

Lung H&E

RESPIRATORY BASIC HISTOLOGY

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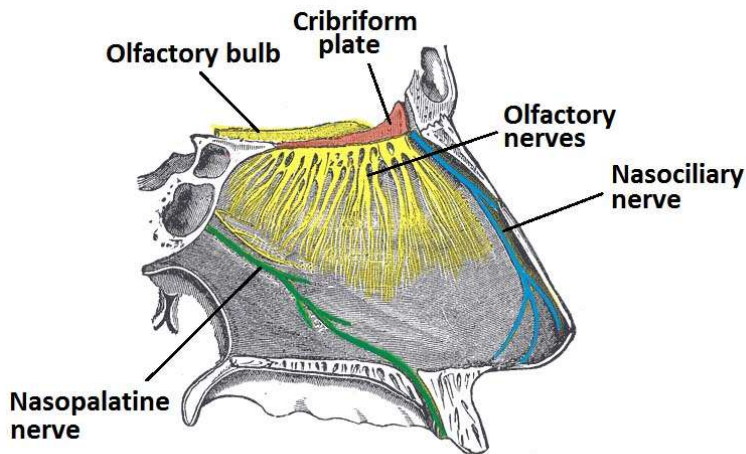
**alveolar type II
cell**

**nucleus of
alveolar type I
cell**



NOSE

- Deeper in the nasal vestibule, stratified squamous epithelium becomes non-keratinized.
- Further down to the respiratory area it becomes Pseudostratified ciliated columnar epithelium with mucous goblet cells and Basal cells.



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The 41 Essential Human Anatomy Diagrams for the Web

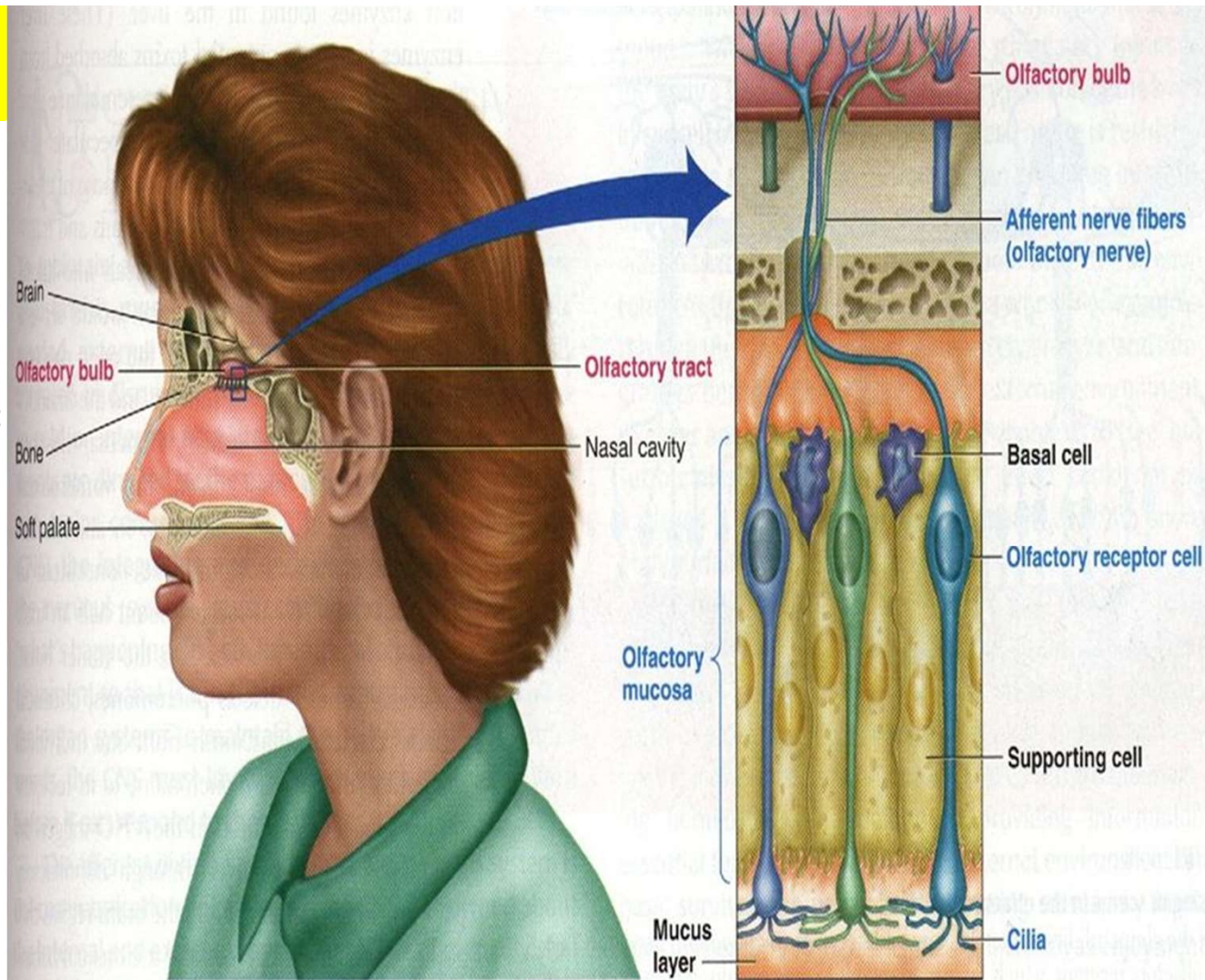
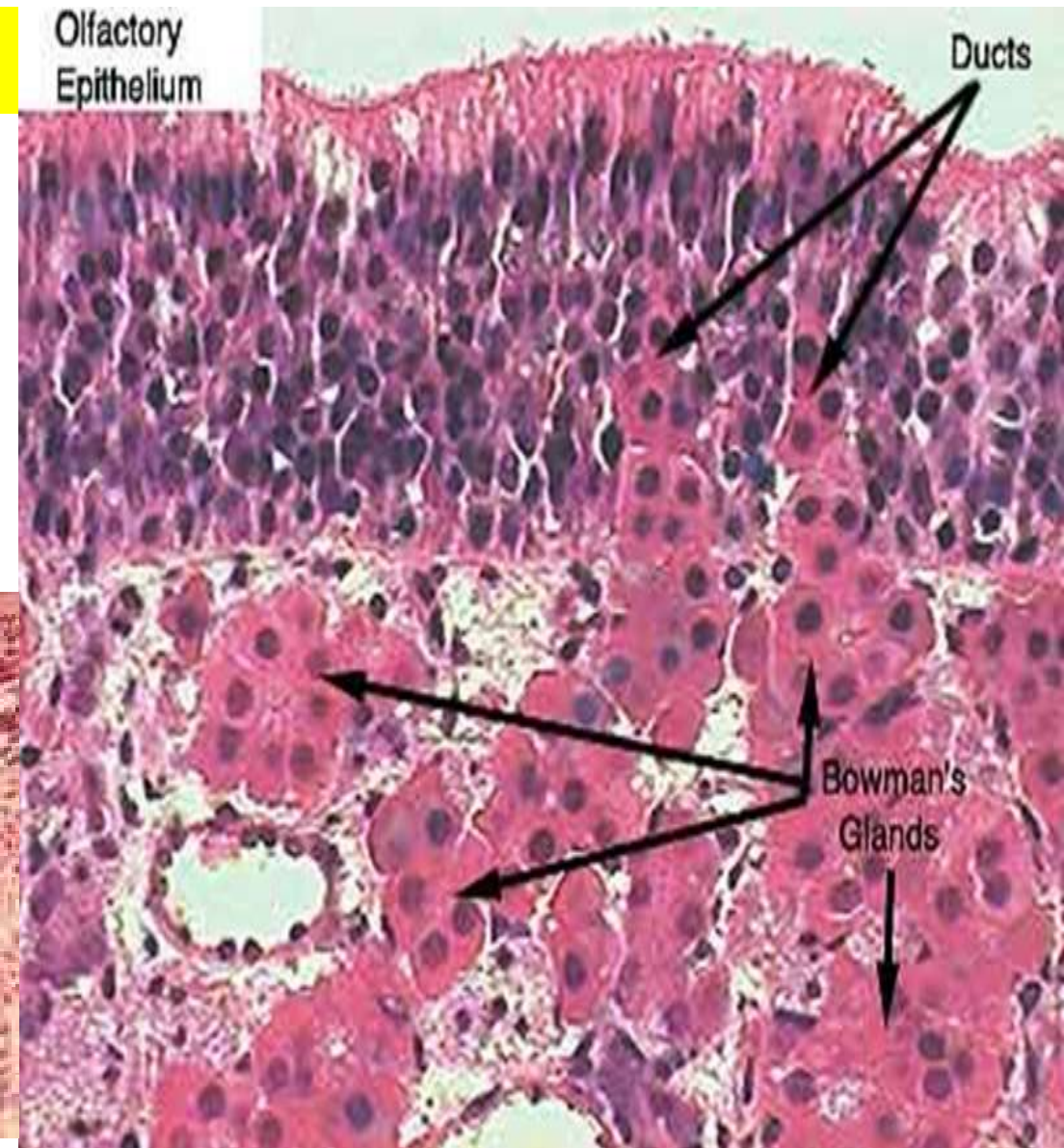
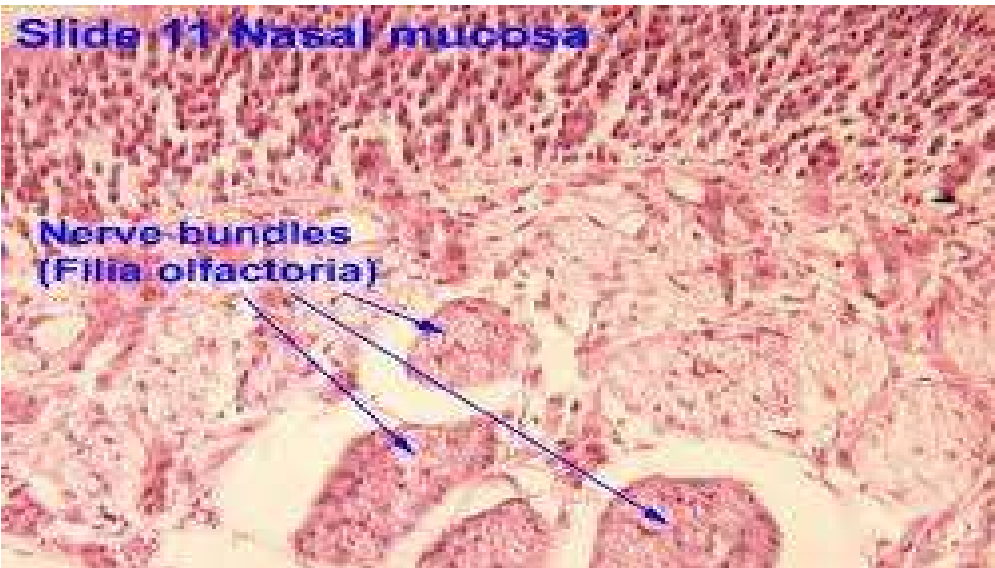


FIGURE 6-47

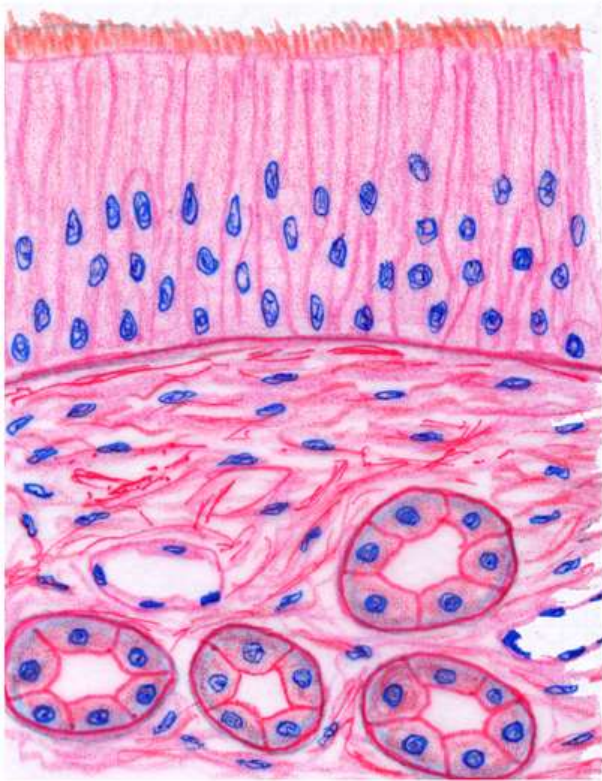
Location and structure of the olfactory receptors

Olfactory or Sensory cells....

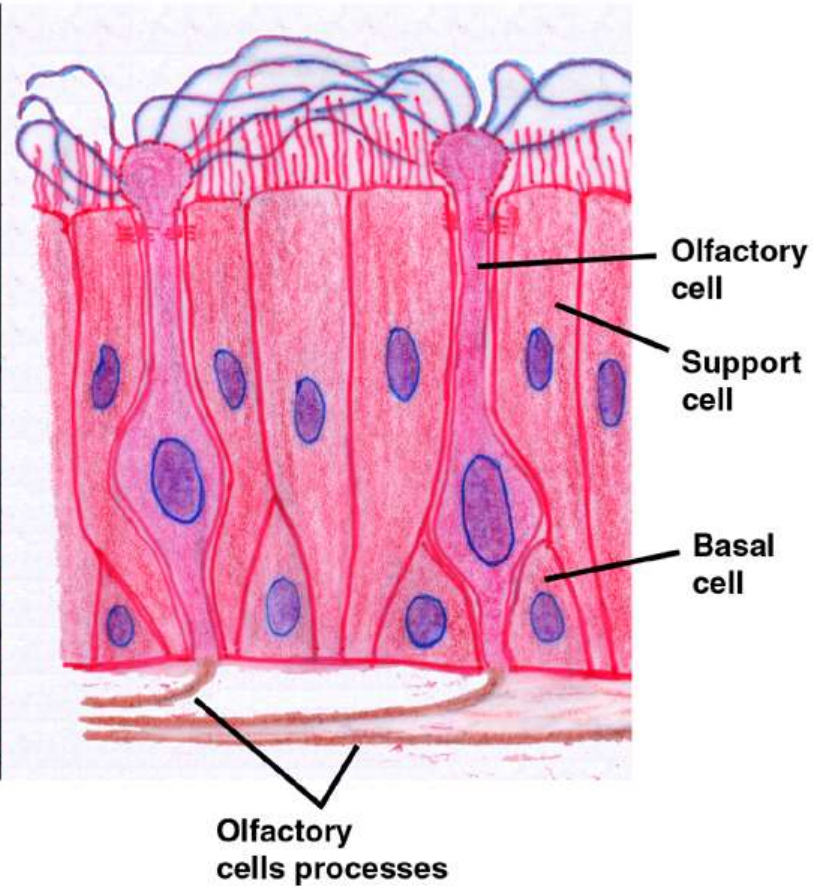
- The basal part of each sensory cell tapers into a slender cylindrical process that passes into the underlying lamina propria as axon which are collected into small **bundles "Fila Olfactoria" → cribriform plate**
- **Glands of Bowman** = Its watery secretions is carried to the surface of the narrow ducts to moisten the surface of the epithelium and serves as solvent for odiferous substances.
 - Its continuous secretions freshens the surface film of fluid and prevents repetition of stimulation of the olfactory hairs of a single odor.



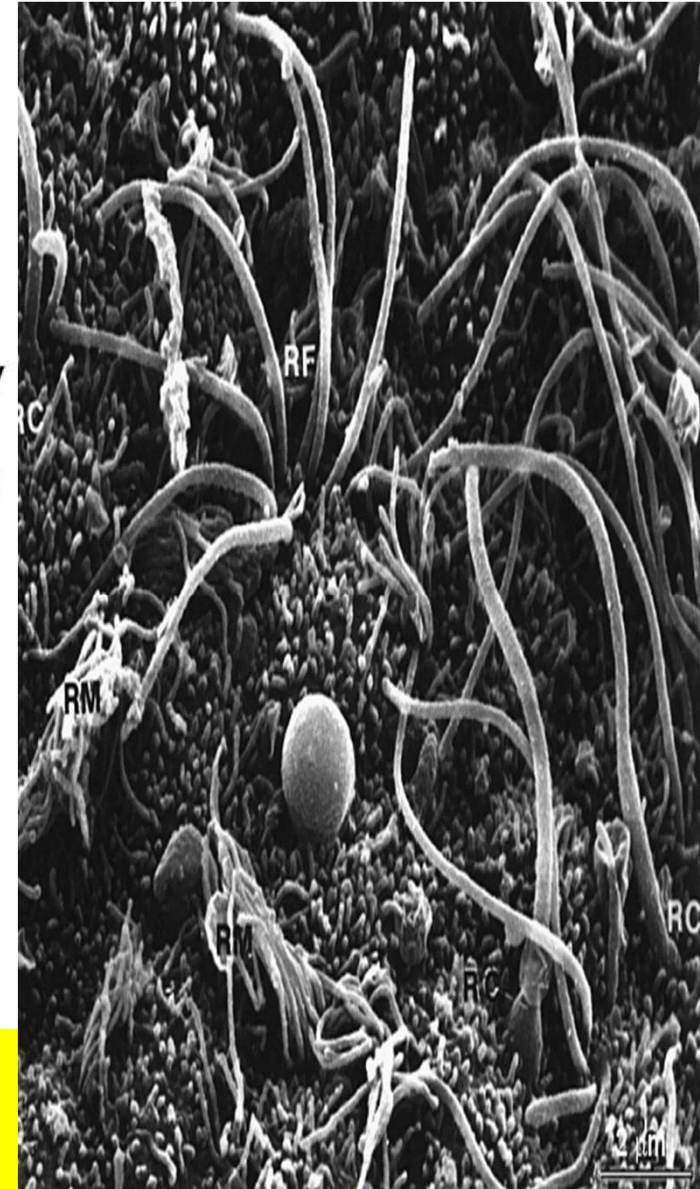
RESPIRATORY



OLFACTORY



Olfactory Epithelium



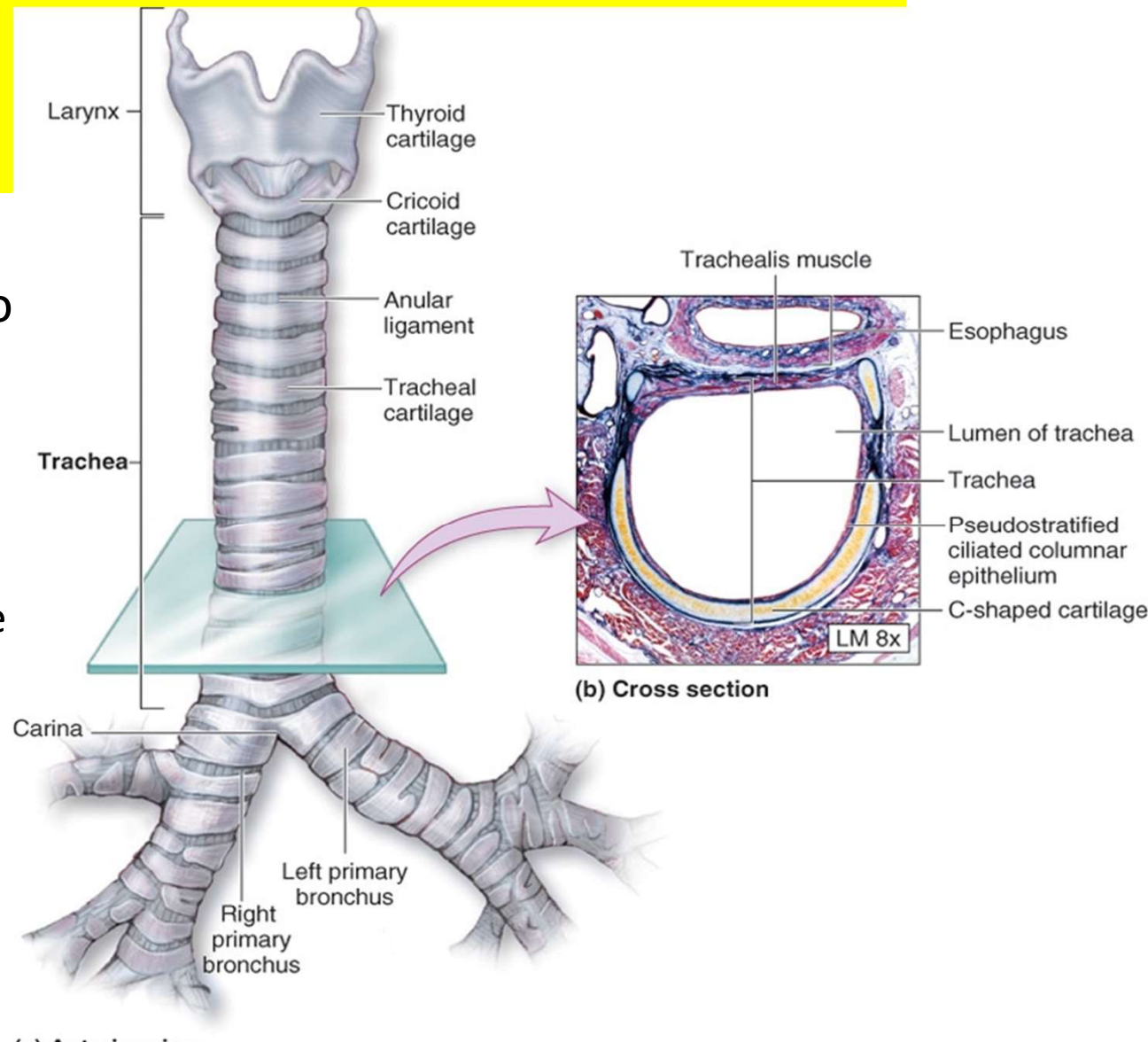
- The majority of the nasal cavity is lined by **respiratory epithelium**.
- Respiratory epithelium is **pseudostratified columnar epithelium** with **goblet cells**.
- The mucus secreted by **goblet cells**, as well as by **mucous glands**, helps filter and trap inspired particulate matter.
- The moist mucus also contributes to **the humidification of inspired air**.
- Cilia help sweep mucus to the pharynx where it is swallowed.
- Respiratory epithelium is **underlain by a dense vasculature**.
- **The blood helps warm inspired air**.
- Mucus also contains lysozyme as well as immunoglobulins [IgA], which help prevent infection.
- **The olfactory epithelium** is located in the most superior region of the nasal cavity and is involved in olfaction.
- The nasal cavity is continuous with the nasopharynx via the posterior nasal apertures.

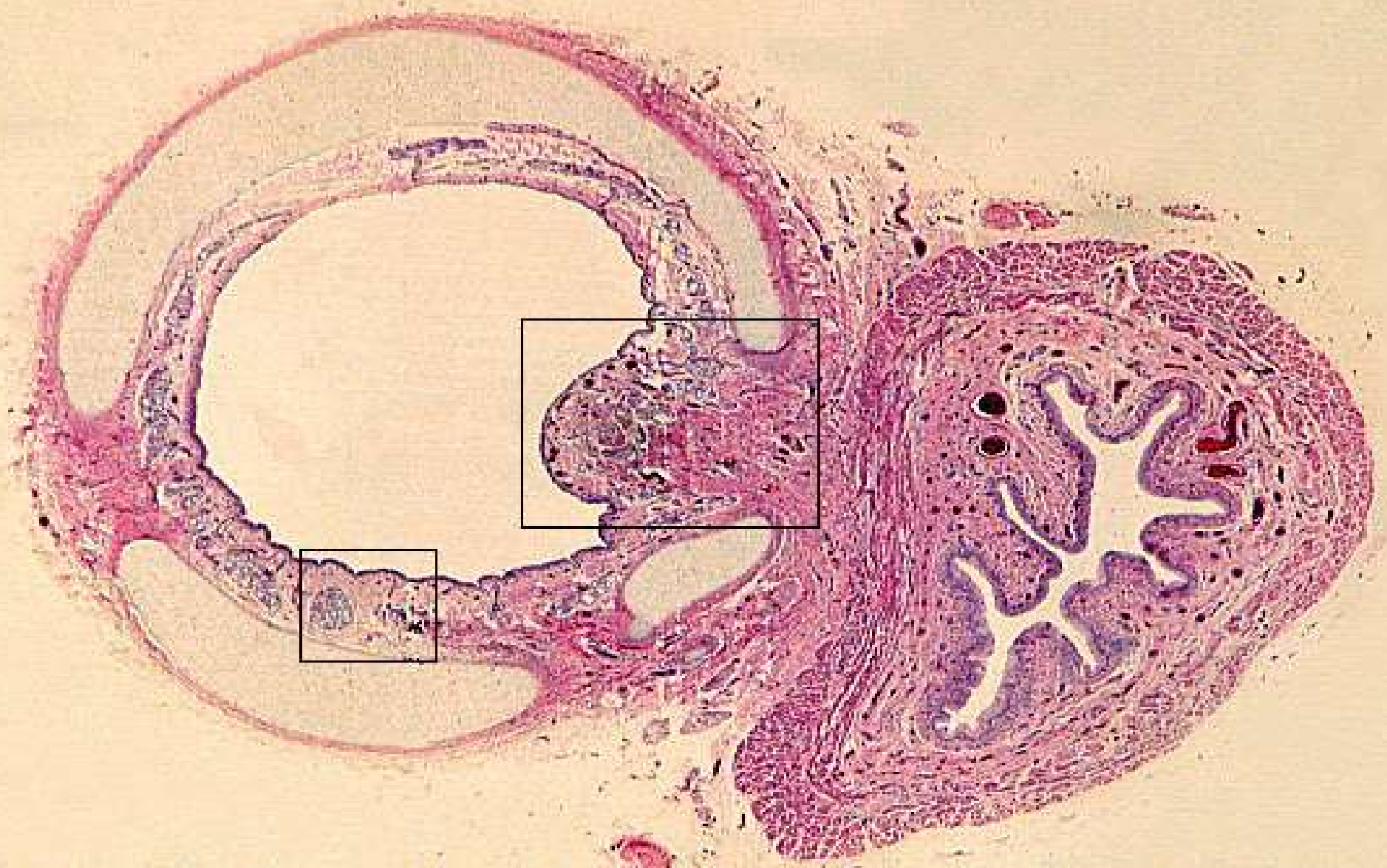
Respiratory histology facts

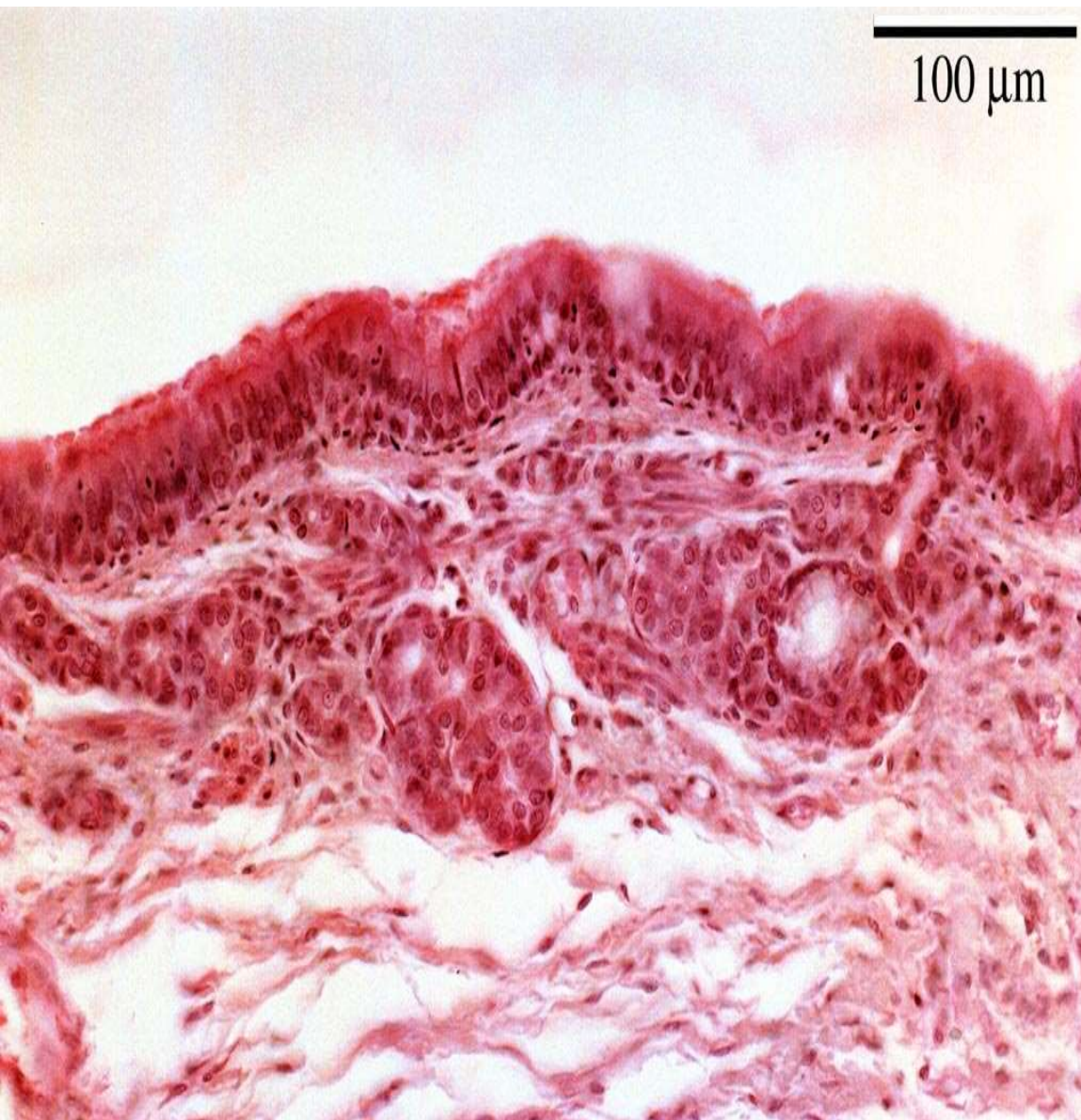
- As the bronchial tree branches, its histology changes markedly:
- 1. **Cartilage rings are replaced by cartilage plates, and within the bronchioles, cartilage is absent entirely.**
- 2. Epithelium changes from **pseudostratified columnar to simple columnar to simple cuboidal**.
- 3. **The number of cilia declines.**
- 4. **The number of goblet cells declines.**
- 5. **The relative amount of smooth muscle increases**

Trachea

- Flexible and mobile tube extending from the larynx into the mediastinum
- Composed of three layers
 - **Mucosa** – made up of goblet cells and ciliated epithelium
 - **Submucosa** – connective tissue deep to the mucosa
 - **Adventitia** – outermost layer made of C-shaped rings of hyaline cartilage







Respiratory tree

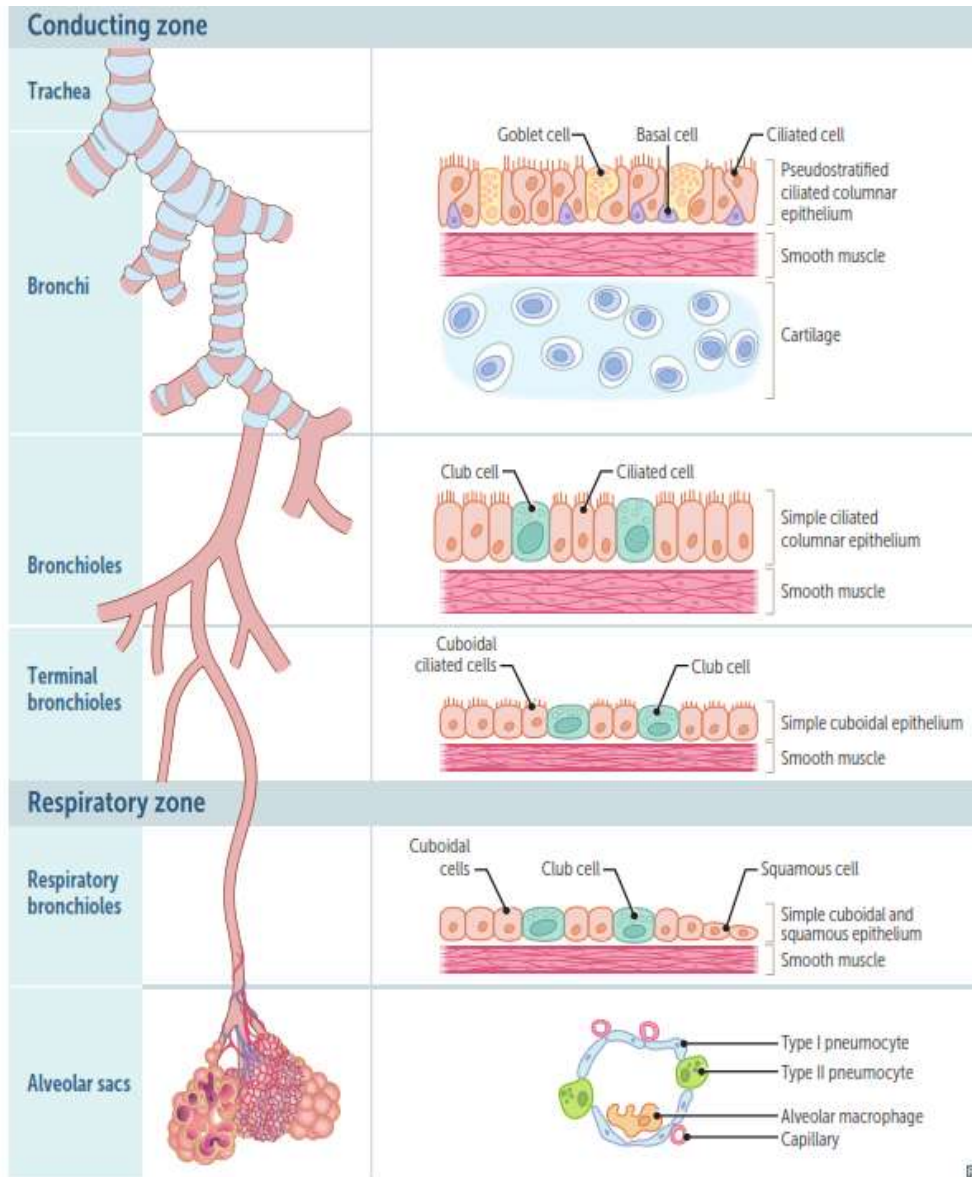
Conducting zone

- a) Large airways : consist of nose, pharynx, larynx, trachea, and bronchi.
- b) Small airways consist of bronchioles that further divide into terminal bronchioles (large numbers in parallel → least airway resistance).
- **Warms, humidifies, and filters air but does not participate in gas exchange “anatomic dead space.”**
- Cartilage and goblet cells extend to the end of bronchi.
- Pseudostratified ciliated columnar cells primarily make up epithelium of bronchus and extend to beginning of terminal bronchioles, then transition to cuboidal cells.
- Clear mucus and debris from lungs (mucociliary escalator).
- Airway smooth muscle cells extend to end of terminal bronchioles (sparse beyond this point).

Respiratory zone

Lung parenchyma; consists of

- respiratory bronchioles,
- alveolar ducts,
- alveoli.
- **Participates in gas exchange.**
- Mostly cuboidal cells in respiratory bronchioles, then simple squamous cells up to alveoli.
- Cilia terminate in respiratory bronchioles.
- Alveolar macrophages clear debris and participate in
- immune response



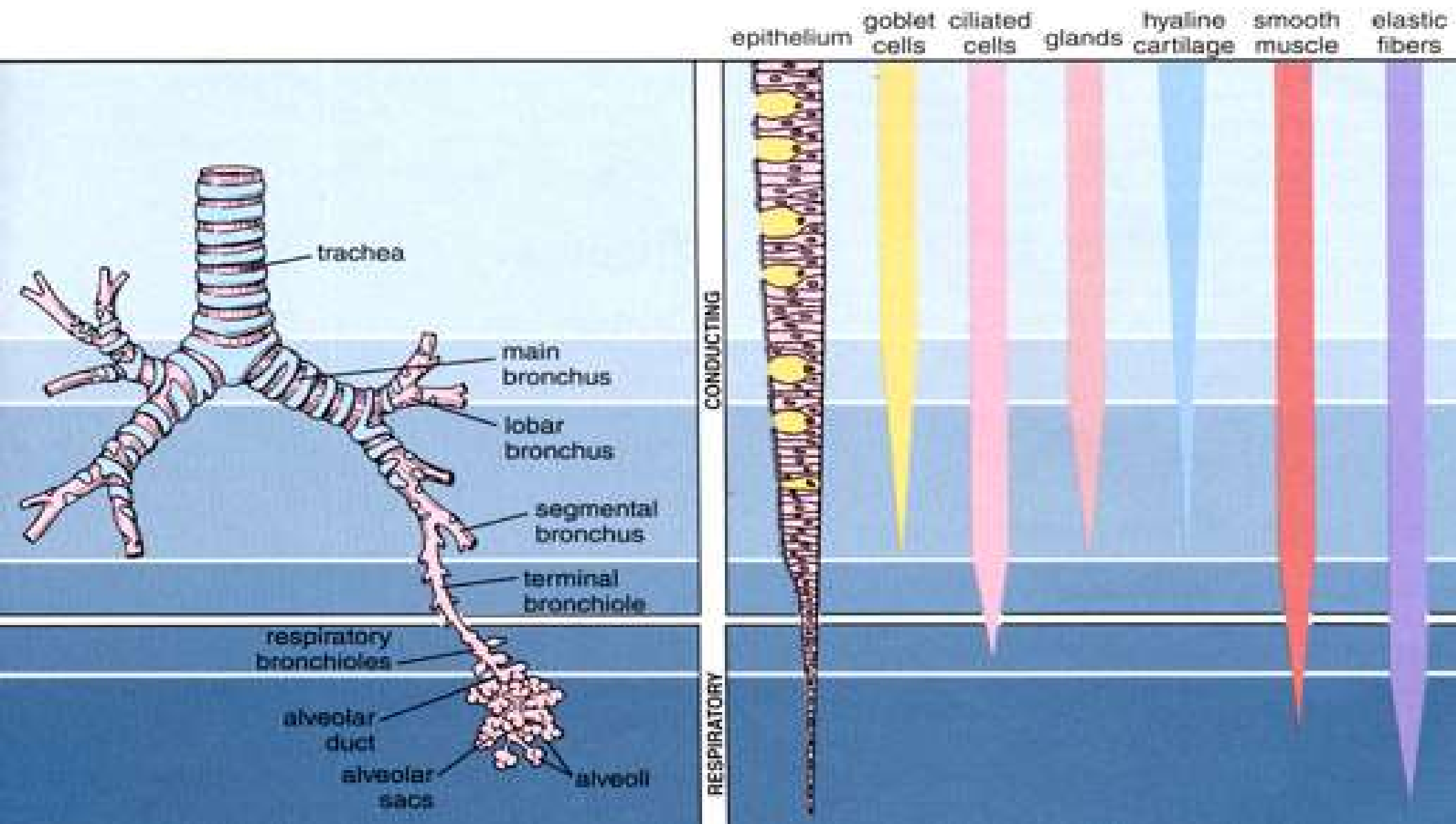
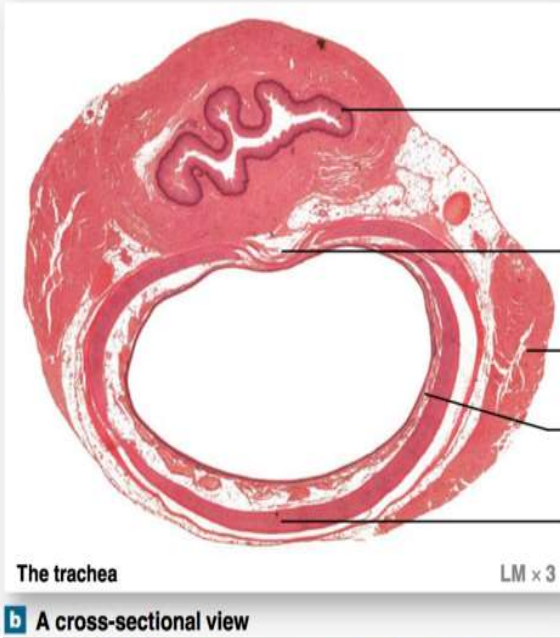
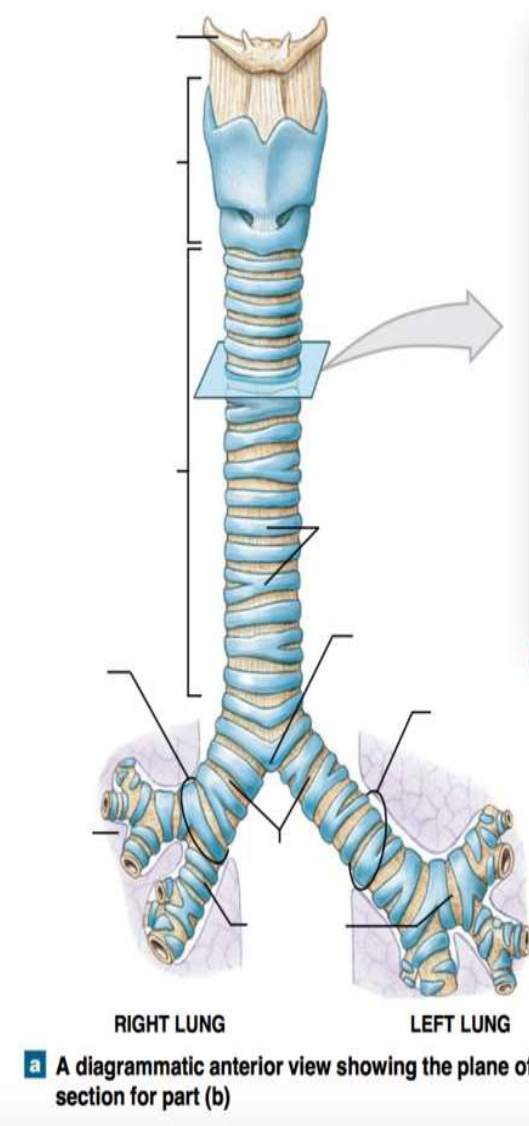
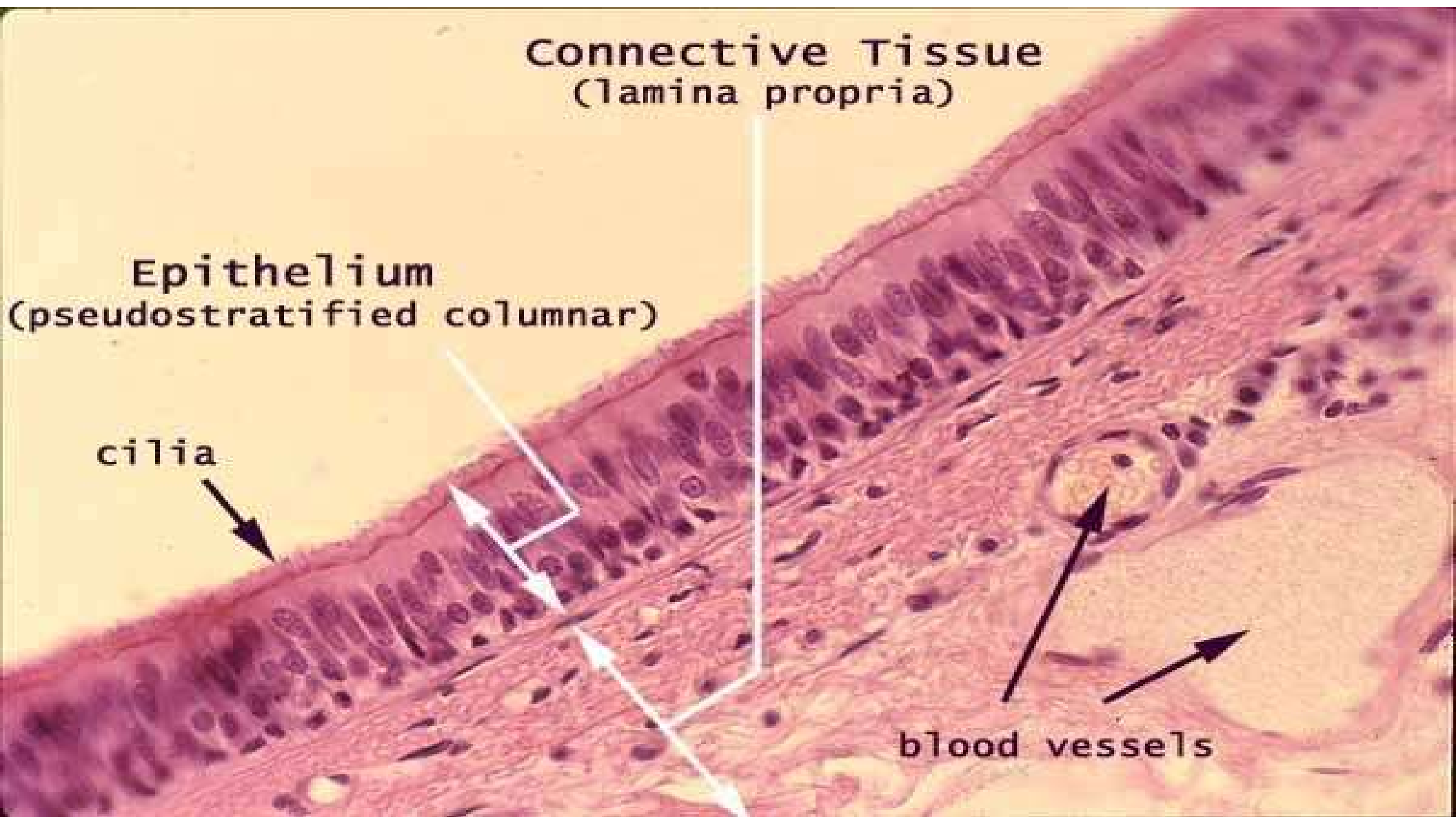
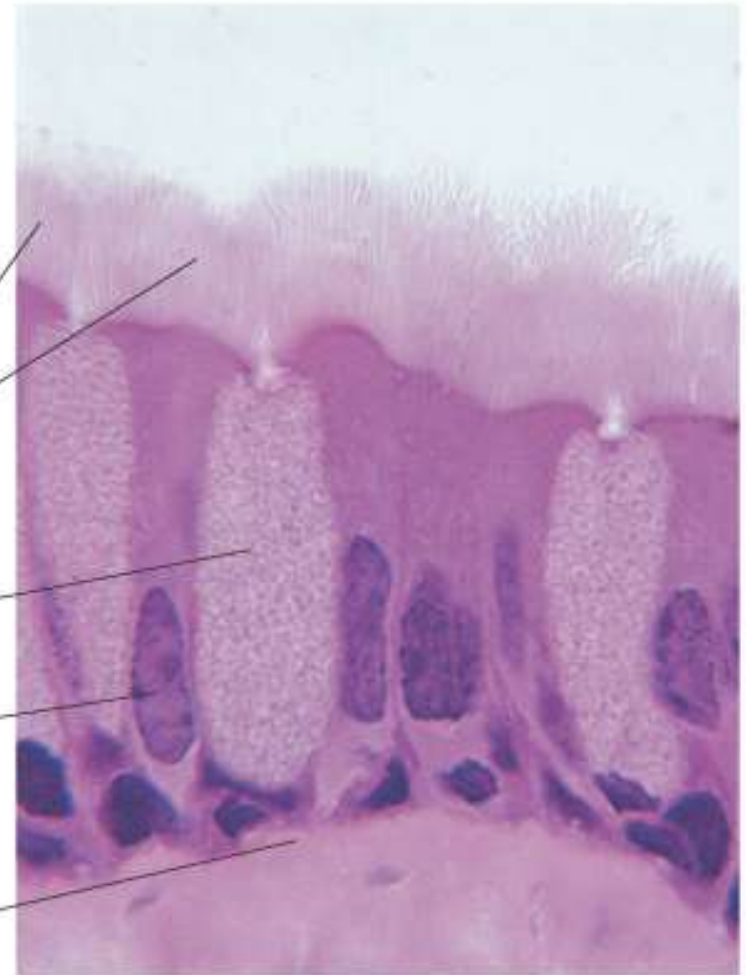
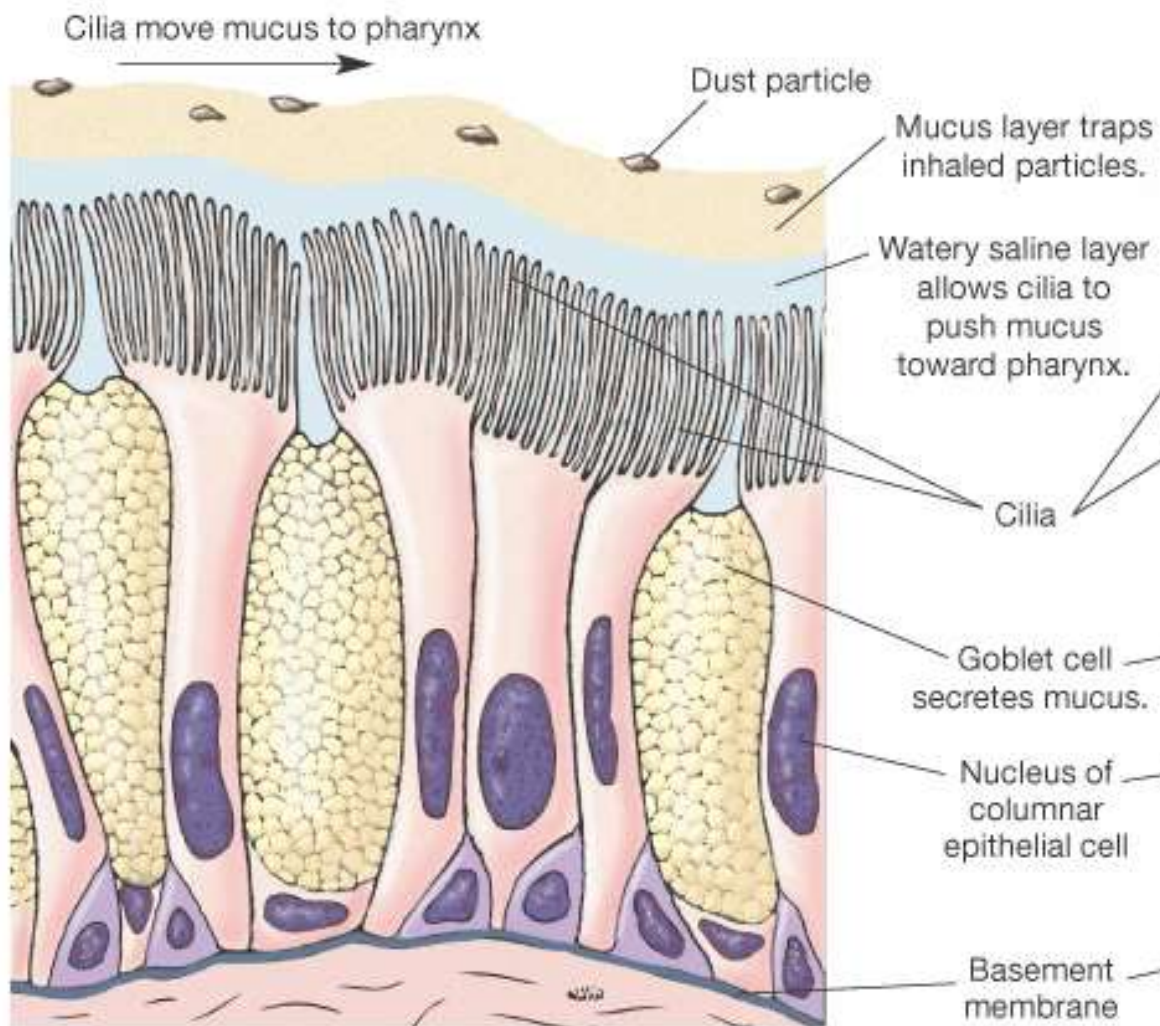


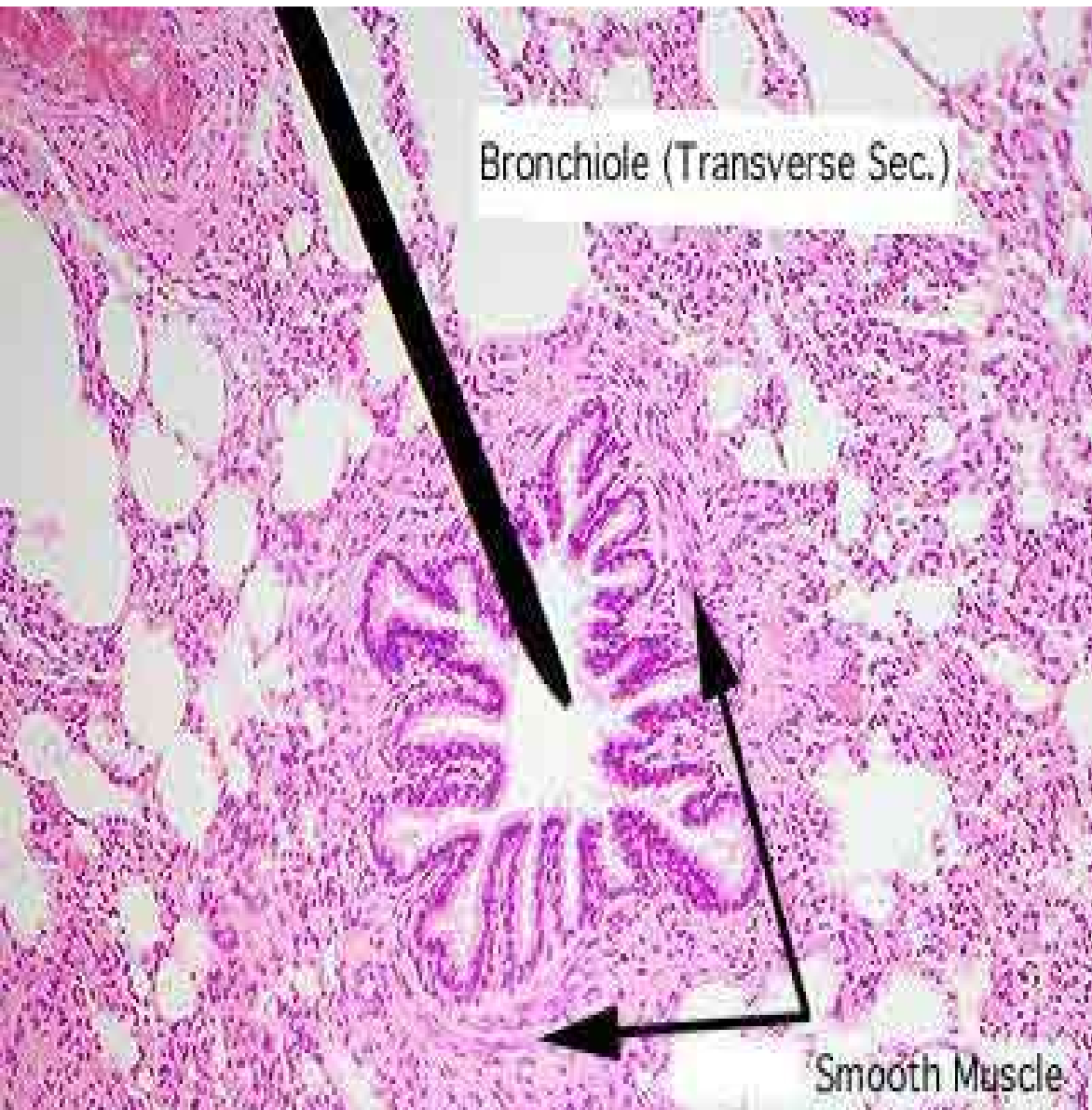
Figure 23-6 The Anatomy of the Trachea



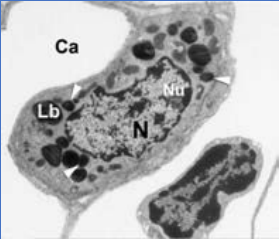
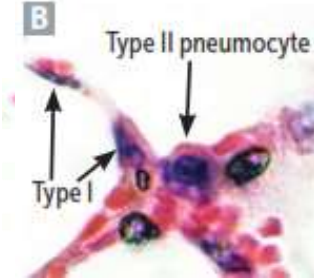




Ciliated epithelium of the trachea



Alveolar cell types

Type I pneumocytes	<ul style="list-style-type: none"> • 97% of alveolar surfaces. • Line the alveoli. • Squamous; thin for optimal gas diffusion. • Responsible for the conversion of the Angiotensin I to II
Type II pneumocytes 	<p>Secrete surfactant from lamellar bodies \Rightarrow ↓ alveolar surface tension,</p> <ul style="list-style-type: none"> • prevents alveolar collapse, • ↓ lung recoil, • ↑ compliance.  <ul style="list-style-type: none"> • Cuboidal and clustered B . • Also serve as precursors to type I cells and other type II cells. <p>Proliferate during lung damage.</p>
Alveolar macrophages = DUST CELLS = MACROPHAGES	<ul style="list-style-type: none"> • Phagocytose foreign materials; • release cytokines and alveolar proteases. • Hemosiderin-laden macrophages may be seen in pulmonary hemorrhage.

Club cells :

- Nonciliated; low columnar/cuboidal with secretory granules.
- Located in bronchioles.
- Degrade toxins; secrete component of surfactant; act as reserve cells.

Collapsing pressure (P) =

$$\frac{2 \text{ (surface tension)}}{\text{radius}}$$

- Alveoli have ↑ tendency to collapse on expiration as radius ↓ (law of Laplace).
- Pulmonary surfactant is a complex mix of
- lecithins, the most important of which is
- dipalmitoylphosphatidylcholine (DPPC).
- Surfactant synthesis begins around week 20 of gestation, but mature levels are not achieved until around week 35.
- Corticosteroids important for fetus surfactant production and lung development.

Pneumocytes

Pseudocolumnar ciliated cells extend to the respiratory bronchioles; goblet cells extend only to the terminal bronchioles.

Type I cells (97% of alveolar surfaces) line the alveoli. Squamous; thin for optimal gas diffusion.

Type II cells (3%) secrete pulmonary surfactant (dipalmitoyl phosphatidylcholine), which ↓ the alveolar surface tension. Cuboidal and clustered. Also serve as precursors to type I cells and other type II cells. Type II cells proliferate during lung damage.

Club cells

Clara cells—nonciliated; columnar with secretory granules. Secrete component of surfactant; degrade toxins; act as reserve cells.

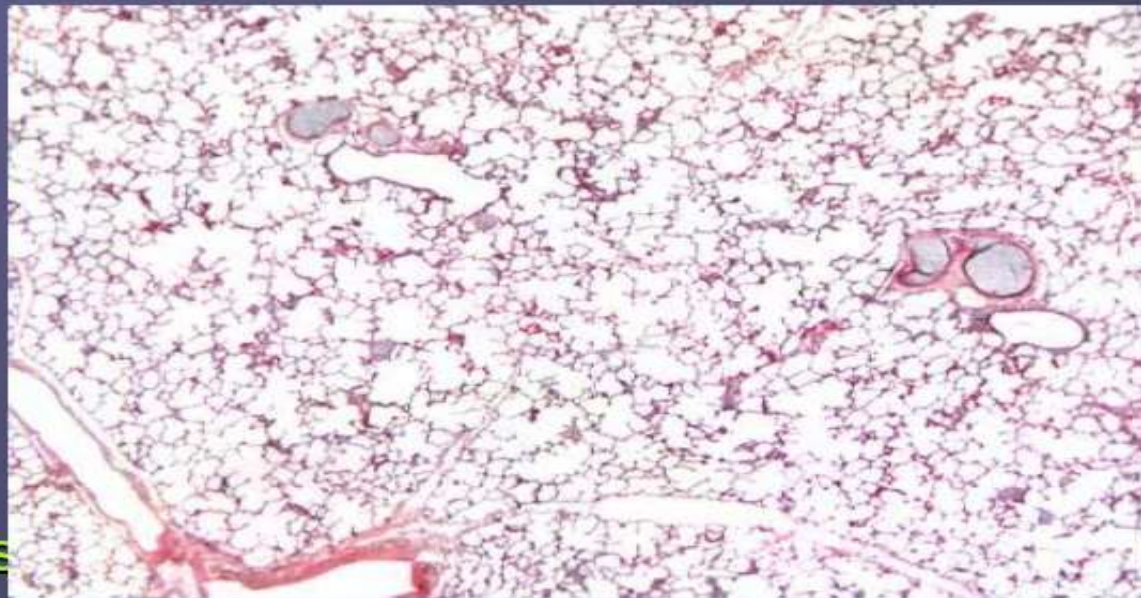
Mucus secretions are swept out of the lungs toward the mouth by ciliated cells.

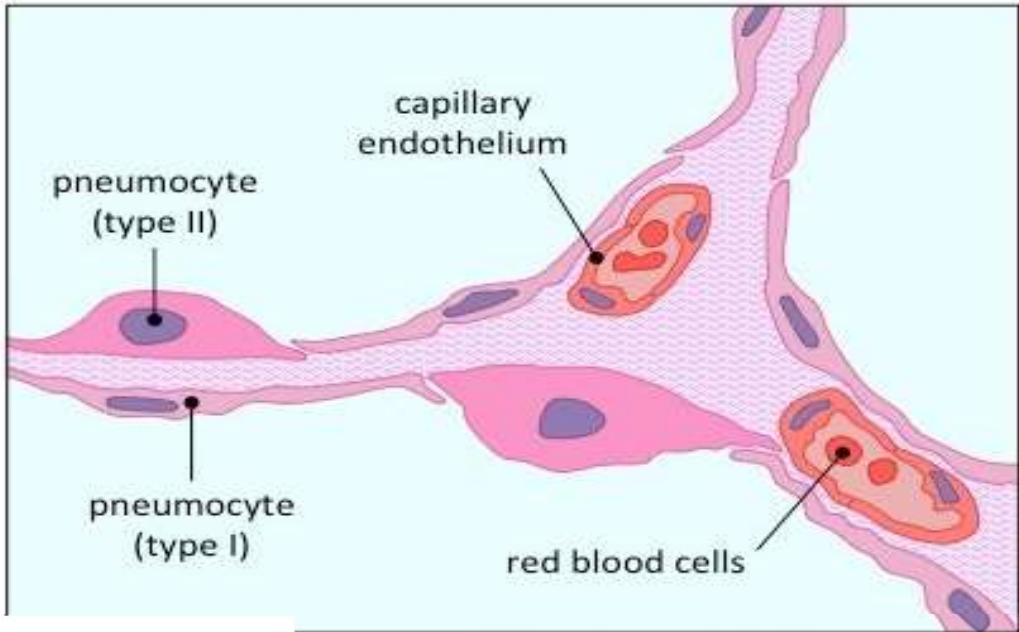
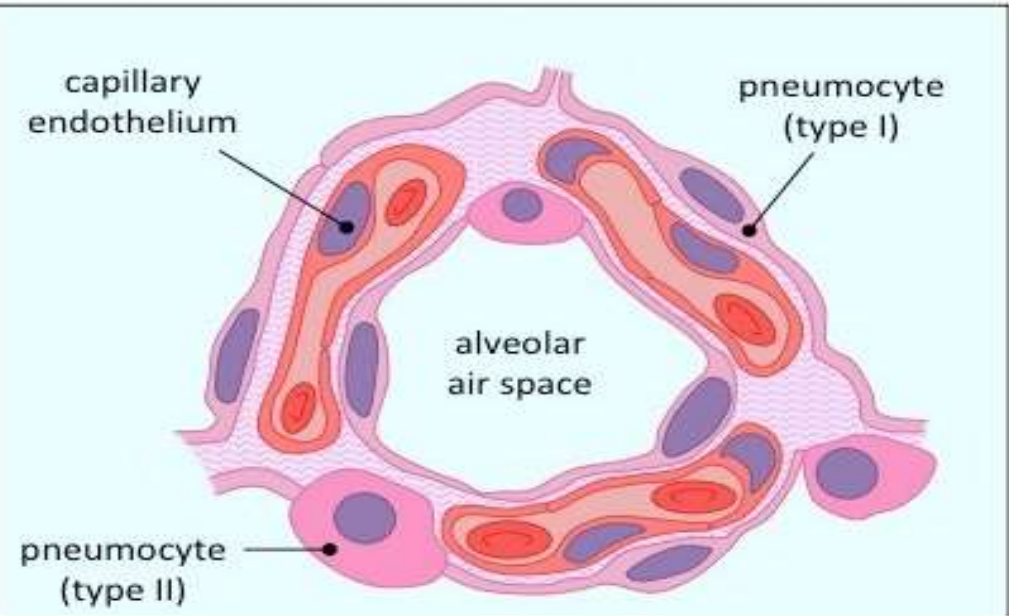
A lecithin-to-sphingomyelin ratio of > 2.0 in amniotic fluid is indicative of fetal lung maturity.

HISTOPATHOLOGY OF ALVEOLI

ALVEOLAR WALL

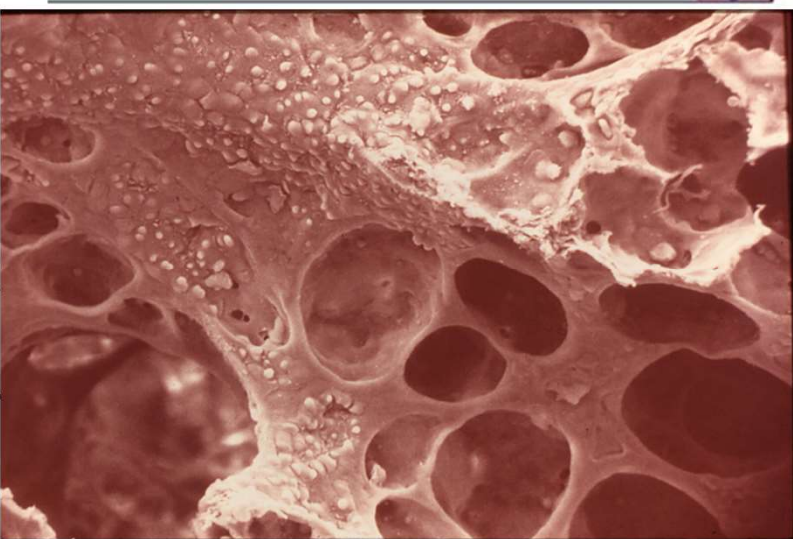
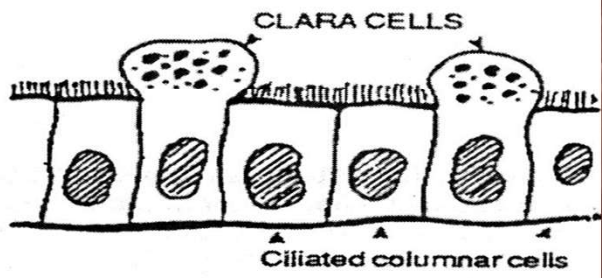
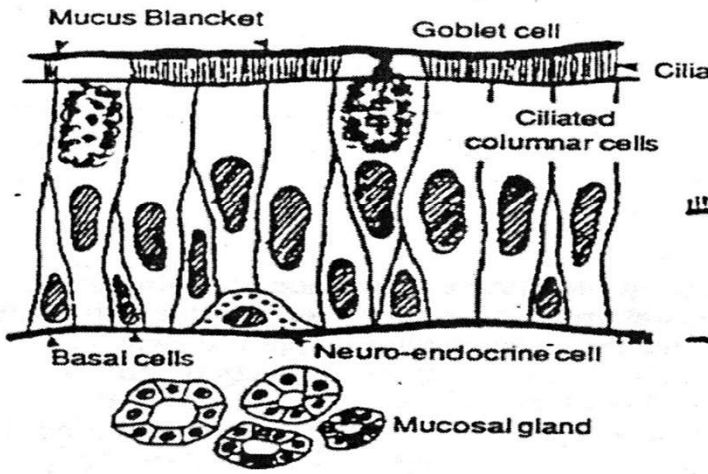
1. Alveolar epithelial cells-
 - Type I pneumocytes
 - Type II pneumocytes
2. Basement Membrane
3. Interstitial Space-
 - Collagen
 - Elastin
 - Unmyelinated Nerves
 - Macrophages
4. Capillary Basement Membrane
5. Capillary Endothelial Cells.

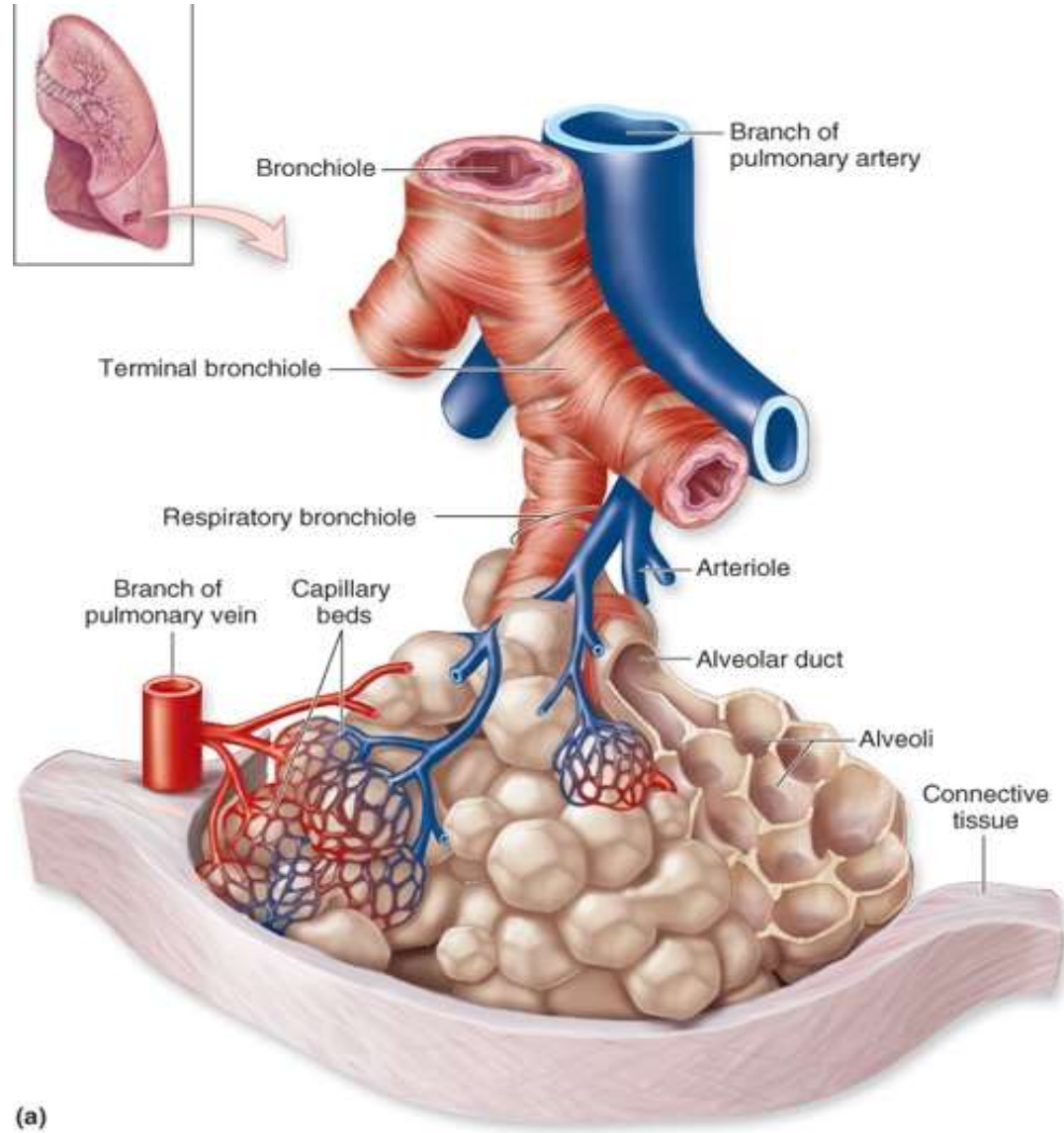
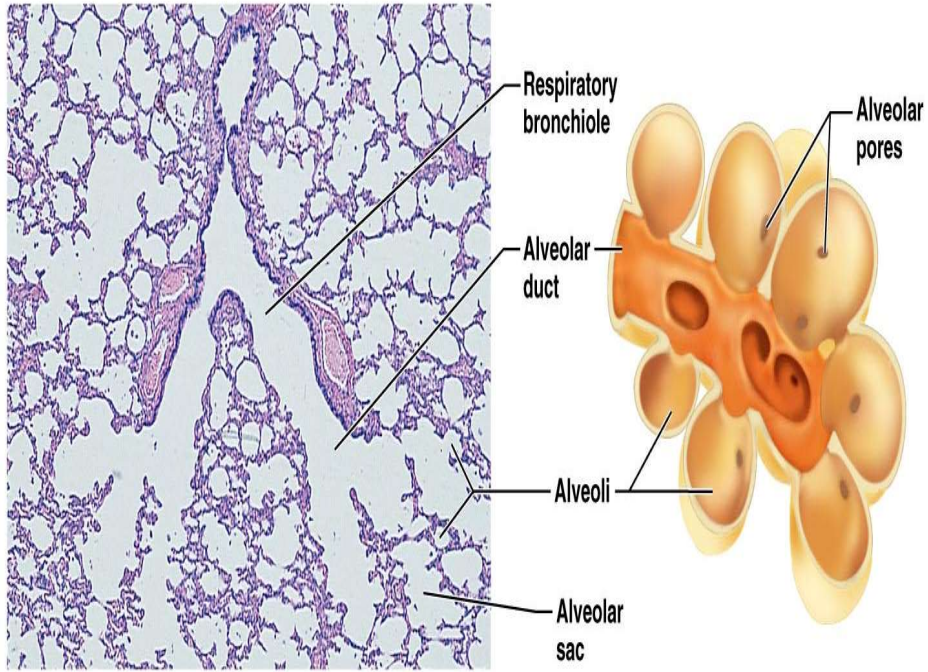




BRONCHUS

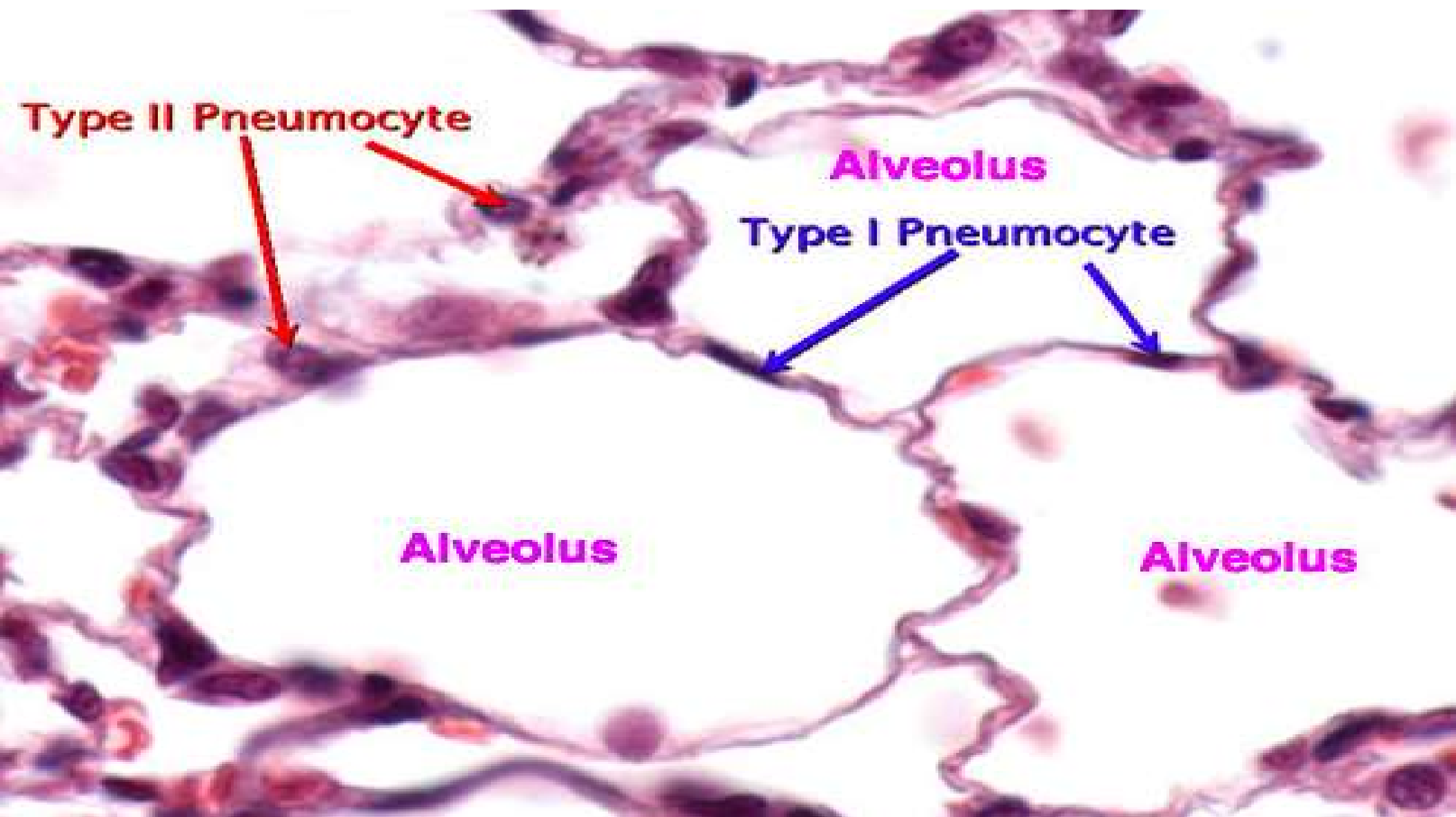
BRONCHIOLE





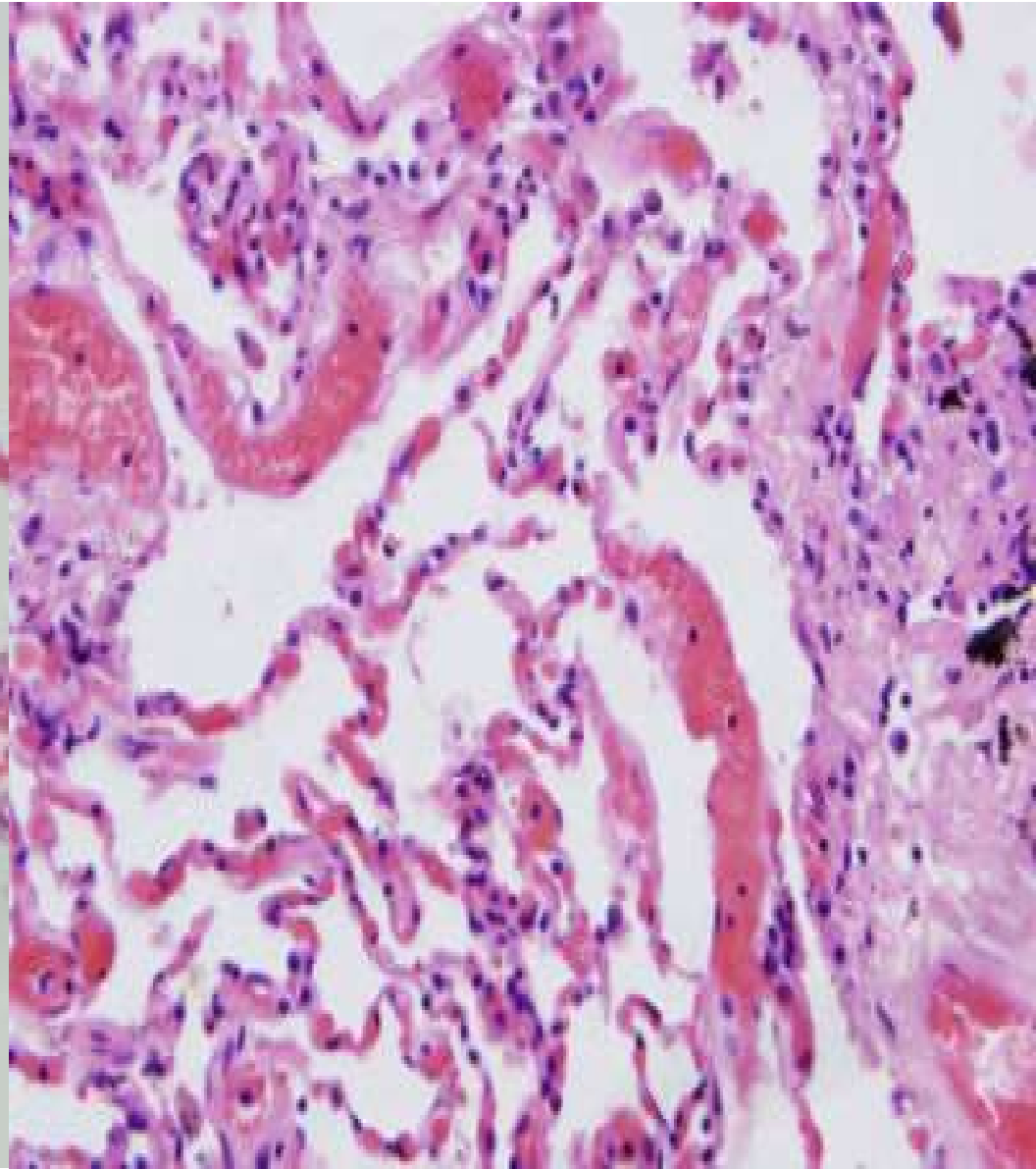
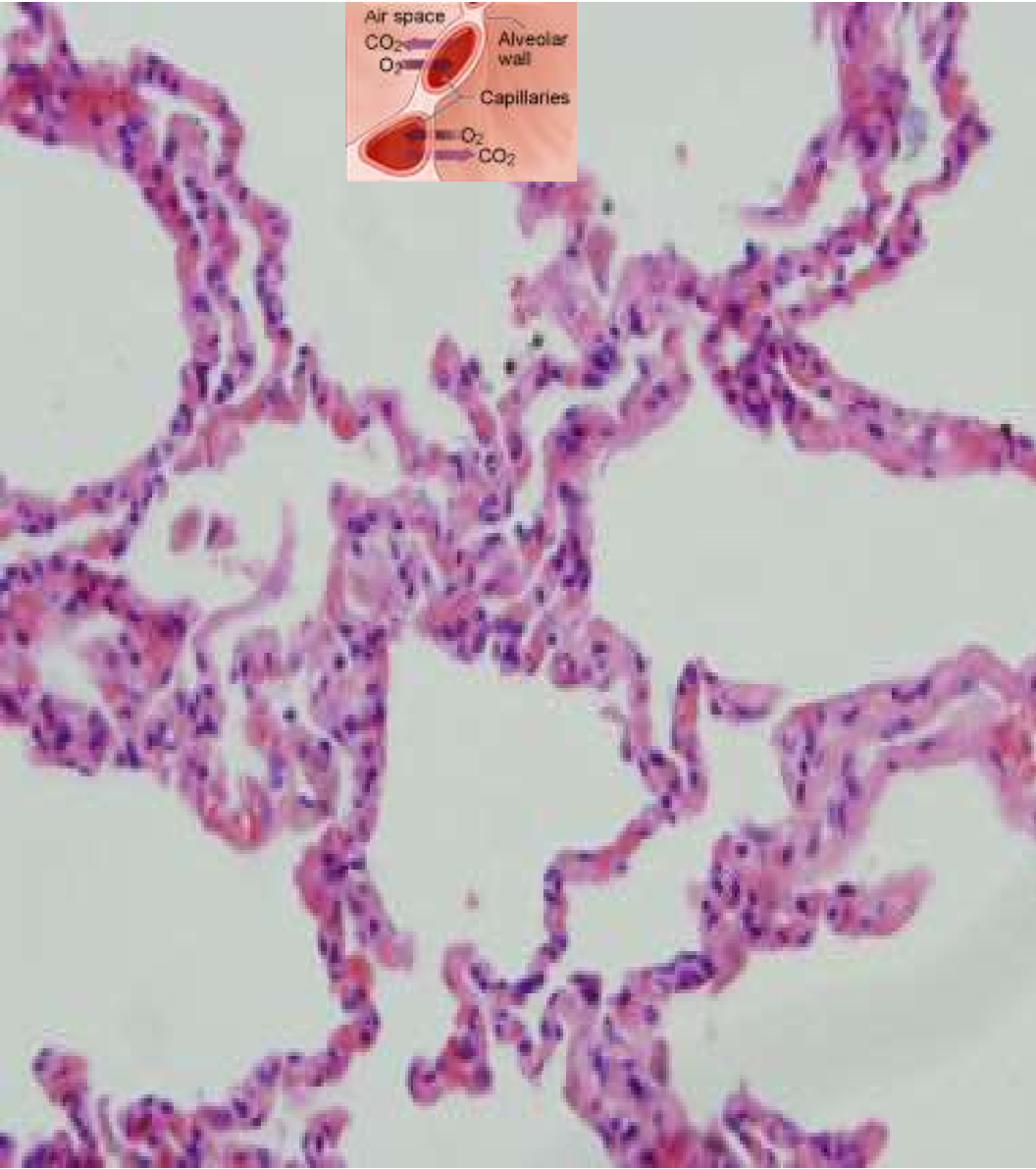
Respiratory Zone

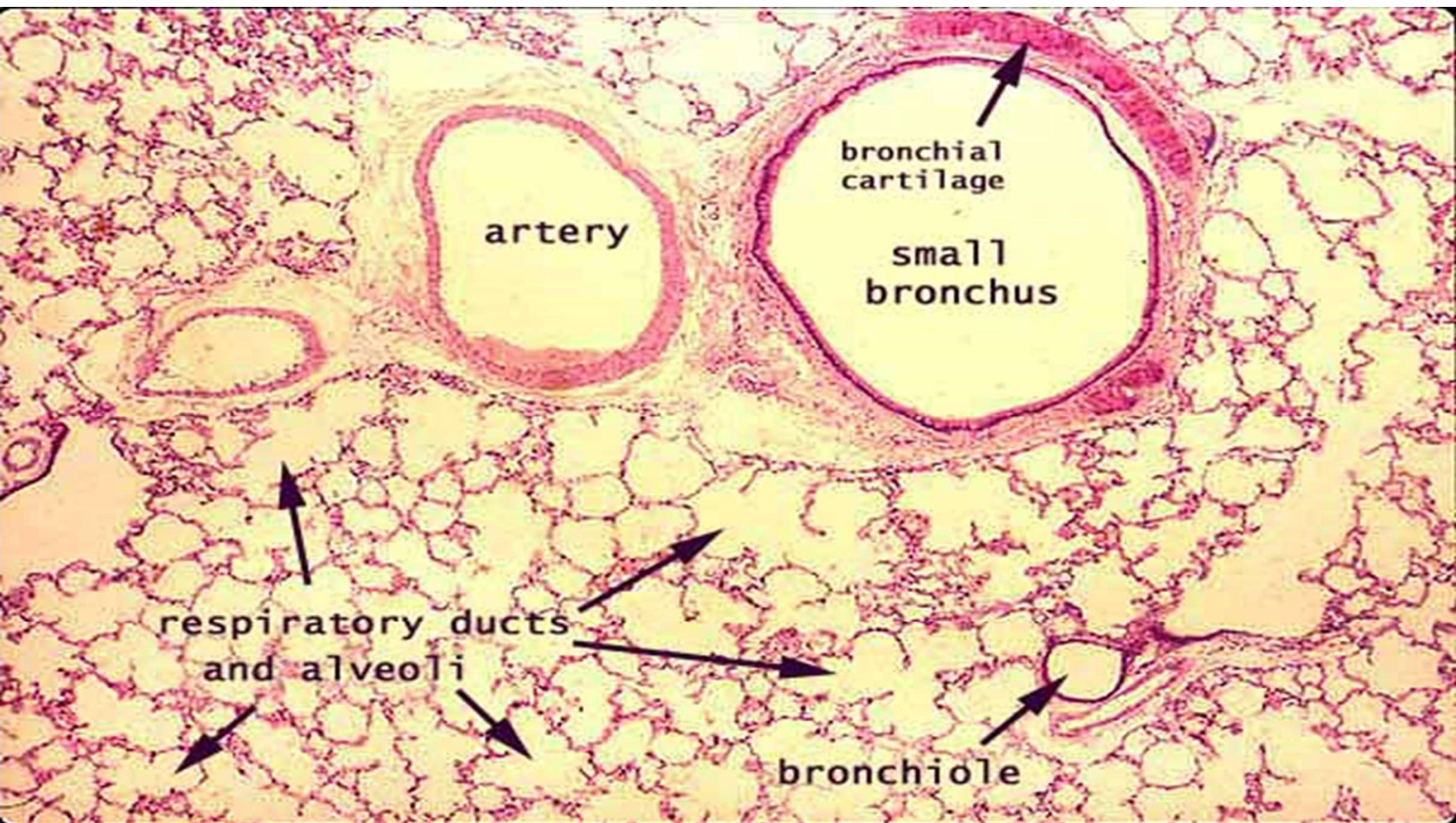
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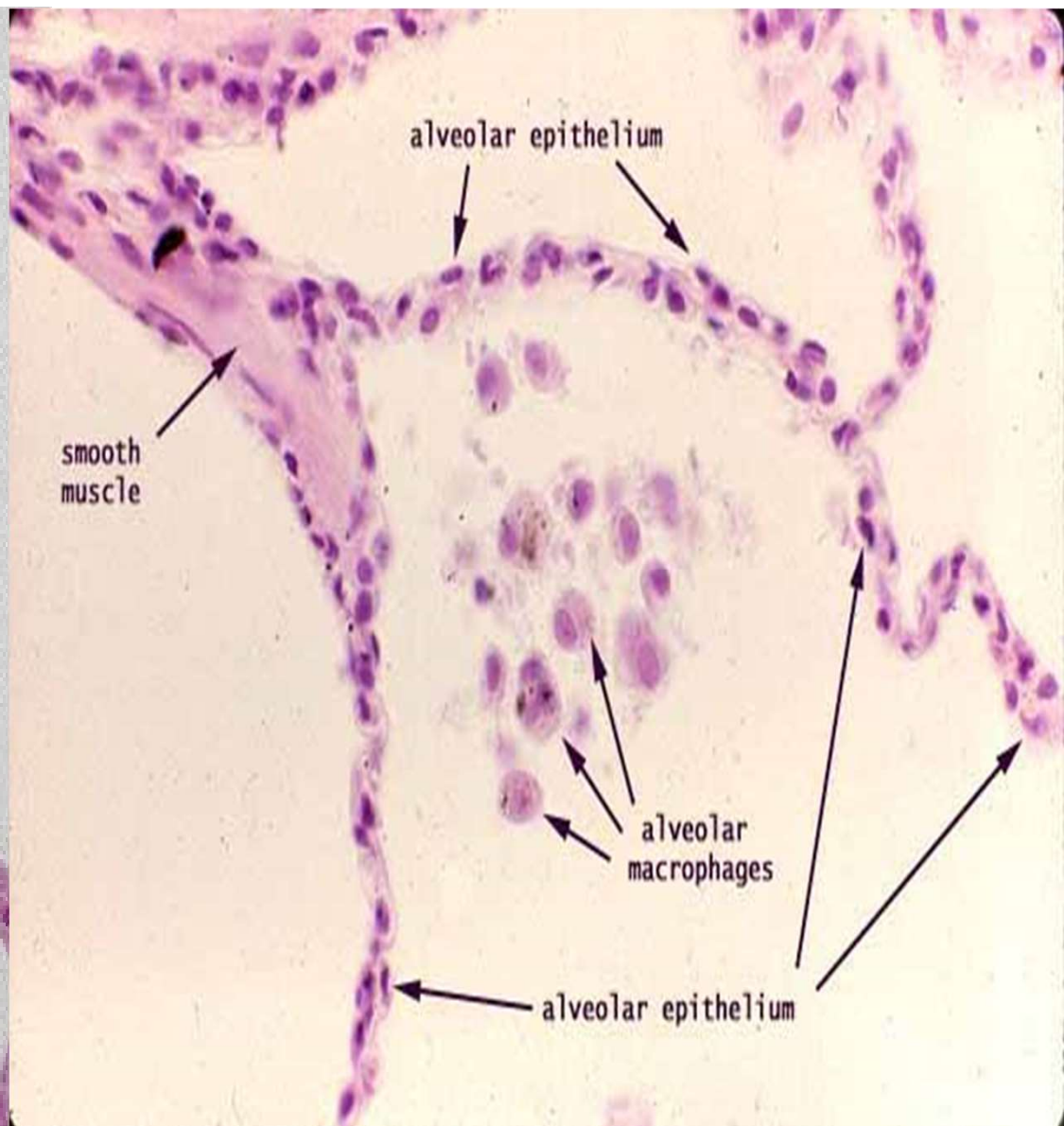
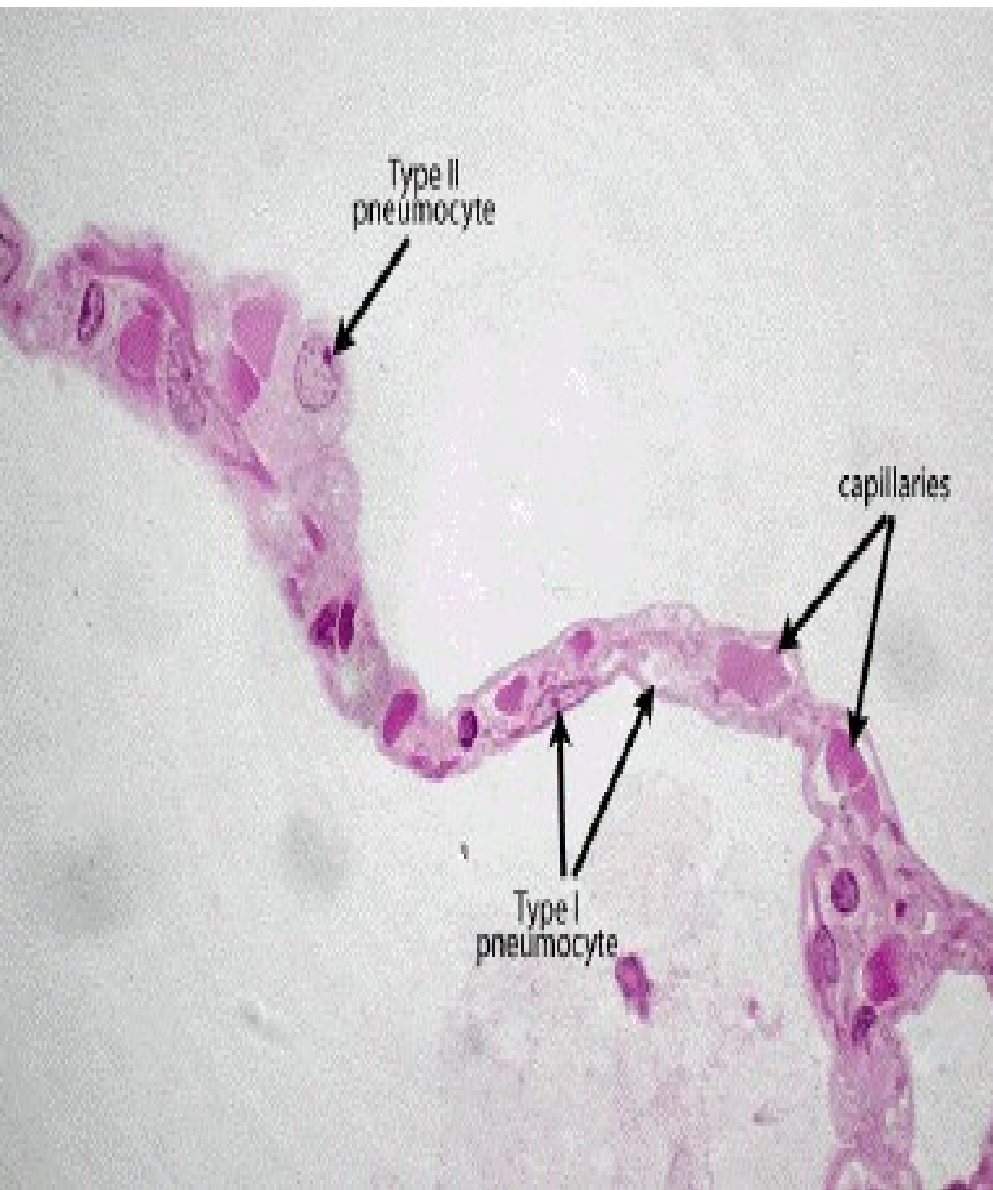


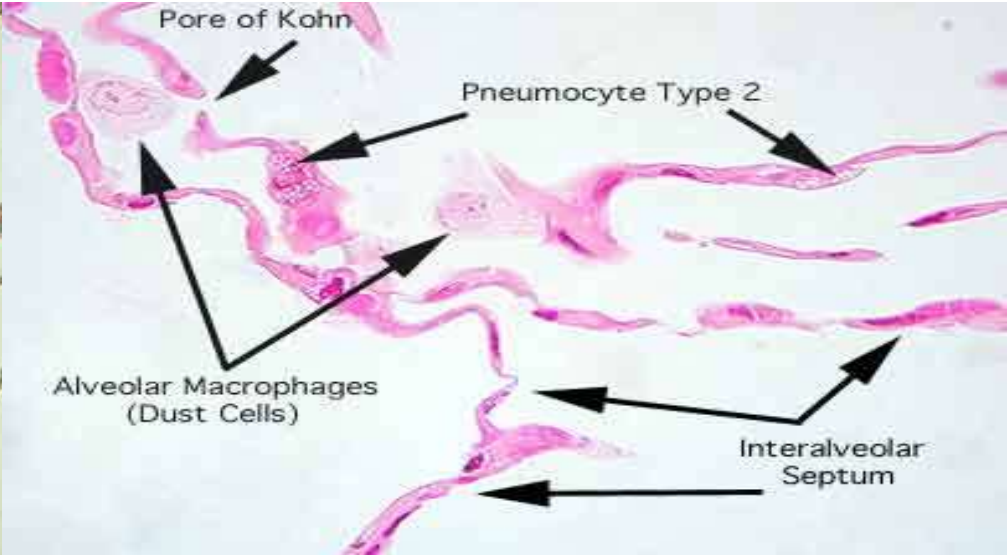
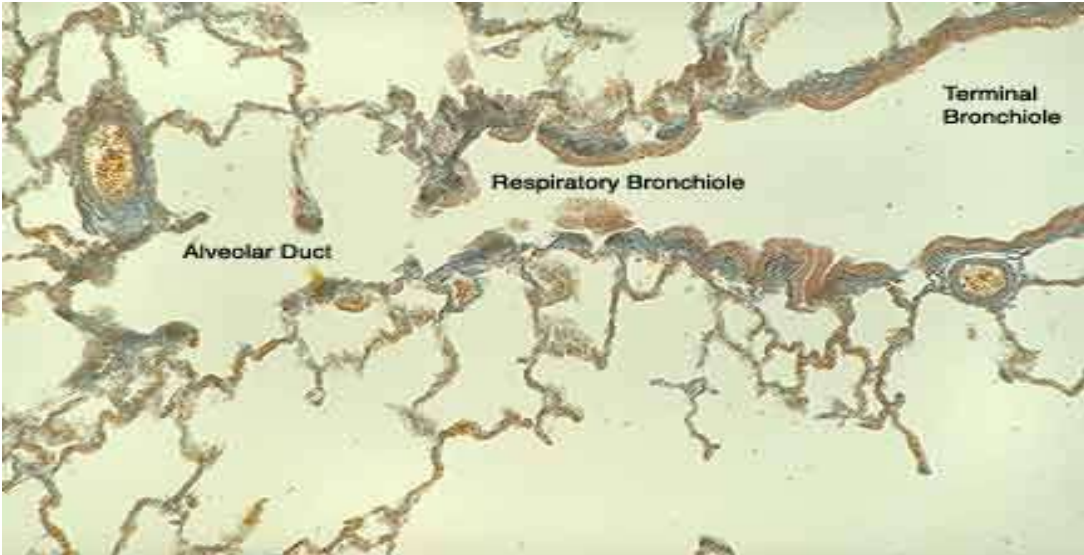


Lung 400x

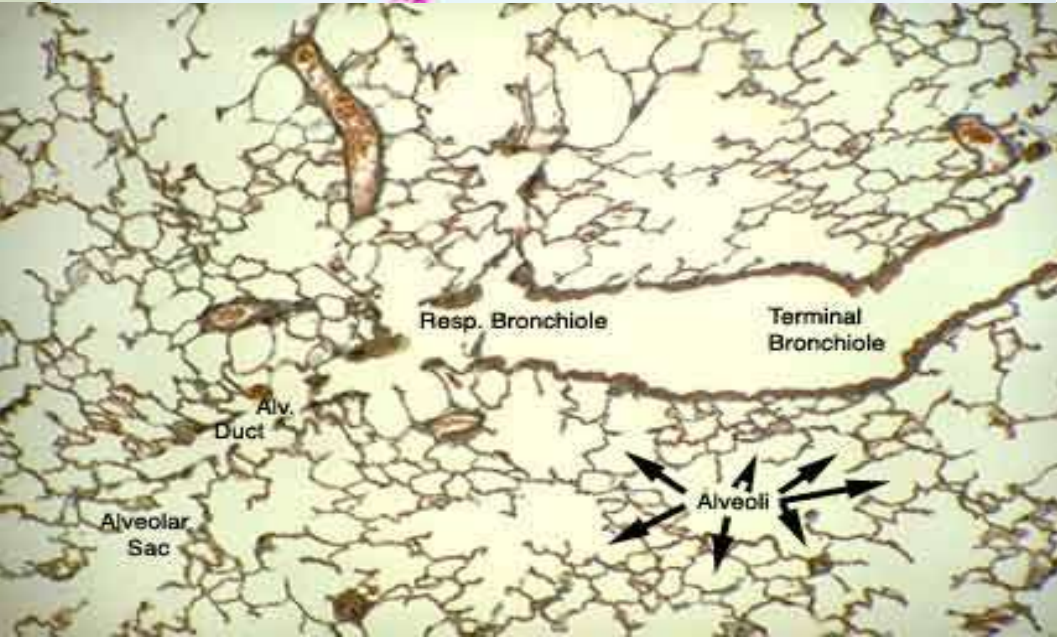
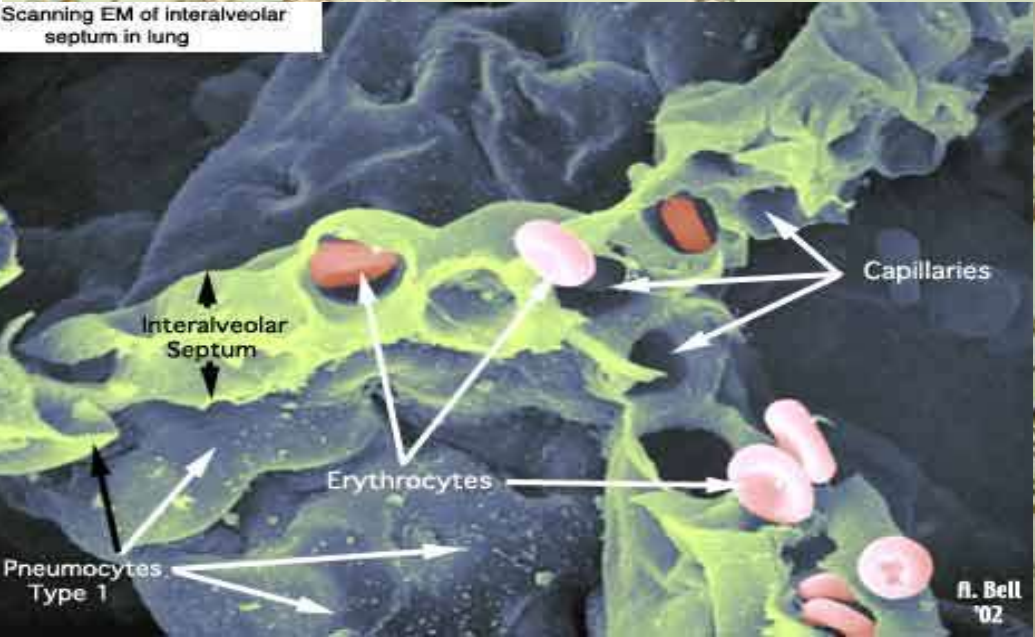




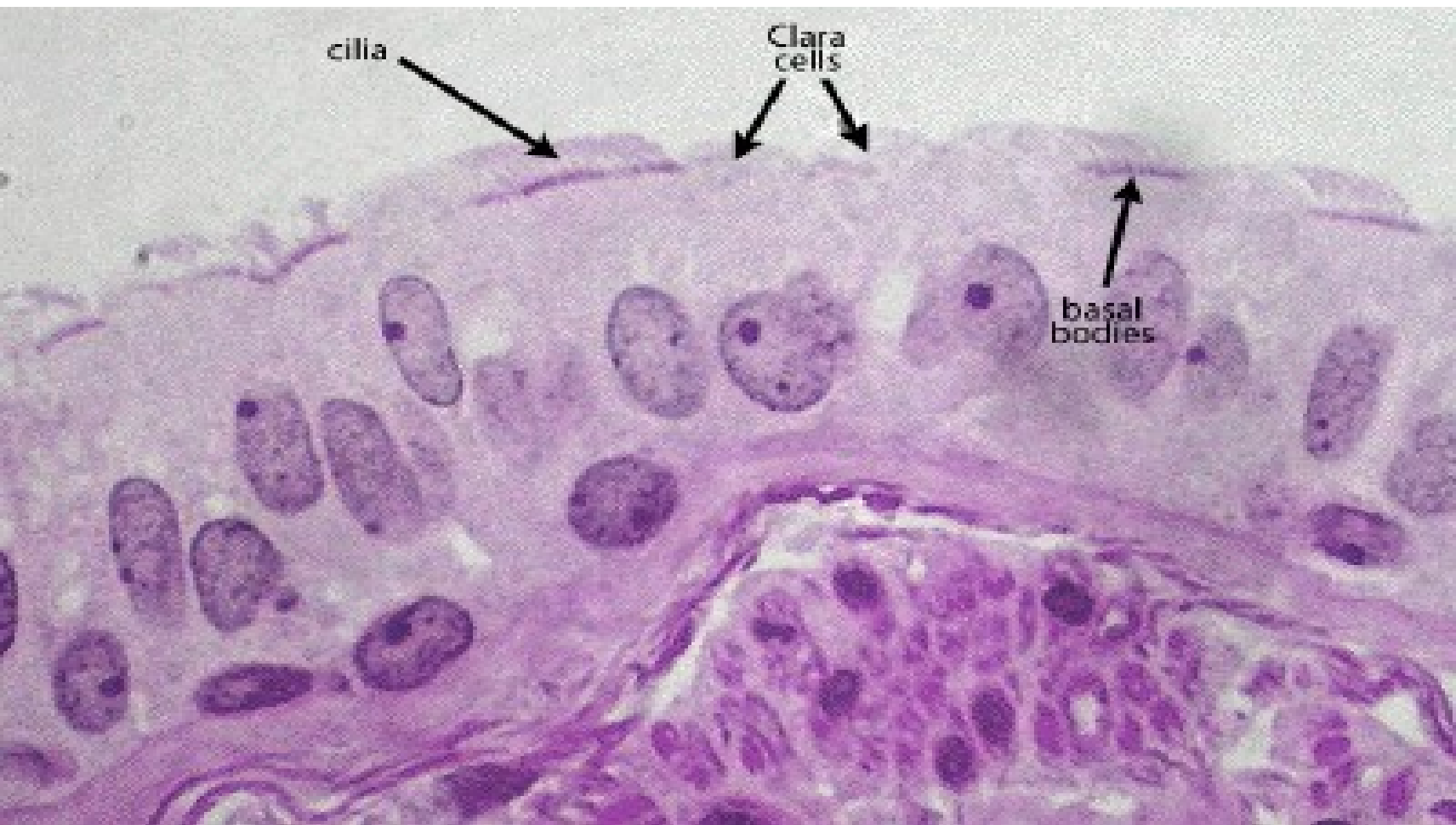




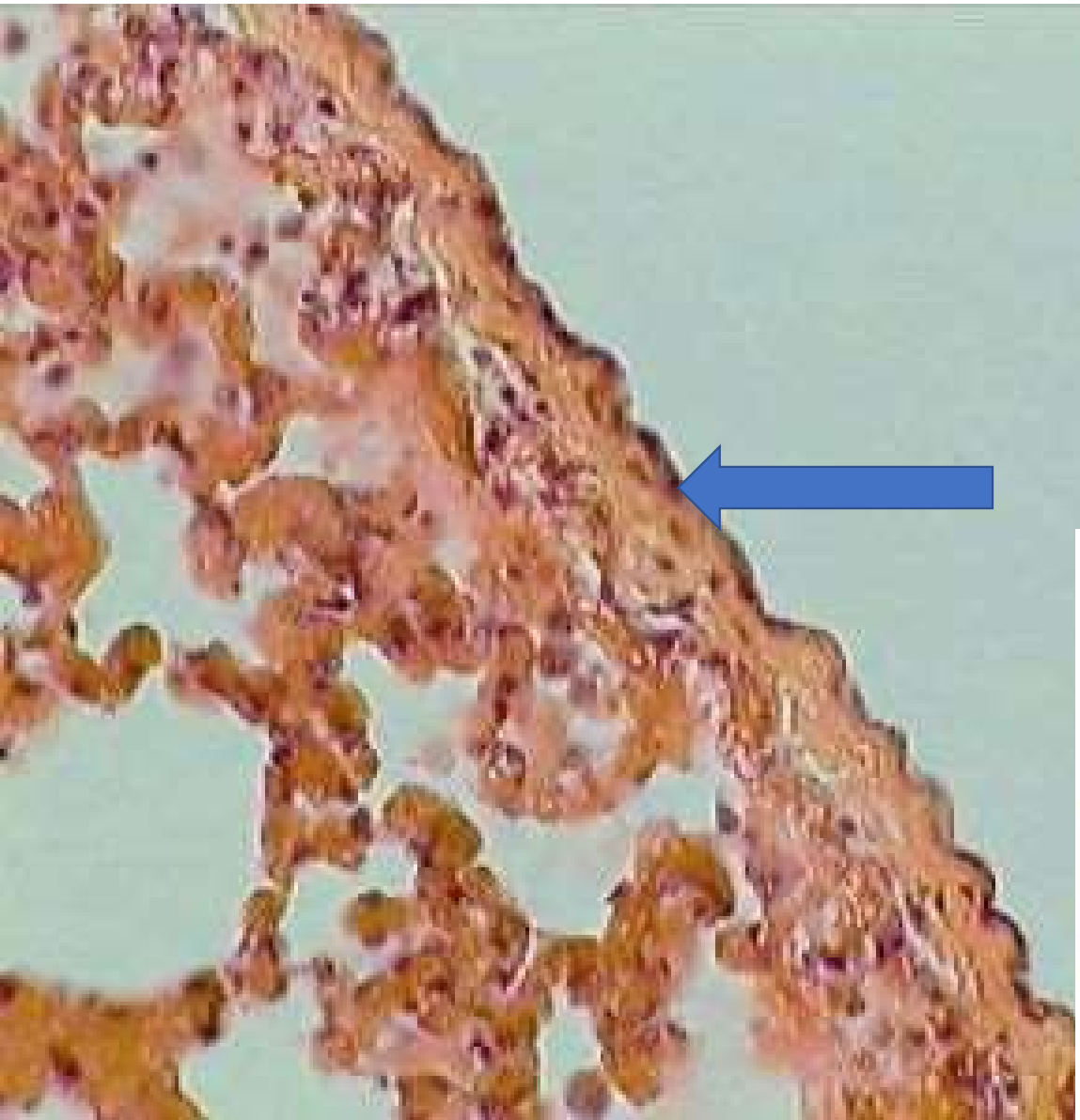
Scanning EM of interalveolar septum in lung



(a)



Pleura



Visceral pleura

