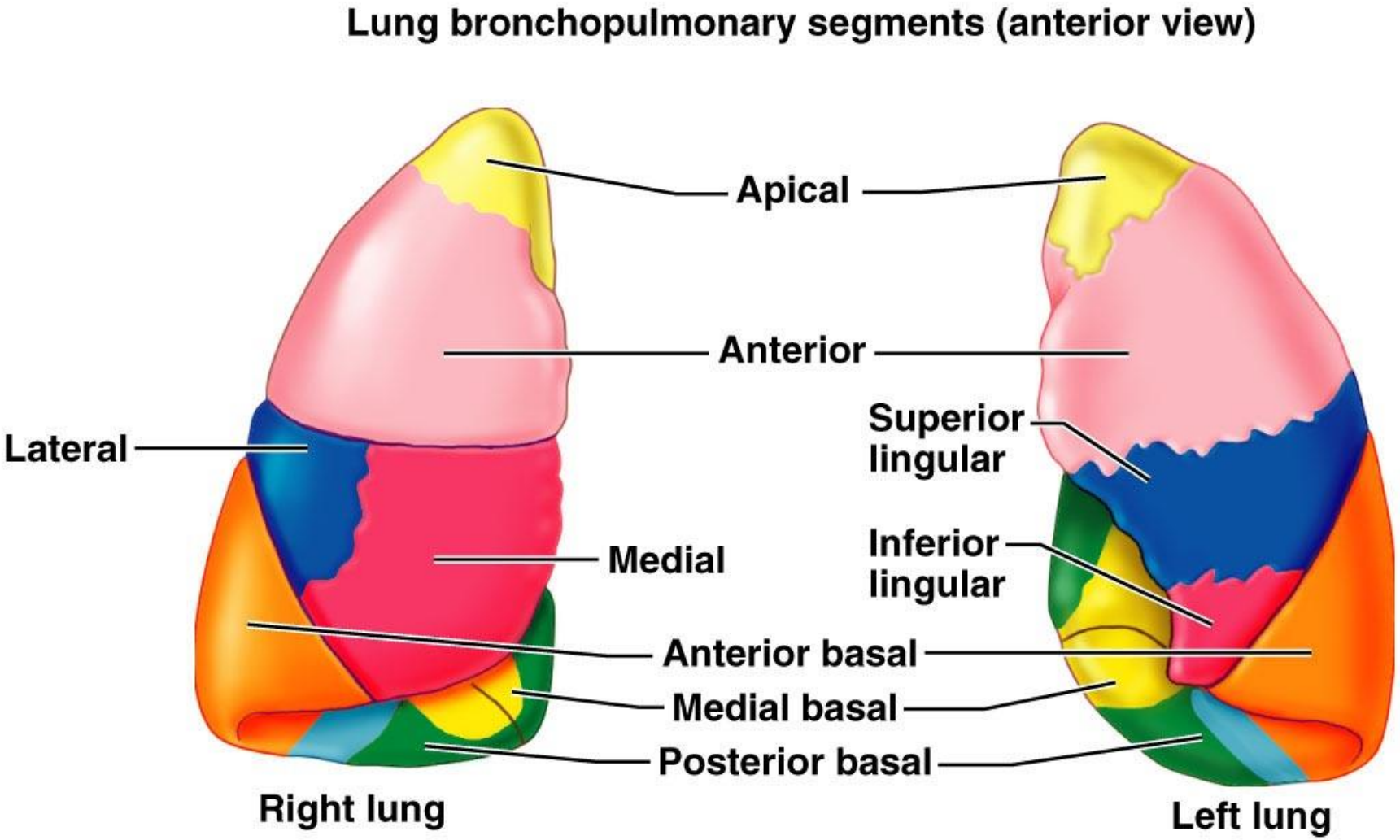
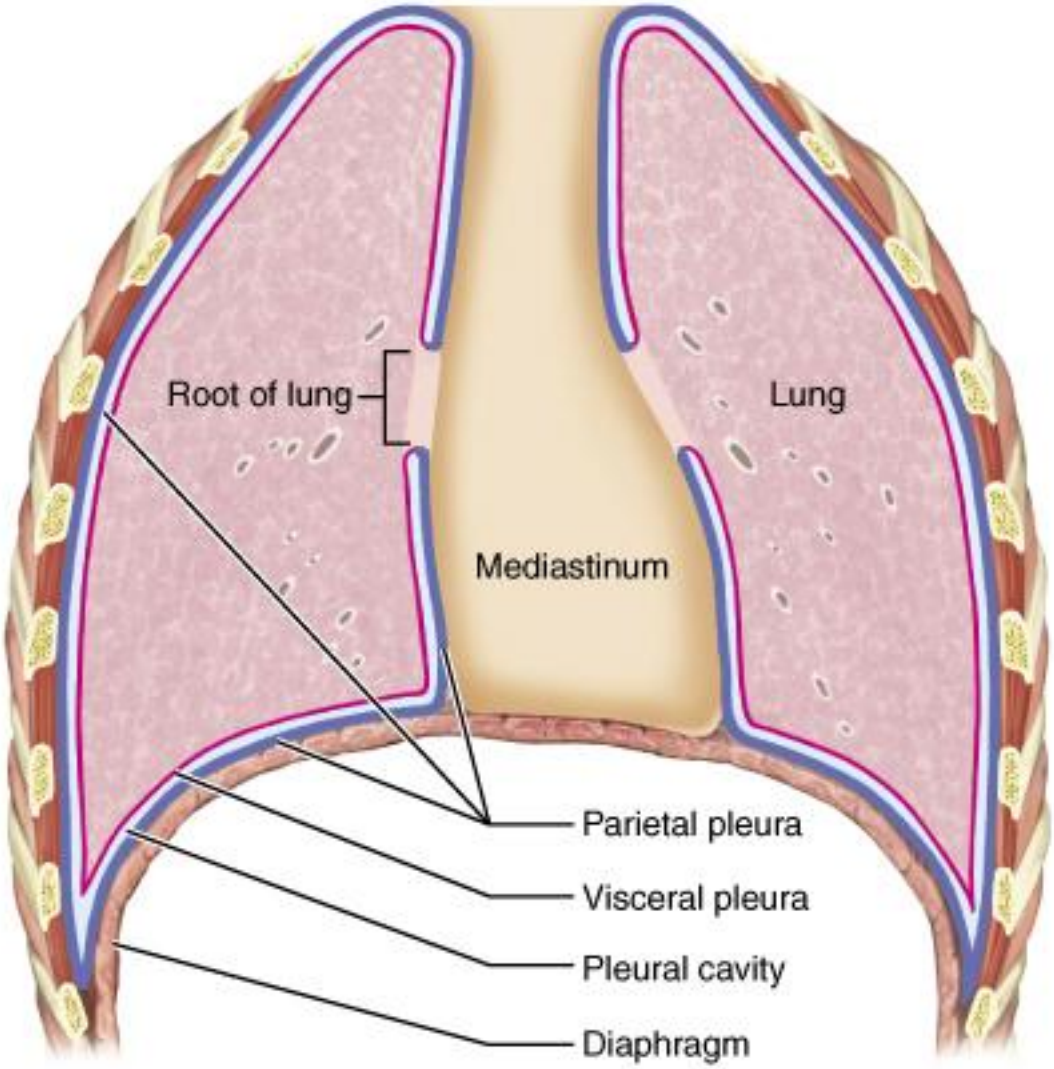
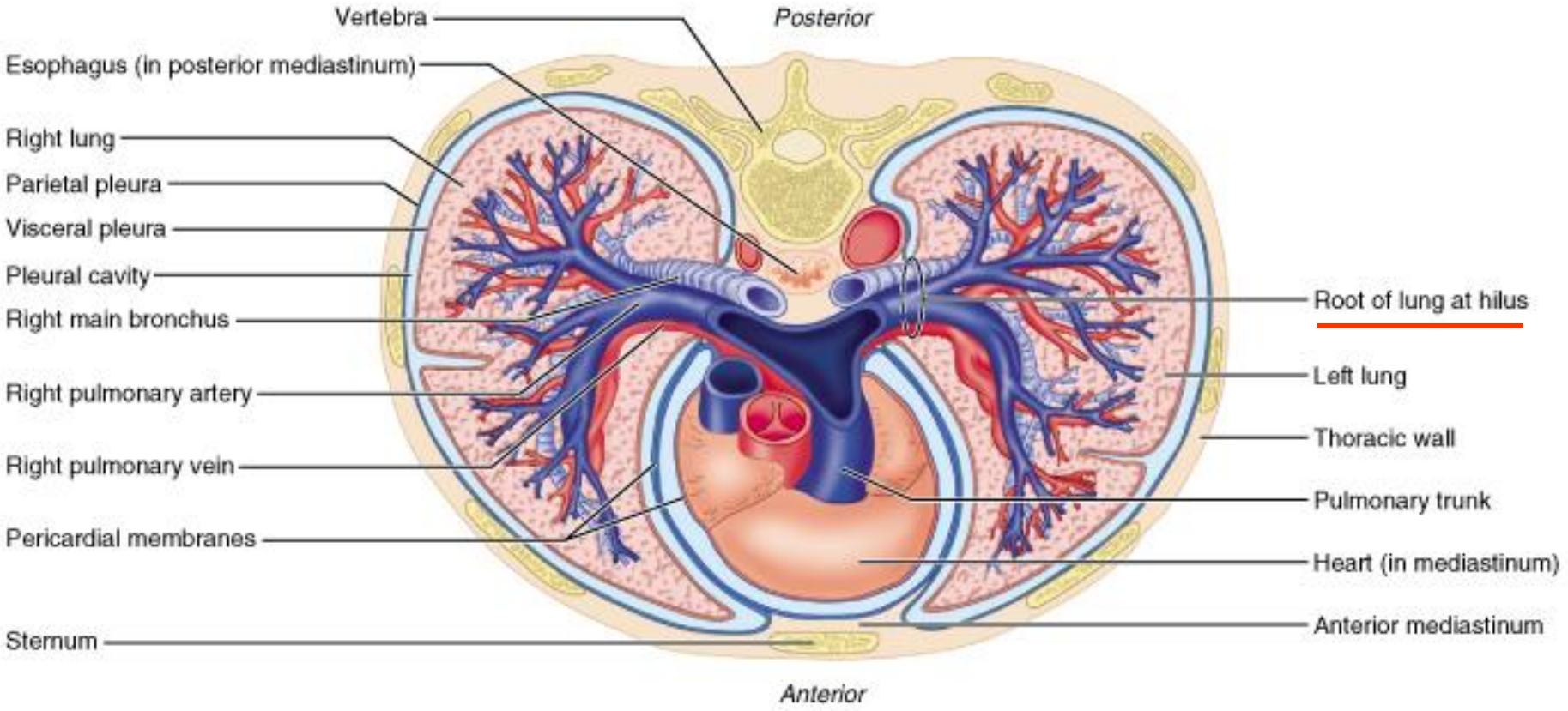
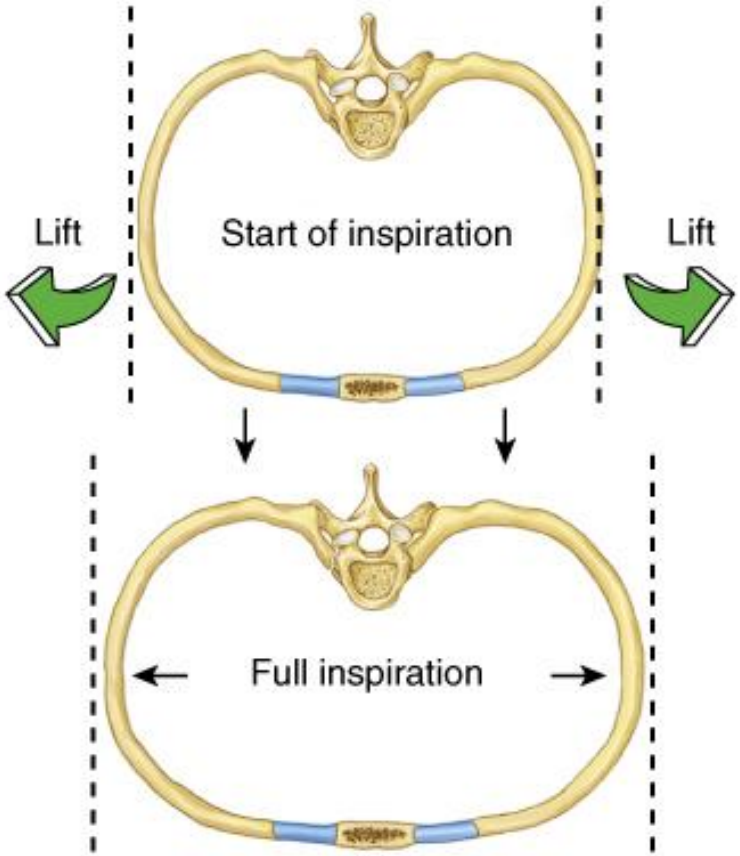


Figure 21.15 (1 of 2)

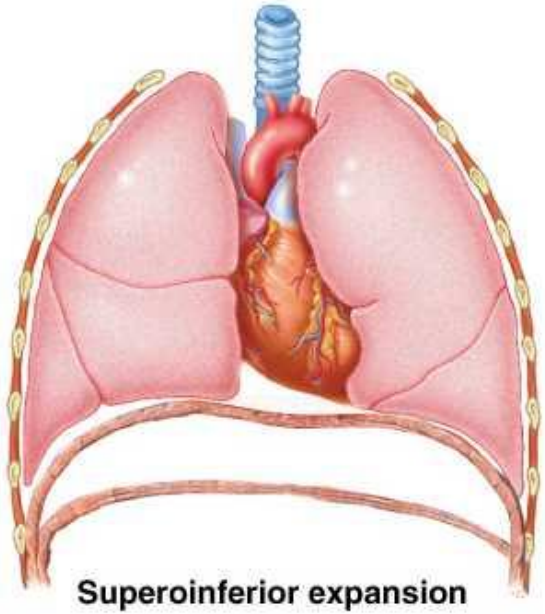




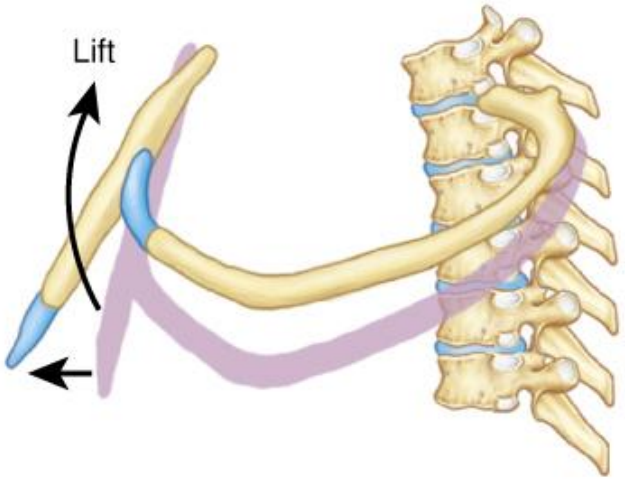
(b)



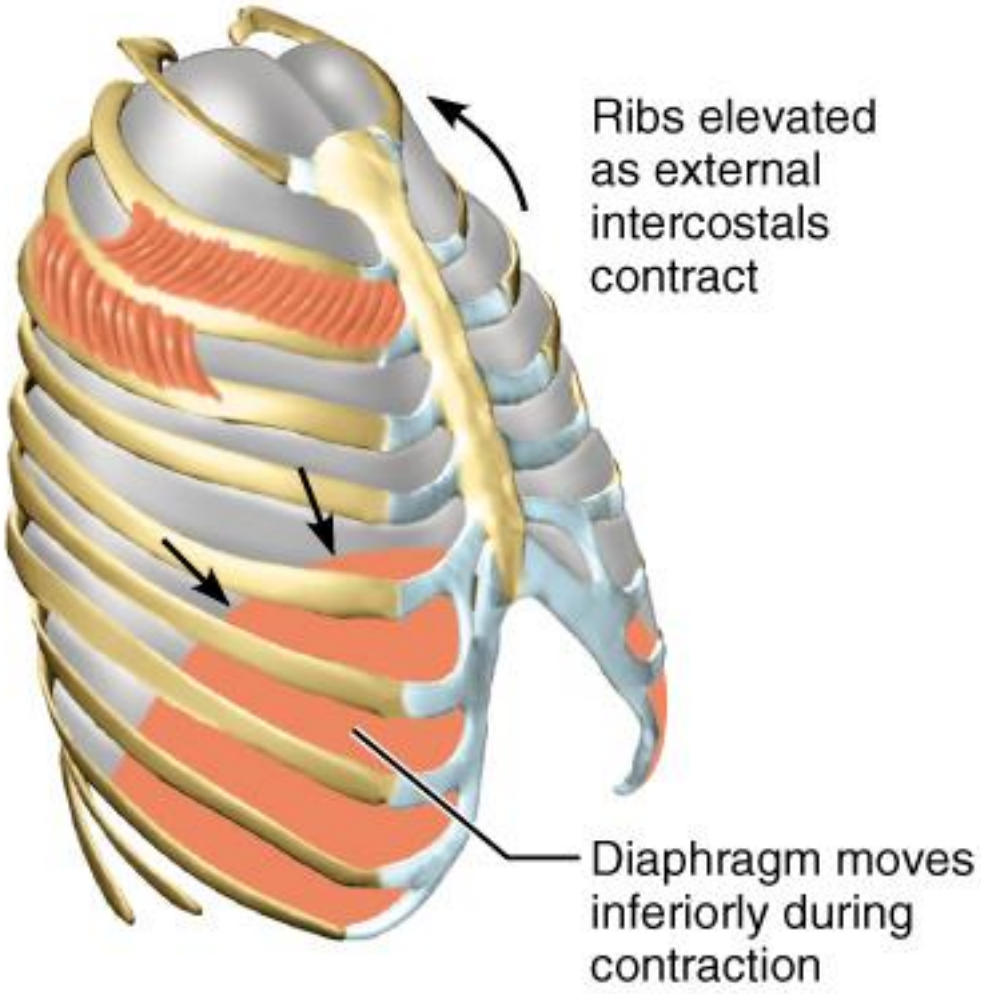
(b) Lateral expansion



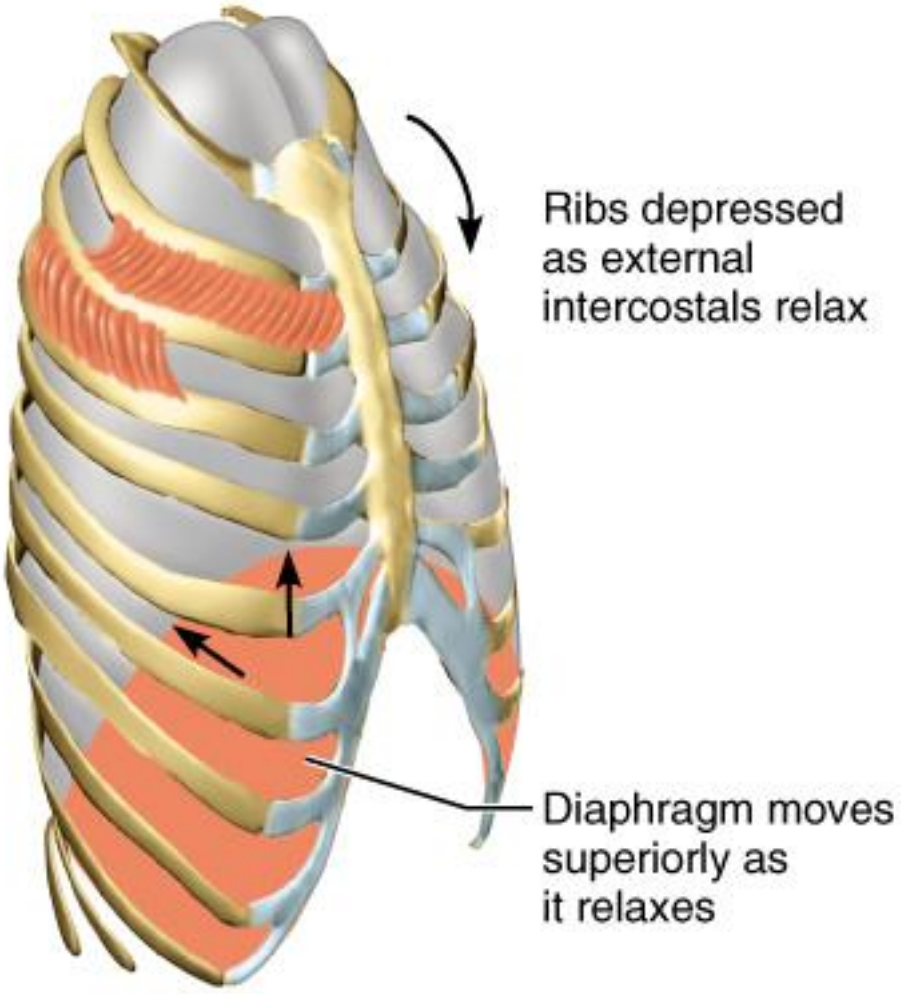
Superoinferior expansion



(c) Anteroposterior expansion

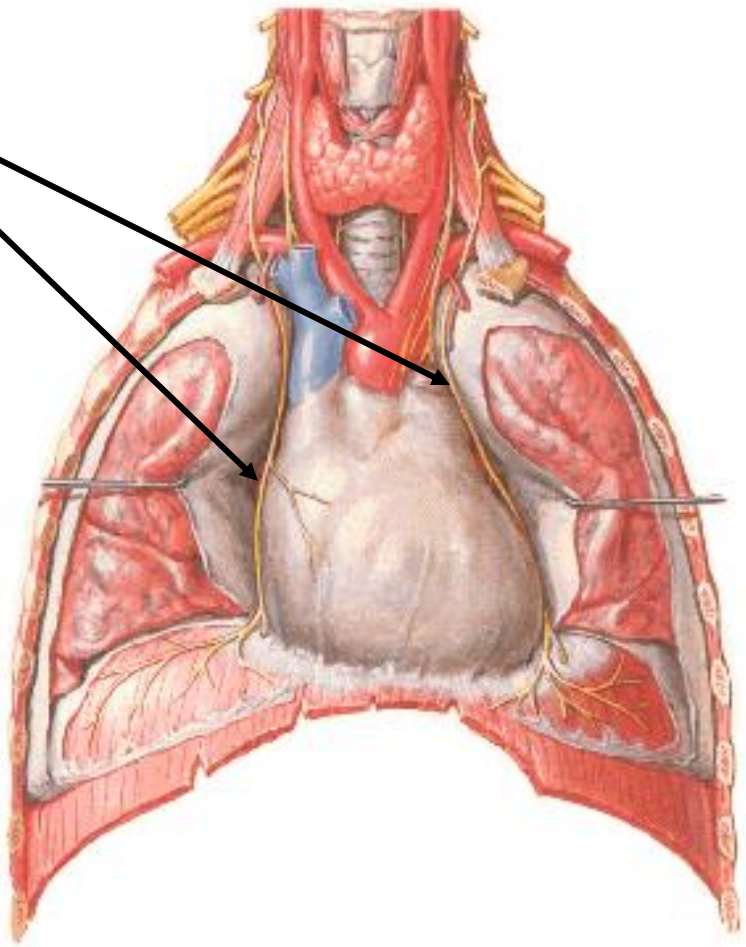


(d) Inspiration



Expiration

Phrenic nerve (C3,4,5)
from cervical plexus
innervates diaphragm



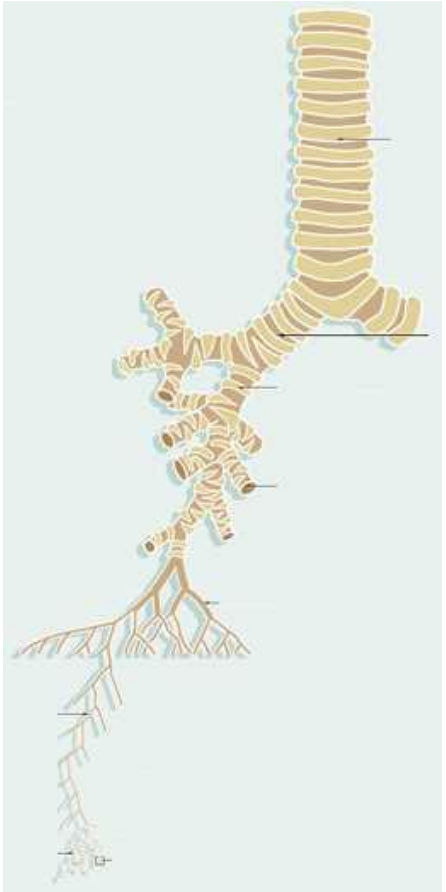
1) **Extrapulmonary bronchi**

   Same structure as trachea

2) **Intrapulmonary bronchi**

   Cartilage in spirals and plaques

   Layer of smooth muscle internal to cartilage



Layers of bronchial wall

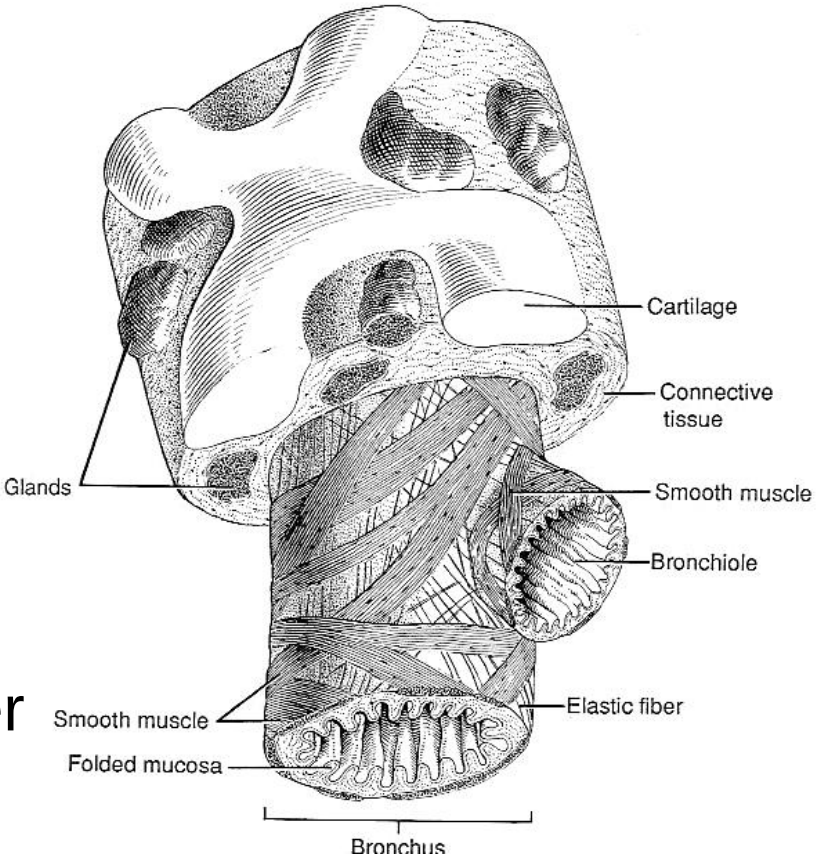
1) Mucosa – same
2) Layer of smooth muscle
3) Submucosa – CT
4) Cartilage in plaques
5) Elastic fibers in submucosa

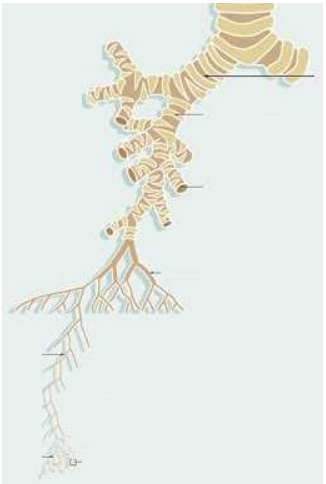
Bronchi get progressively smaller

As decrease size of bronchi >

    1) Increase in smooth muscle
    2) Decrease in cartilage

When cartilage gone = bronchiole





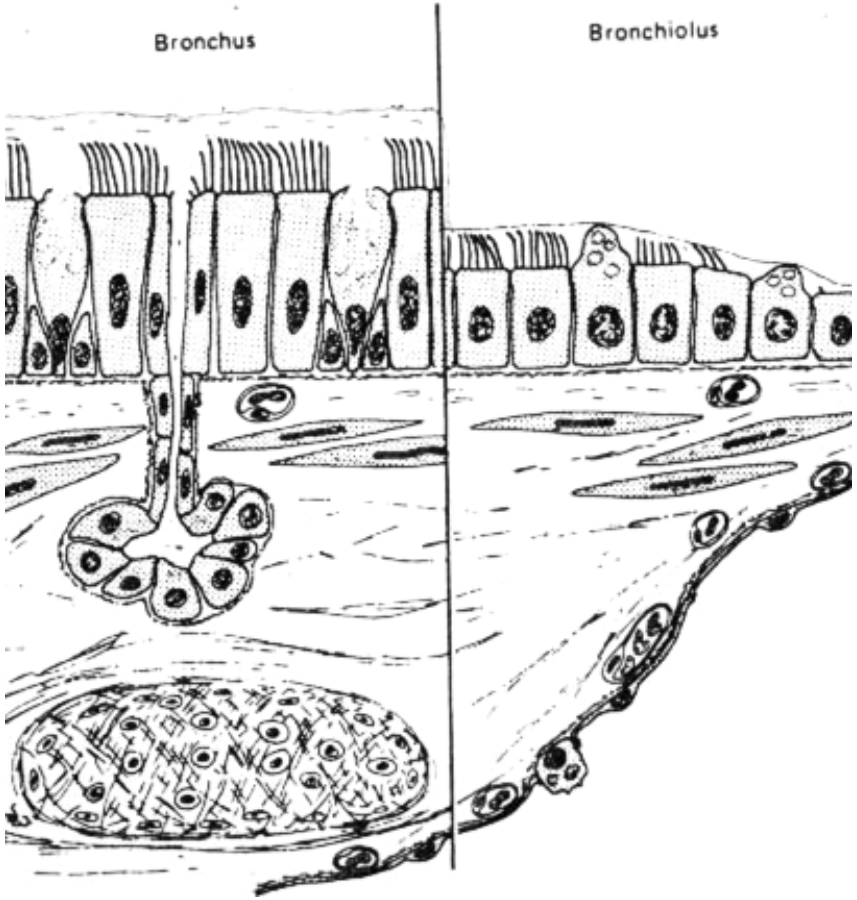
Bronchioles

No cartilage

Complete ring of smooth muscle, also elastic fibers

Epithelium = simple columnar > simple cuboidal, no goblet cells

Smallest = **Terminal bronchioles**



Respiratory Passages

Respiratory bronchioles

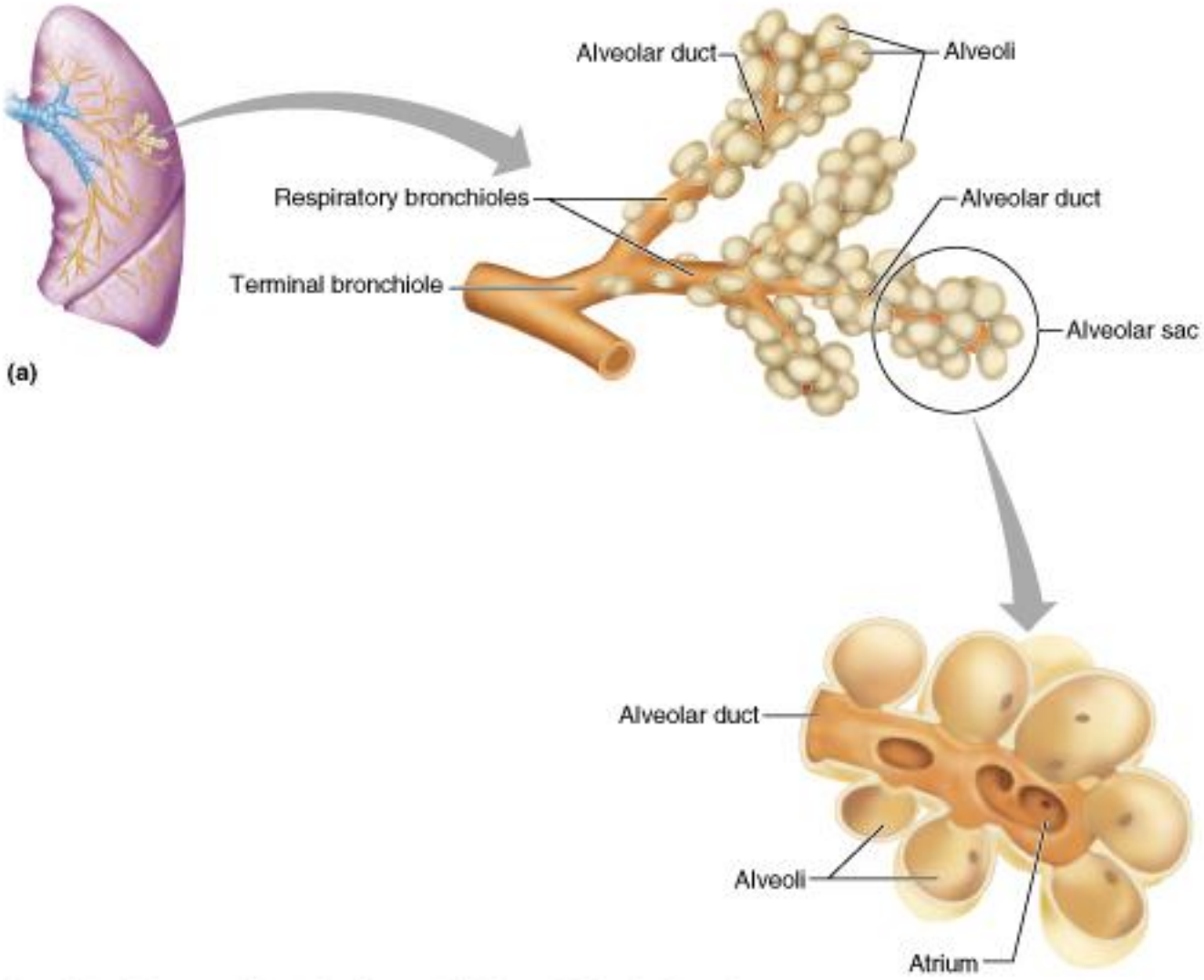
- Alveoli along wall

Alveolar ducts

- Alveoli increase in density until solid wall of alveoli

Alveolar sac

- Blind end of passages
- Totally lined by alveoli



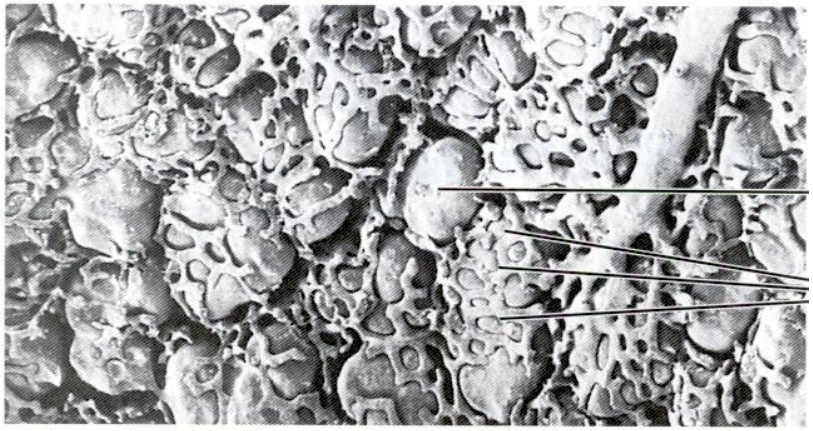
Alveolus

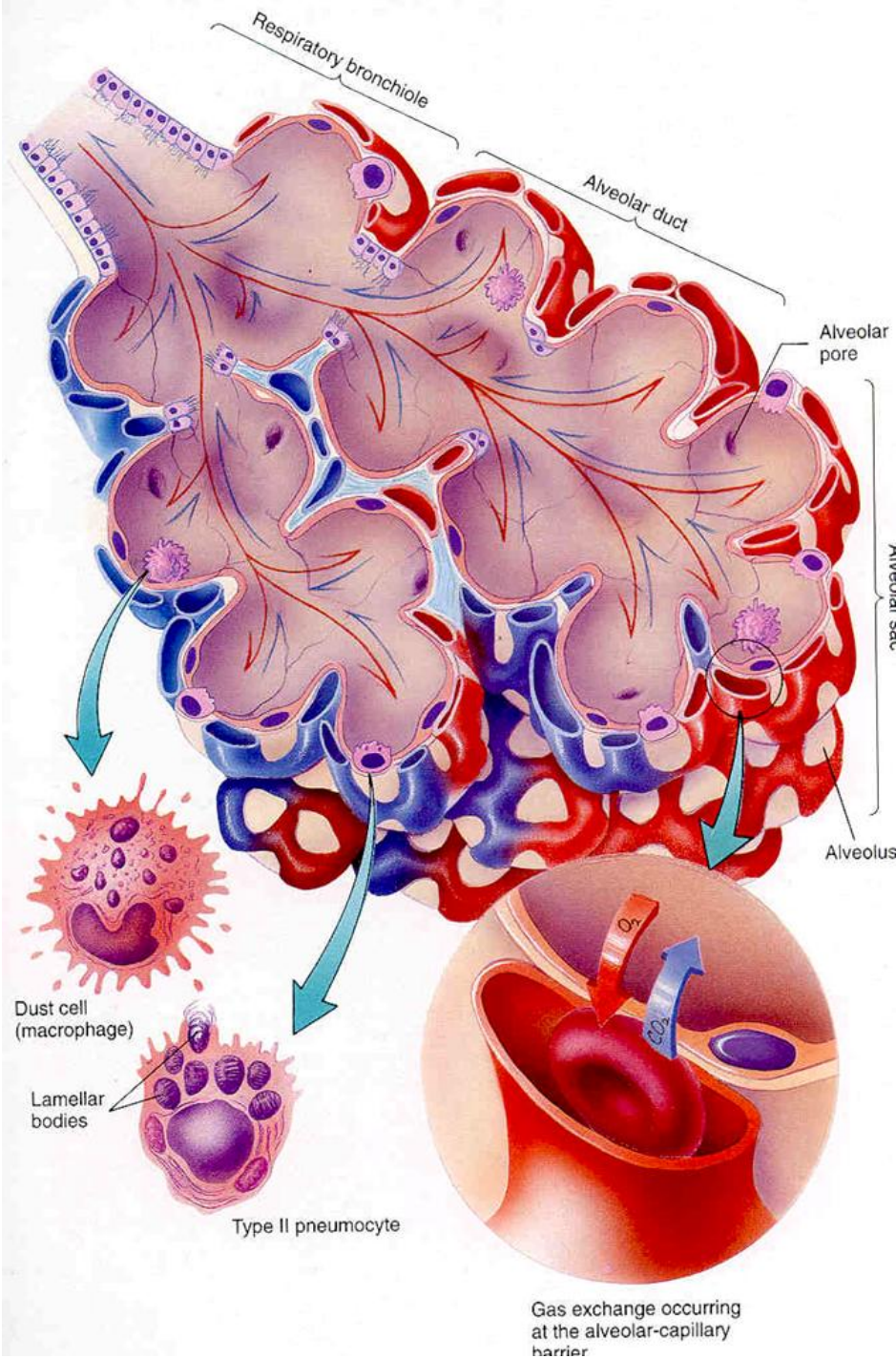
300 million alveoli

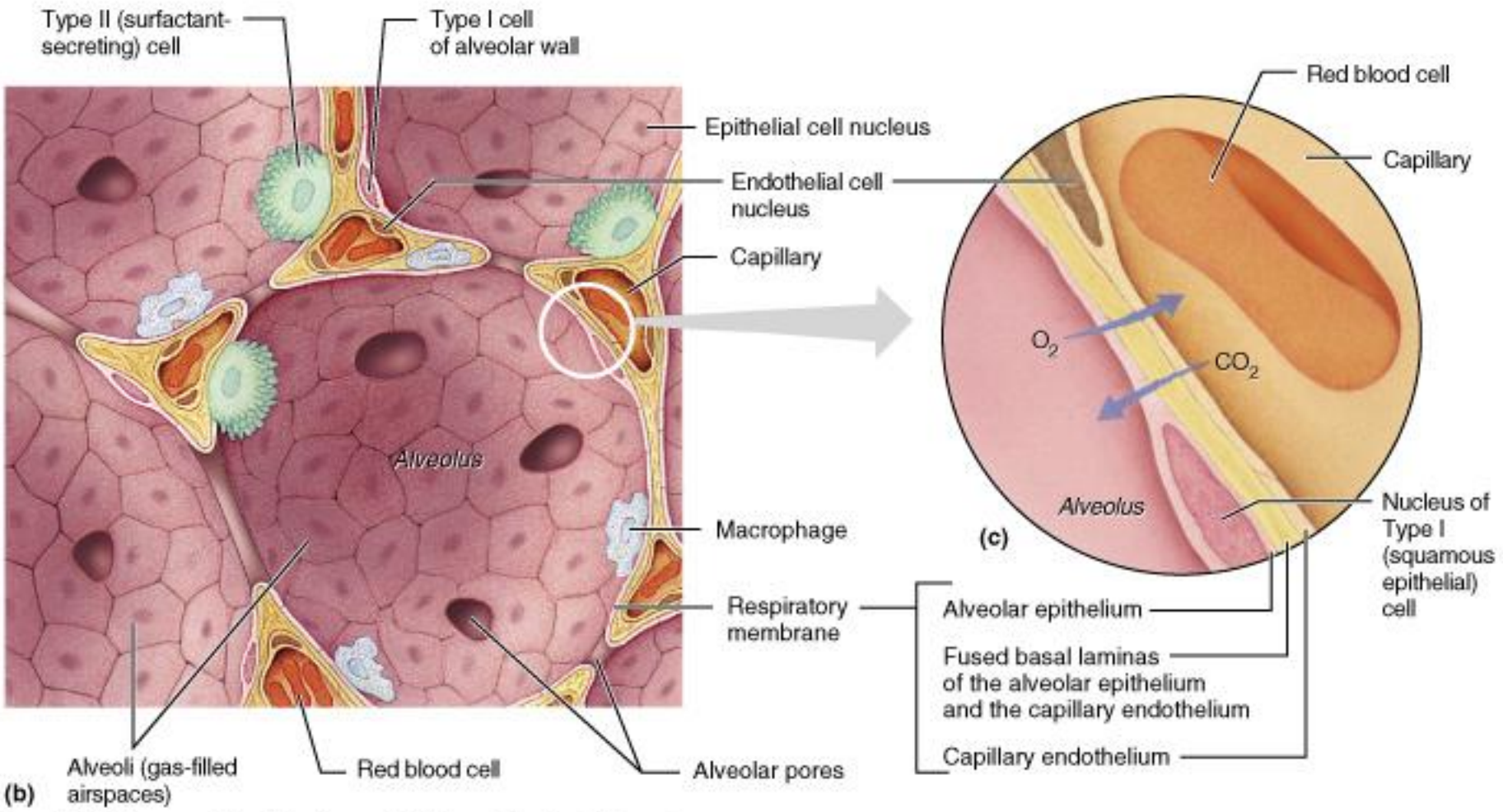
70 to 80 square meters of surface area

Thin walled sacs (<1 micron)

Back to back with capillary network



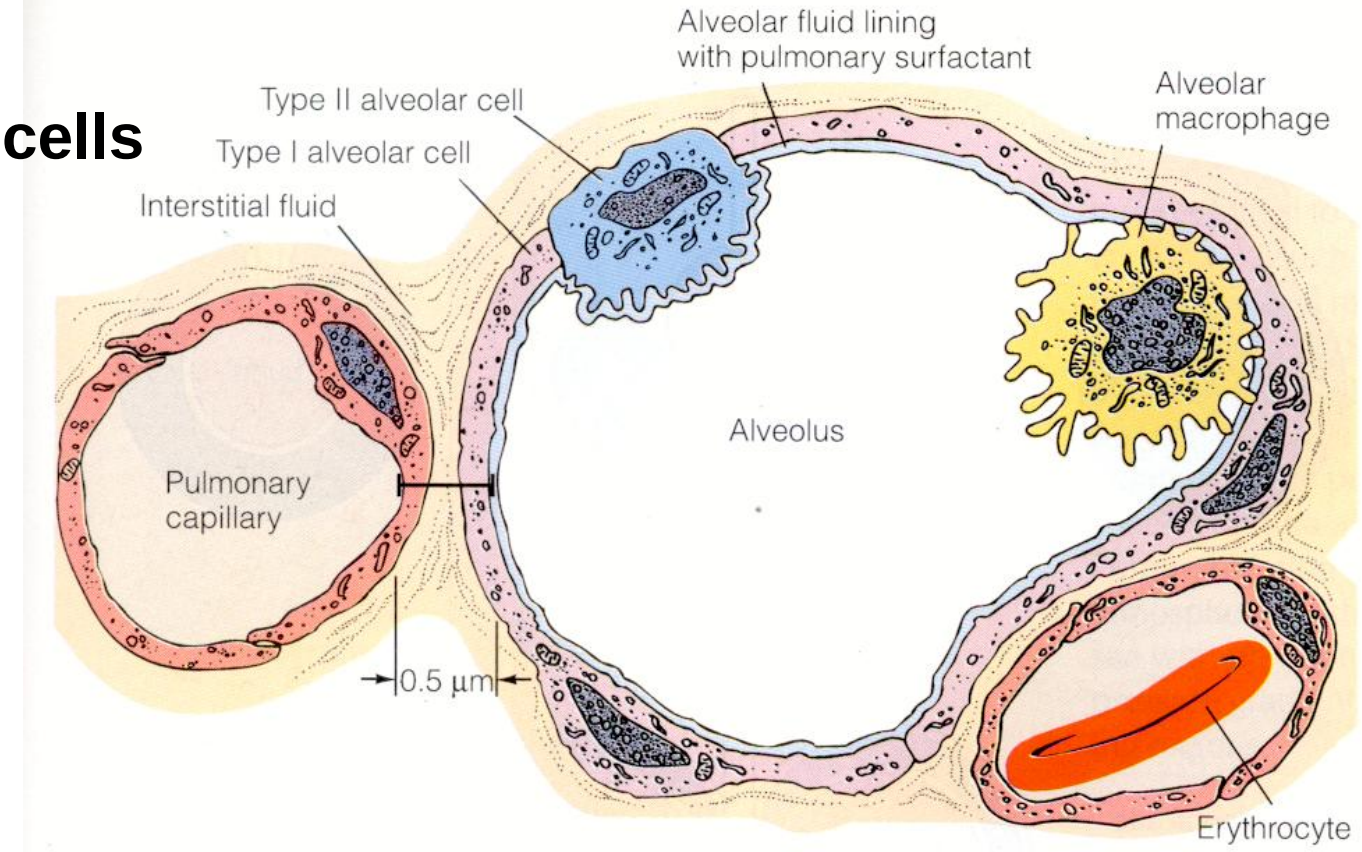




Alveolar wall

1) **Type I pulmonary epithelial cells**
2) **Type II pulmonary cell = great alveolar cells = septal cells**

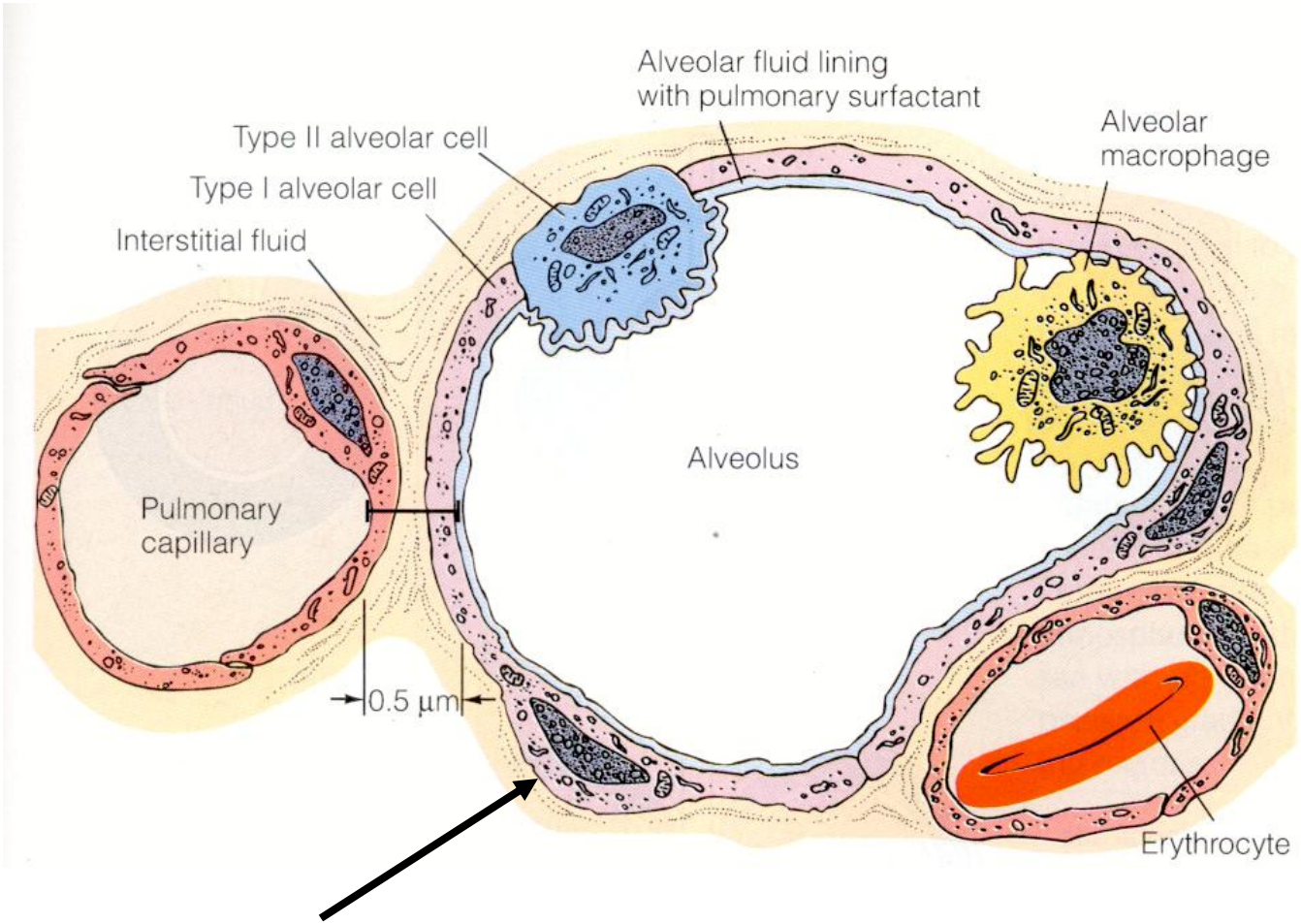
Dust cells



Alveolar wall

1) Type I pulmonary epithelial cells

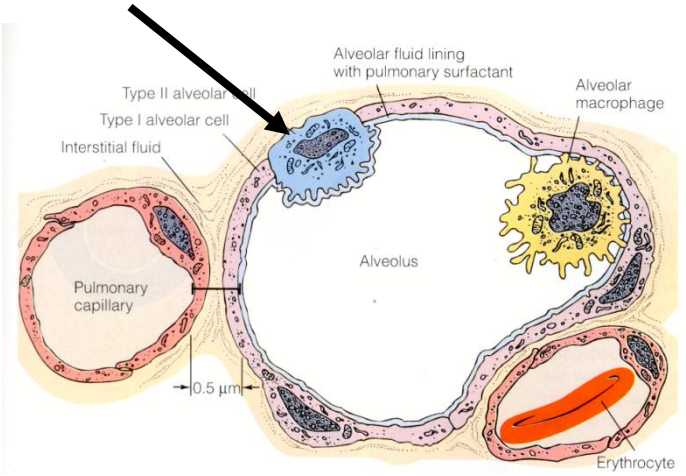
Simple squamous epithelial cells

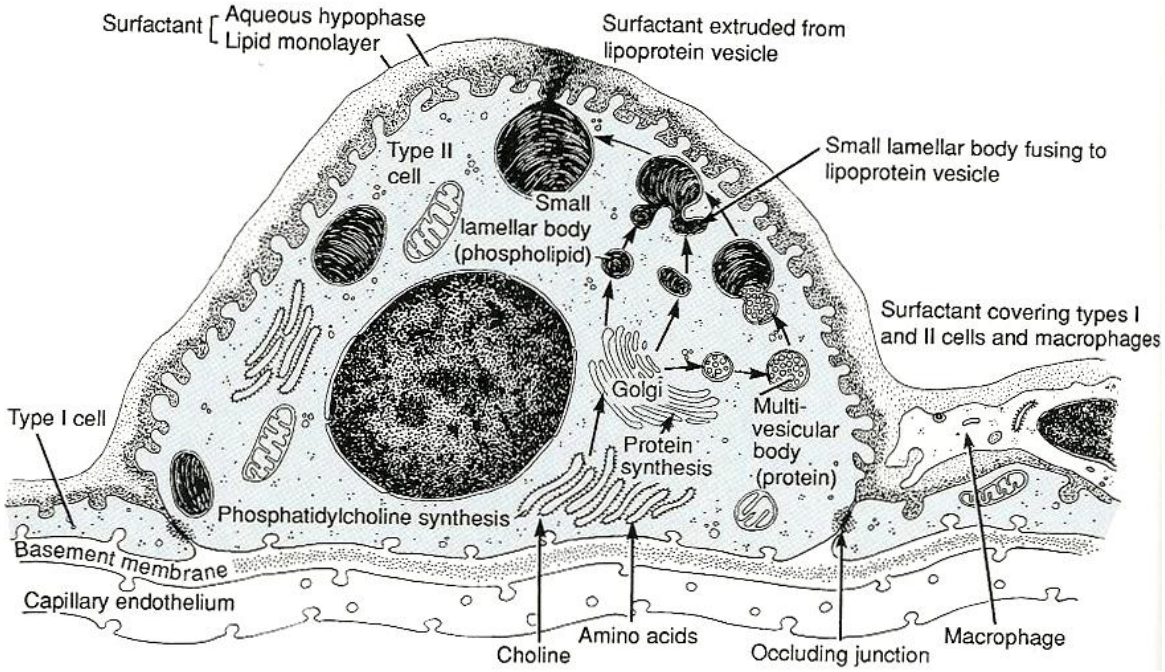


Alveolar wall

2) Type II pulmonary cell = great alveolar cells = septal cells

Produce **surfactant** – decreases surface tension to ease work of distending lungs

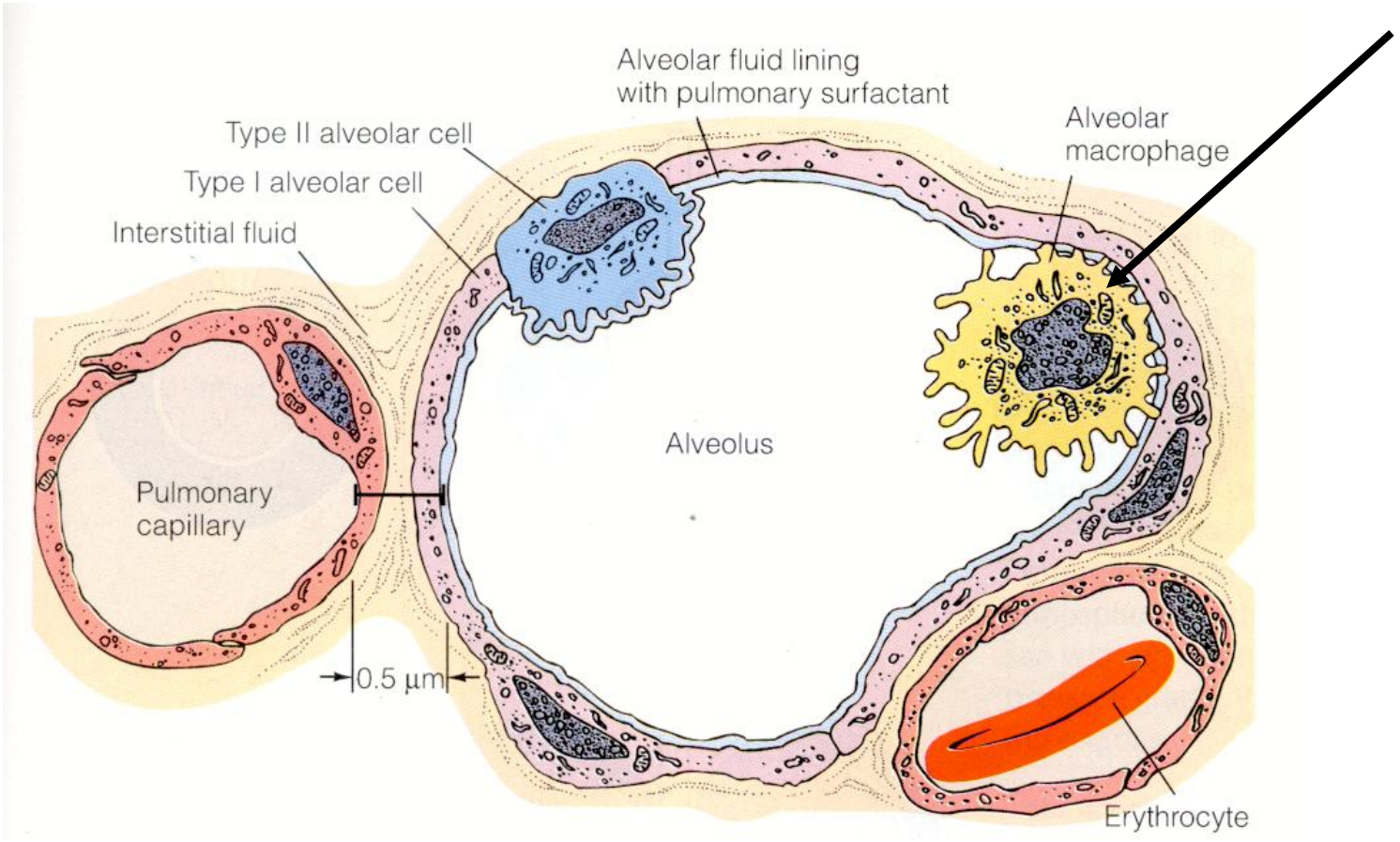




Alveolar wall

3) Dust cells (does not form wall)

Wandering macrophages, within lumen



Diffusion barrier (.5 micron)

1) Pulmonary cell
2) Basement membrane
3) Endothelial cells of capillary