



Respiratory system

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Why?
tell me
why!



B- Respiratory portion

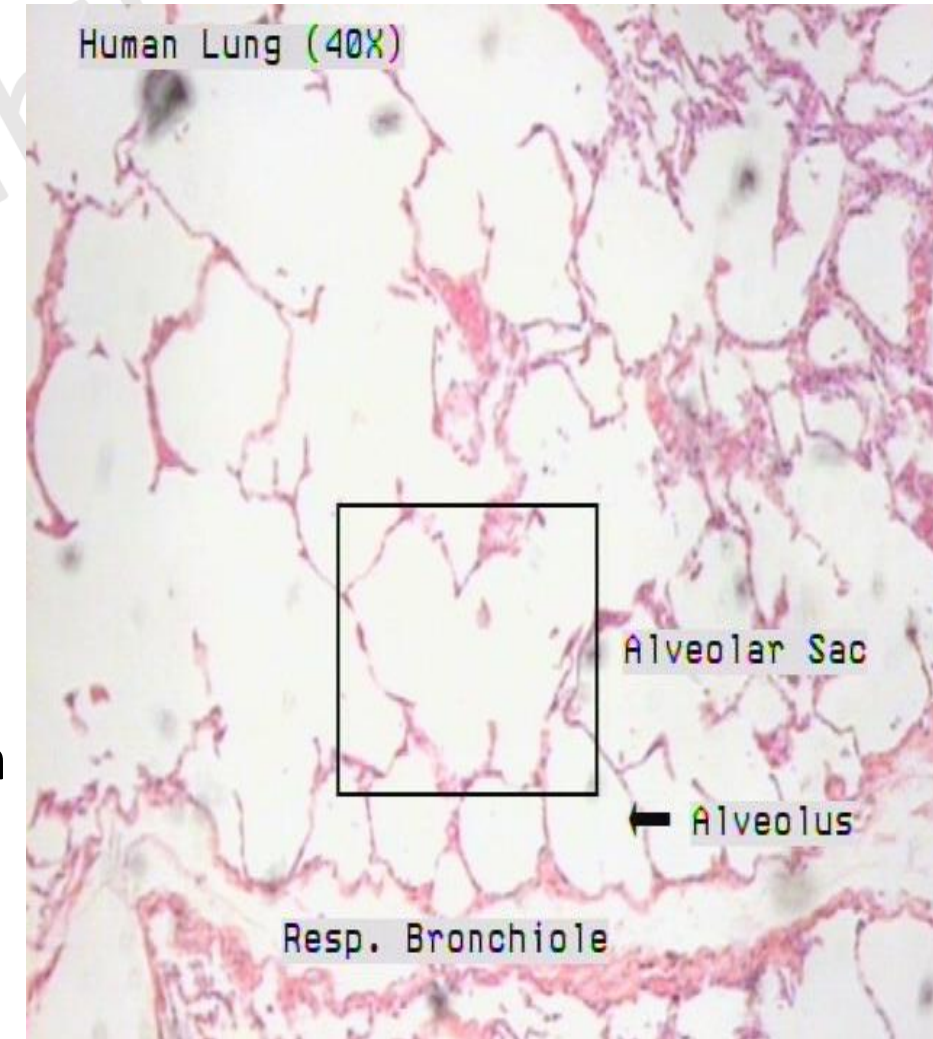
1- Respiratory bronchioles:

- They are lined by *cuboidal ciliated* epithelium with Clara cells where the cilia gradually disappear.
- The alveoli arise from their walls as outpocketings.

2- Alveolar duct: They are elongated branching passages arising from the distal ends of the respiratory bronchioles.

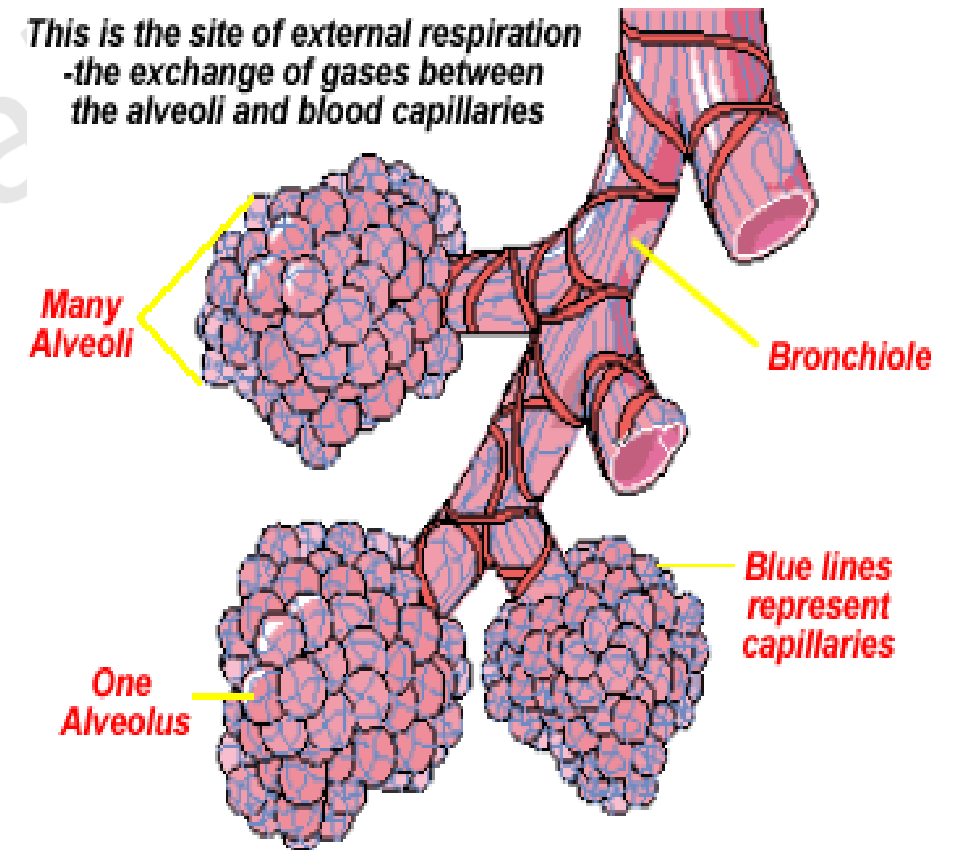
- Their walls are lined by *simple squamous* epithelium and surrounded by thin lamina propria containing elastic fibers and smooth muscle fibers.

3- Alveolar sac: They arise from the distal ends of the alveolar ducts where a cluster of alveoli open into each alveolar sac.



Alveoli

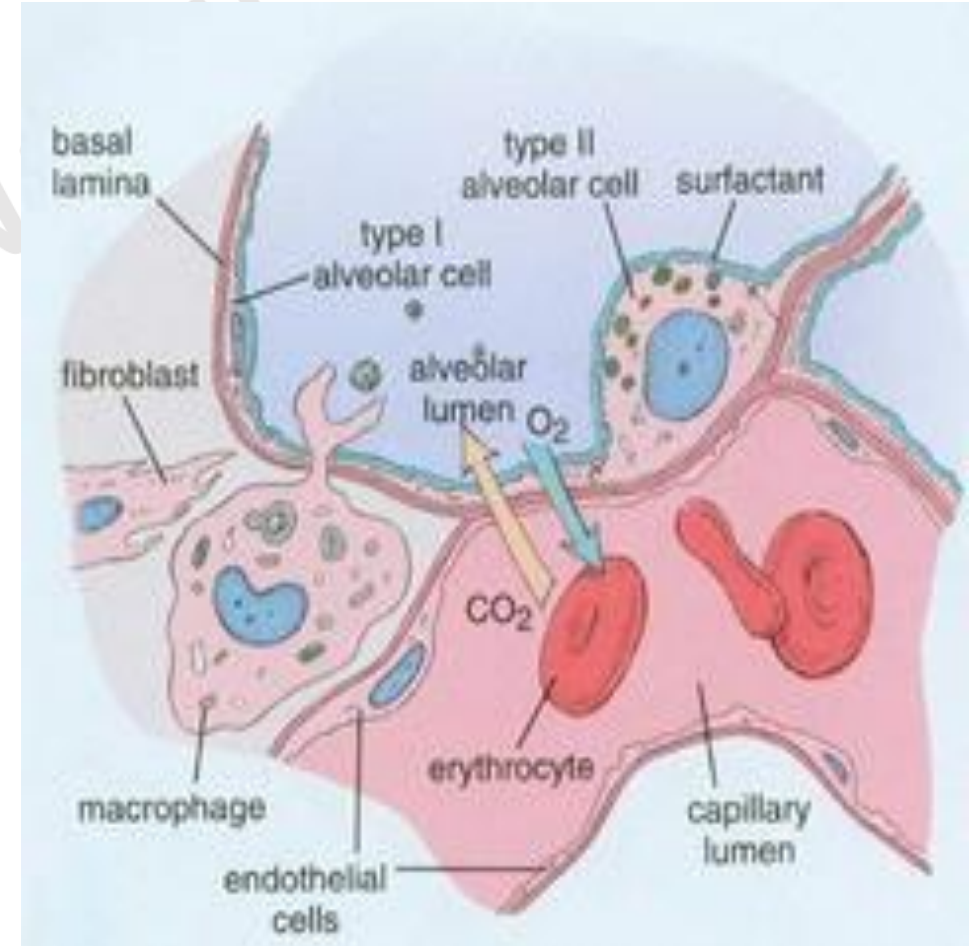
- These are *the structural and functional units* in which gaseous exchange between inspired air and blood takes place.
- They are minute air spaces which open into the respiratory bronchiole, alveolar ducts and alveolar sacs.
- They are responsible for the spongy structure of the lungs.



Alveolar epithelium=Alveolar cells

1- Type I pneumocytes

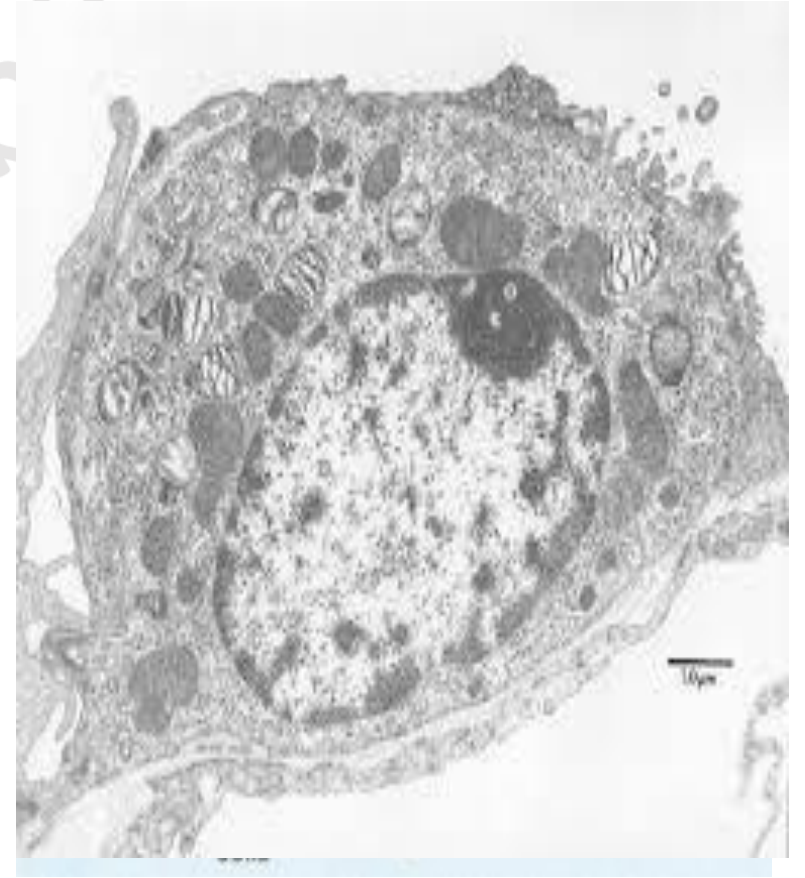
- **Prevalence:** They cover approximately 95% of the alveolar surface.
- **Function:** They form the alveolar side of the *blood- air barrier for gas exchange*.
- **Structure:**
 - Squamous cells with extremely flat nuclei.
 - They are attached to one another and to type II pneumocytes by *occluding junctions*.



Alveolar epithelium

2- Type II pneumocytes

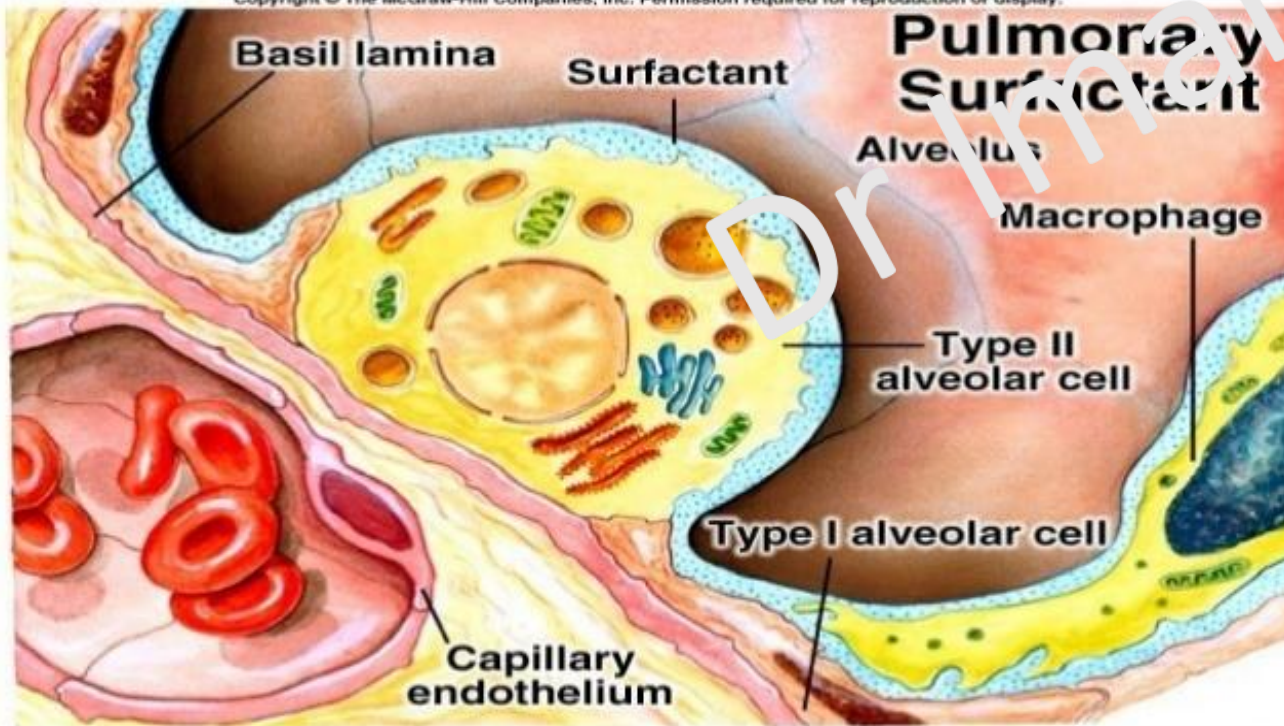
- **Prevalence:** They cover approximately 5% of the alveolar surface.
- **Structure:**
 - Cuboidal cells that bulge into the air space.
 - They are attached to the adjacent type I cells by *occluding junctions*.
 - They have rounded nuclei with short microvilli. Their cytoplasm contains membrane- bounded secretory granules called *lamellar bodies* contain the pulmonary surfactant.
- **Function:**
 - 1- Secretion of surfactant.
 - 2- They are progenitor cells for type I alveolar cells.



Pulmonary surfactant

N.B.: surfactant is only secreted late in pregnancy so premature babies usually have respiratory distress due to deficiency of surfactant.

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What difference does it make....????

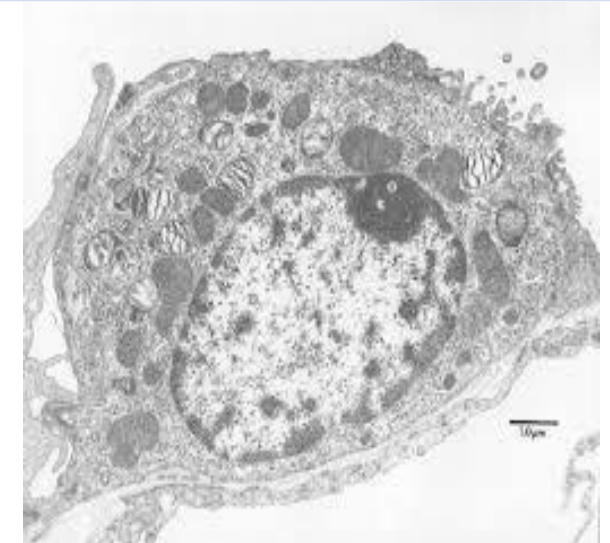
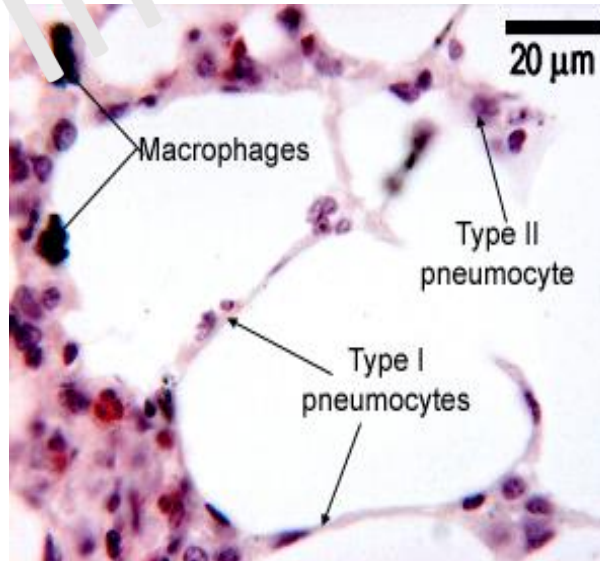
**Normal Expiration
With Surfactant**



**Abnormal Respiration
Without Surfactant**

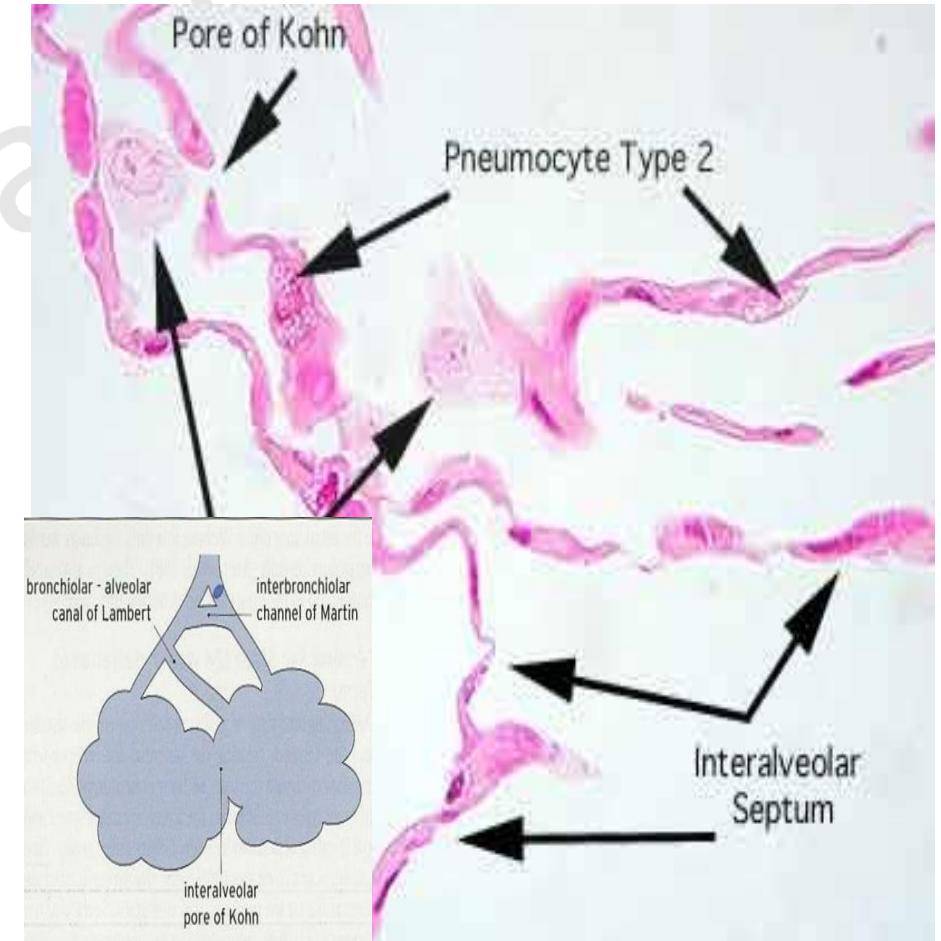


	Type I	Type II
1- Surface area	95%	5%
2- Shape	•Simple squamous with very flat nucleus. •Attached to each other and to type II by occluding junction.	•Large, cuboidal. •Attached to each other and to type I by occluding junction. •Have microvilli. •Cytoplasm contains amellar bodies.
3-Function	Gas exchange	•Secrete surfactant •Progenitor for type I (so ↑ in lung injury)



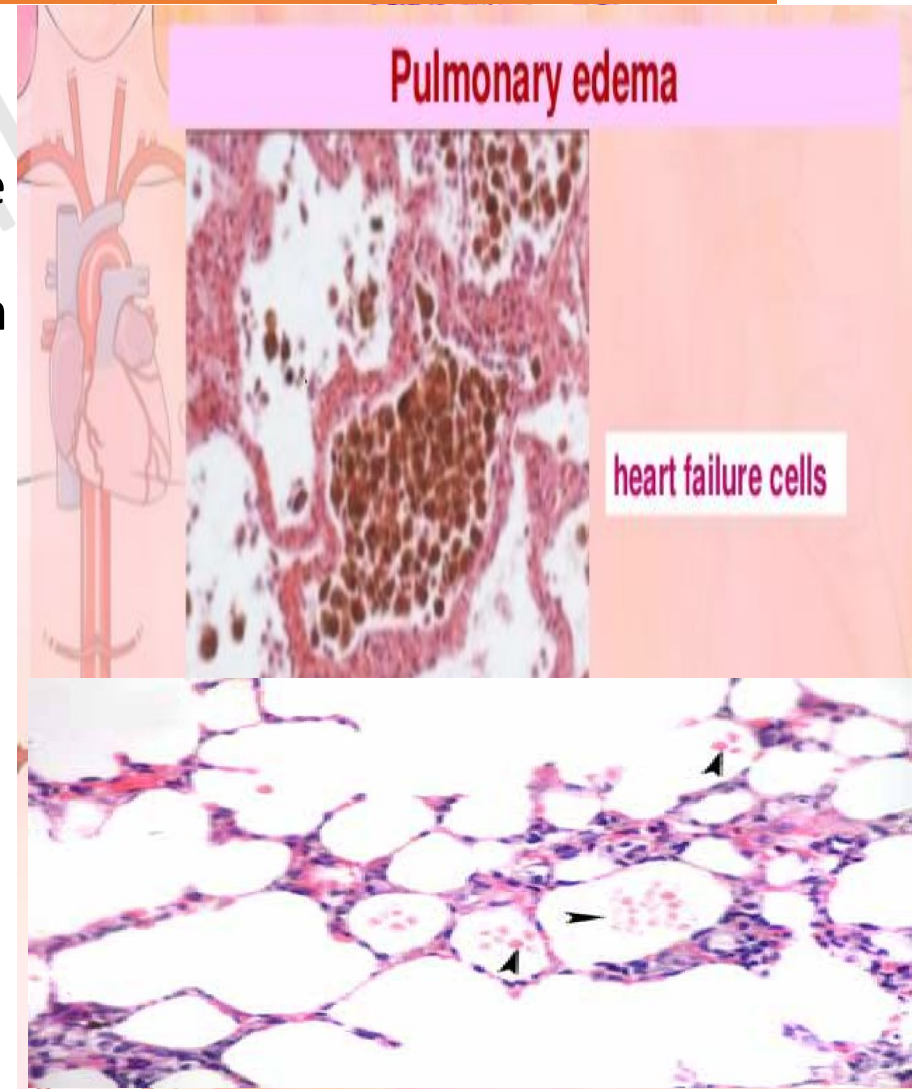
The interalveolar septum

- **Definition:** It is the thin connective tissue layer that surrounds and separates the alveoli from one another.
- It is traversed by *the alveolar pores* that allow collateral respiration in case of a small airway passage becomes obstructed.
- **Contents:**
 - 1- An extensive *capillary network*.
 - 2- Elastic and reticular *fibers*.
 - 3- *Interstitial fibroblasts*: secrete fibers and extracellular matrix of the interstitium.
 - 4- *Alveolar macrophages*.



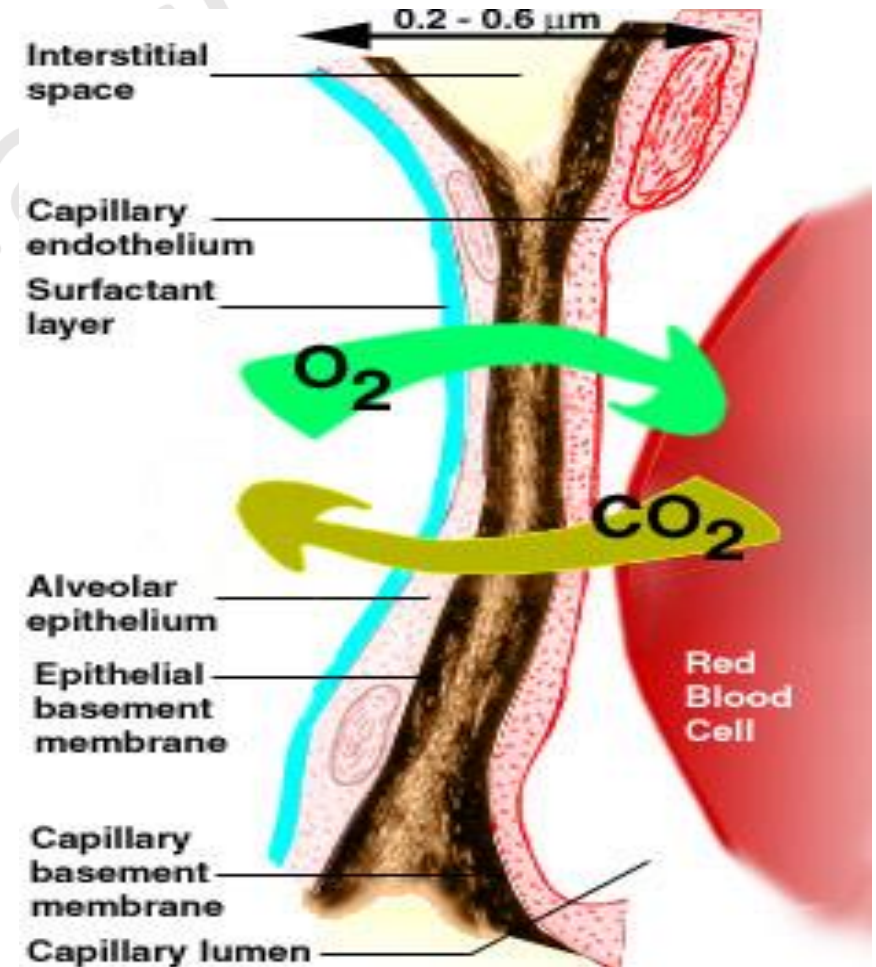
Alveolar macrophages

- **Origin:** from the blood monocytes (members of mononuclear phagocyte system).
- **Site:** in the interalveolar septa and in the air spaces of the alveoli.
- **Structure:** They have an irregular nucleus & the cytoplasm contains large number of lysosomes.
- **Function:** They engulf any inhaled dust, or bacteria that escape the mucous blanket of the respiratory epithelium, then they are propelled by the ciliary action where they are coughed in the sputum and known as *dust cells*.
- In heart failure: the alveolar macrophages phagocytose RBCs which are extravasated into the alveoli from the congested pulmonary capillaries. Here the macrophages contain hemosiderin pigment granules inside their cytoplasm and are known as *heart failure cells*.



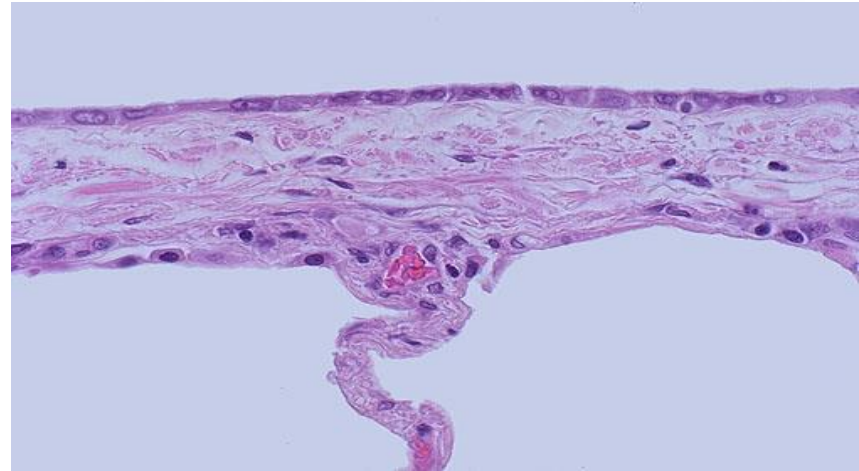
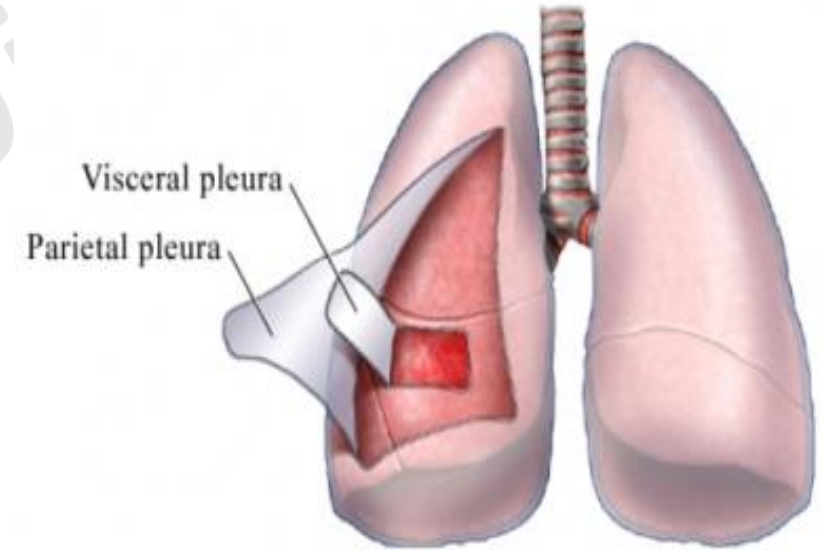
The alveolar capillary barrier= blood air barrier

- **Definition:** It is the thin portion of the interalveolar septum, where air the alveoli is separated from capillary blood by 4 components:
- **Components:**
 - 1- A layer of surfactant.
 - 2- Type I pneumocytes.
 - 3- Fused basal laminae of type I pneumocytes and endothelial cells of the capillaries.
 - 4- Endothelial cells of the pulmonary continuous capillaries.
- **Function:** It is the site of exchange of gases between inhaled air & blood.



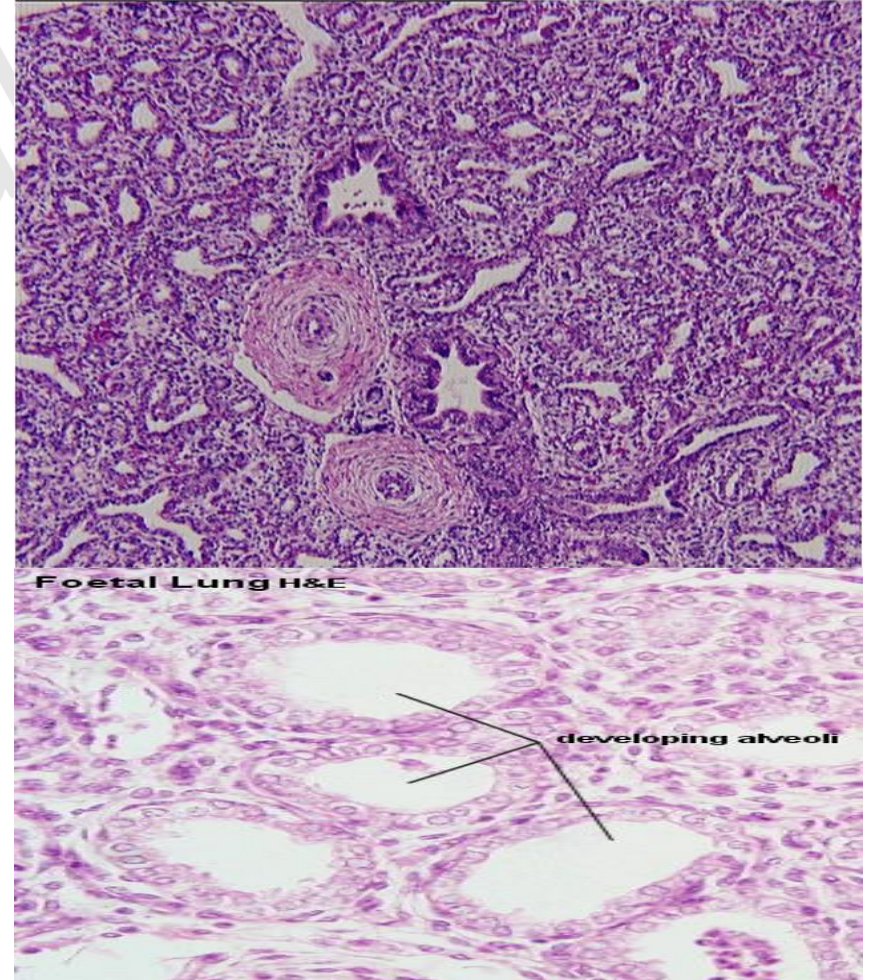
Pleura

- **Definition:** It is the serous membrane covering the lung(*visceral pleura*) and lining the internal wall of the thoracic cavity (*parietal pleura*).
- **Structure:** Simple squamous cell (mesothelium) supported by a thin connective tissue layer of collagen and elastic fibers.
- The cavity between the parietal and visceral layers contains *a serous fluid* produced by the mesothelial cells which permits frictionless movement of the lungs during ventilation.

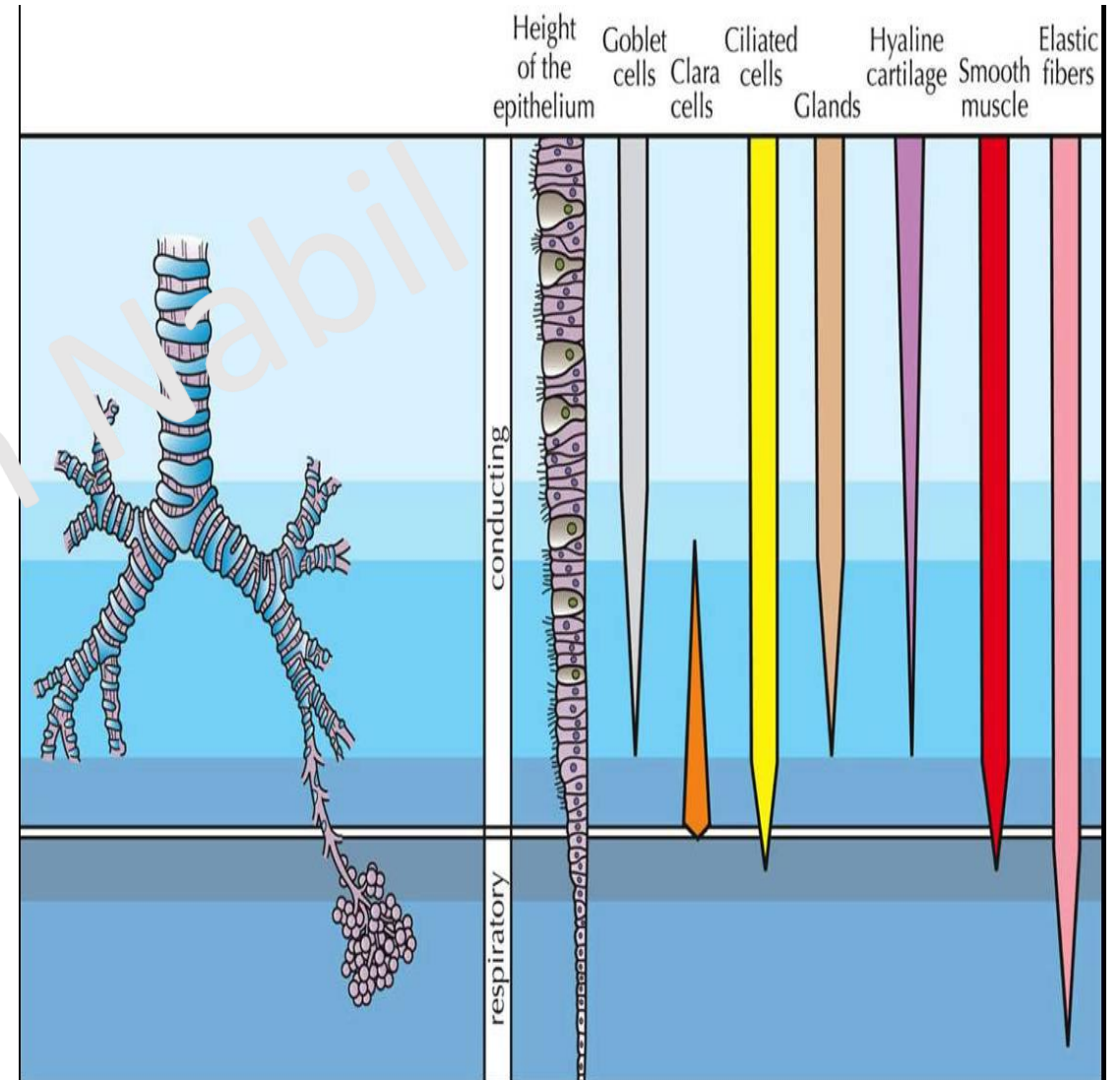
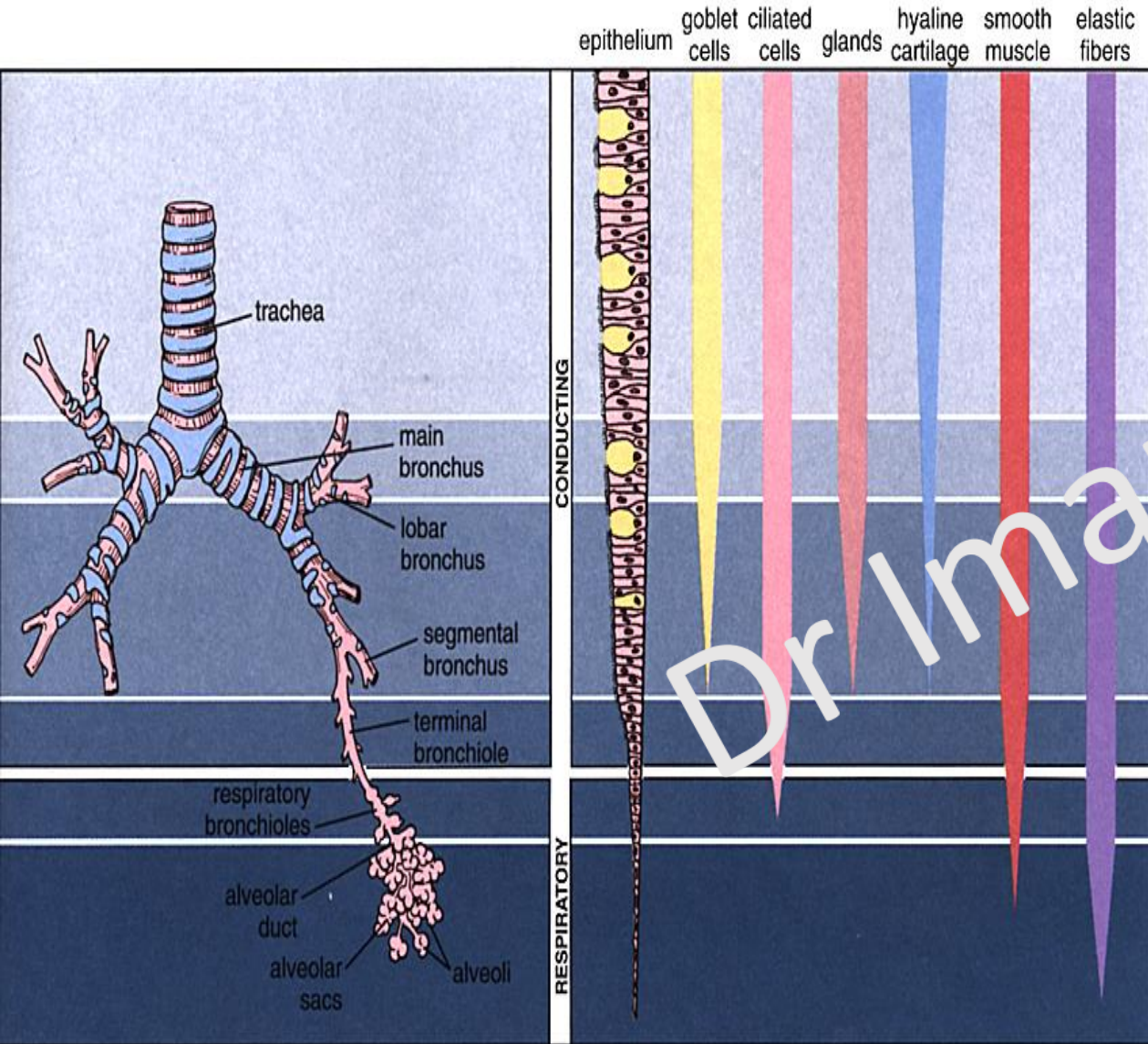


Fetal lung

- 1- It has *a gland-like appearance* with prominent lobulation due to its thick interlobular septa.
- 2- The alveoli and the alveolar ducts: are lined by *cuboidal epithelium* and are *collapsed*.
- 3- The bronchi and bronchioles: are *folded*.
- 4- The pulmonary blood vessels are *congested*.

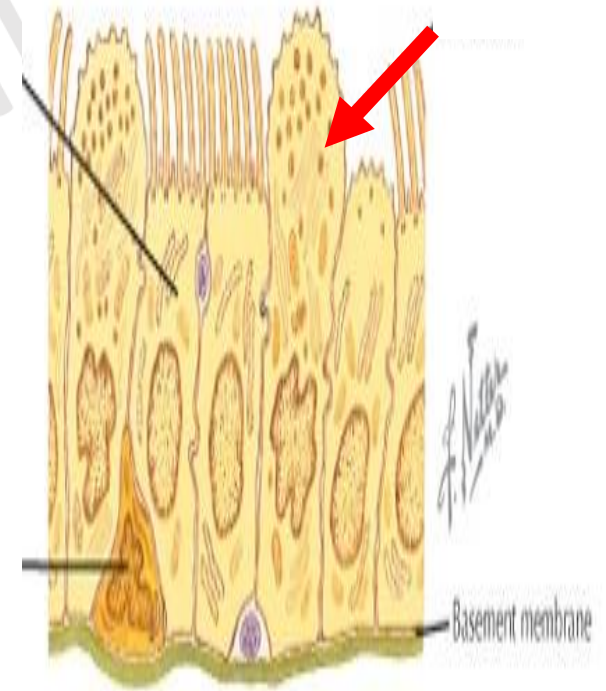


	Trachea	Bronchi	Bronchiole	Respiratory bronchioles	Alveoli
Mucosa •Epithelium •Lamina prop • Musculosa	Pseudostratified ciliated columnar with goblet cell+3 types of cells. Loose CT (↑elastic+ lymphoid nodules) -----	Pseudostratified ciliated columnar with goblet cell+3 (↓ height of epithelium) Loose CT with lymphoid nodules Present	Pseudostratified then Simple columnar of 3 types of cells Loose CT Thin Present	Ciliated cuboidal + Clara cell then cilia disappear.	Pneumocytes I & II
Submucosa	Seromucous glands	Seromucous glands			
Cartilage& Adventitia	C-shaped cartilage.	Irregular plates			
Function	•Conduction	•Conduction	•Conduction	•Gas exchange	•Gas exchange



Which statement is correct regarding the structure of the pointed cell by the red arrow?

- 1- It is present in the lining epithelium of the trachea.
- 2- It forms the blood air barrier.
- 3- It proliferates to renew the adjacent cell.
- 4- It secretes surfactant-like fluid.



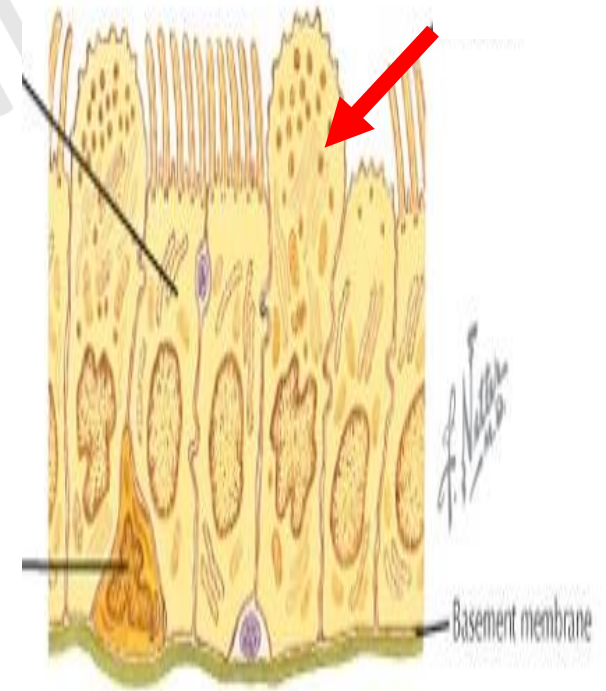
Which statement is considered as the best matching to the function of the cell in the opposite diagram?

- 1- Alveolar type II cell move mucous blanket.
- 2- Clara cell.....secretes surfactant-like fluid.
- 3- Alveolar type II cell.....increase in number in lung injury.
- 4- Clara cell regulates vascular caliber.



Which statement is correct regarding the structure of the pointed cell by the red arrow?

- 1- It is present in the lining epithelium of the trachea.
- 2- It forms the blood air barrier.
- 3- It proliferates to renew the adjacent cell.
- 4- It secretes a surfactant-like fluid.



Which statement is considered as the best matching to the function of the cell in the opposite diagram?

- 1- Alveolar type II cell move mucous blanket.
- 2- Clara cell.....secretes surfactant-like fluid.
- 3- Alveolar type II cell.....increase in number in lung injury.
- 4- Clara cell regulates vascular caliber.



