

RESPIRATORY SYSTEM (II)

**Histology of the Lower Respiratory Tract
(Trachea, Bronchi, Bronchioles) & the Lung**

Objectives:

By the end of this lecture, the student should be able to describe:

1- The microscopic structures of the wall of:

- Trachea.
- Primary or extrapulmonary bronchi.
- Intrapulmonary (secondary and tertiary) bronchi.
- Bronchioles.

2- The microscopic structures of :

Interalveolar septum.

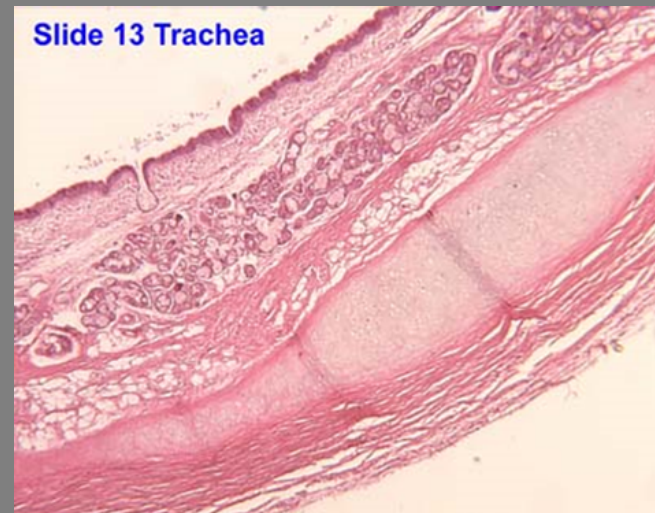
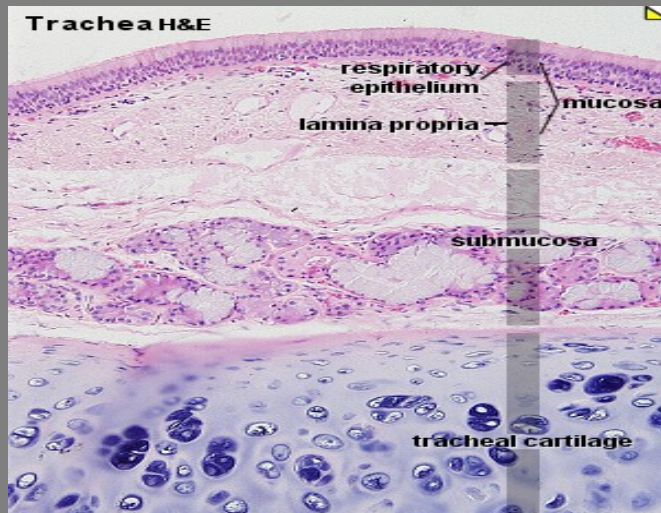
Alveolar phagocytes.

Pleura.

TRACHEA

The wall of trachea is formed of:

- (1) Mucosa.
- (2) Submucosa.
- (3) Adventitia.



MUCOSA OF TRACHEA

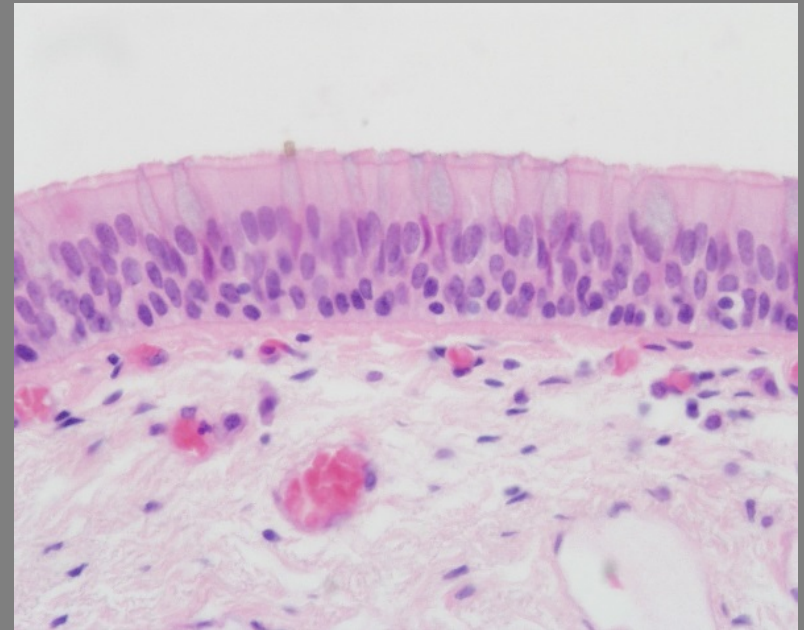
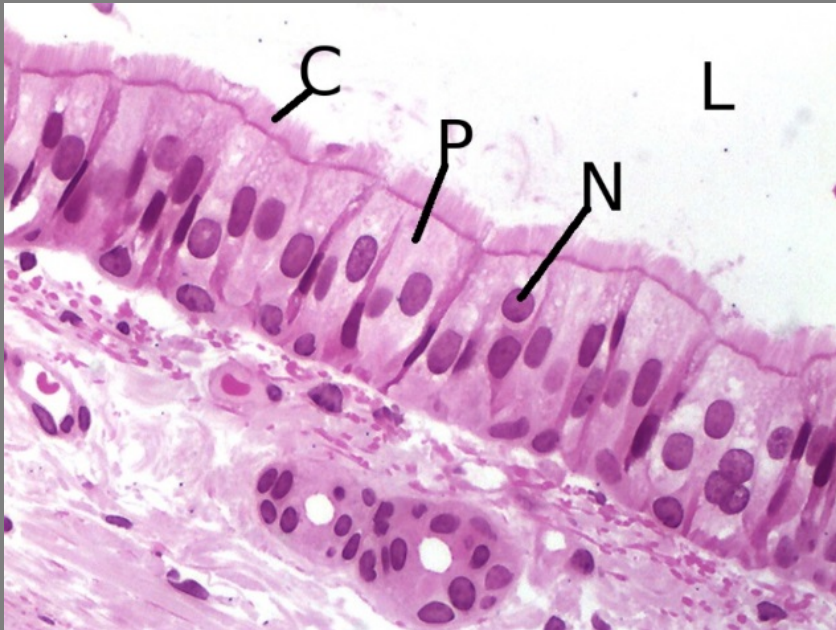
(1) **Epithelium:** Respiratory epithelium

(2) **Lamina propria.**

(3) **Elastic lamina:**

It is formed of elastic fibers.

It separates lamina propria from submucosa.



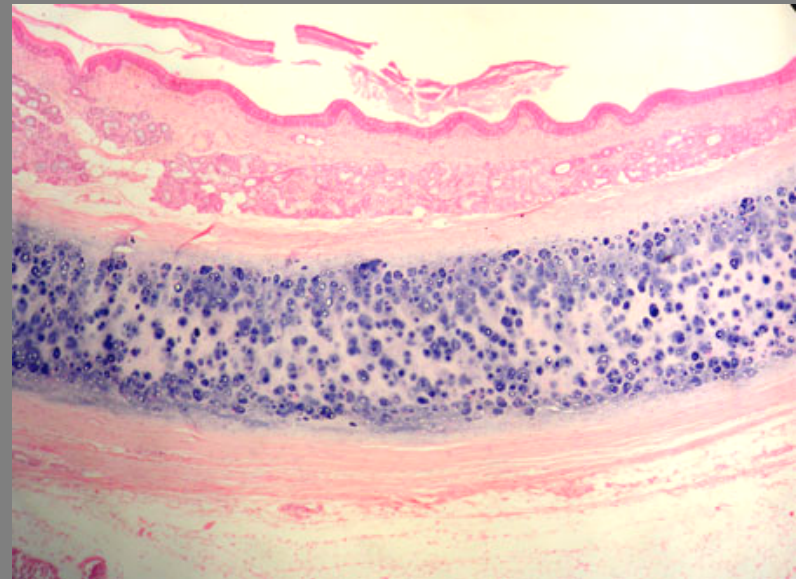
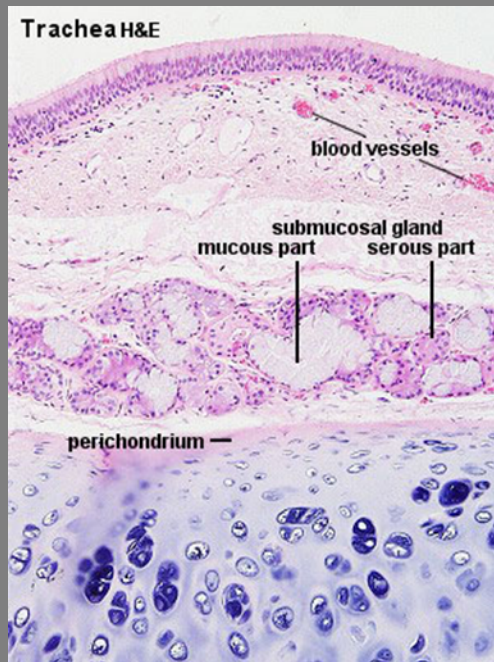
SUBMUCOSA OF TRACHEA

Contents:

1- C.T.

2- Numerous mucous & seromucous glands.

3- Lymphoid elements.



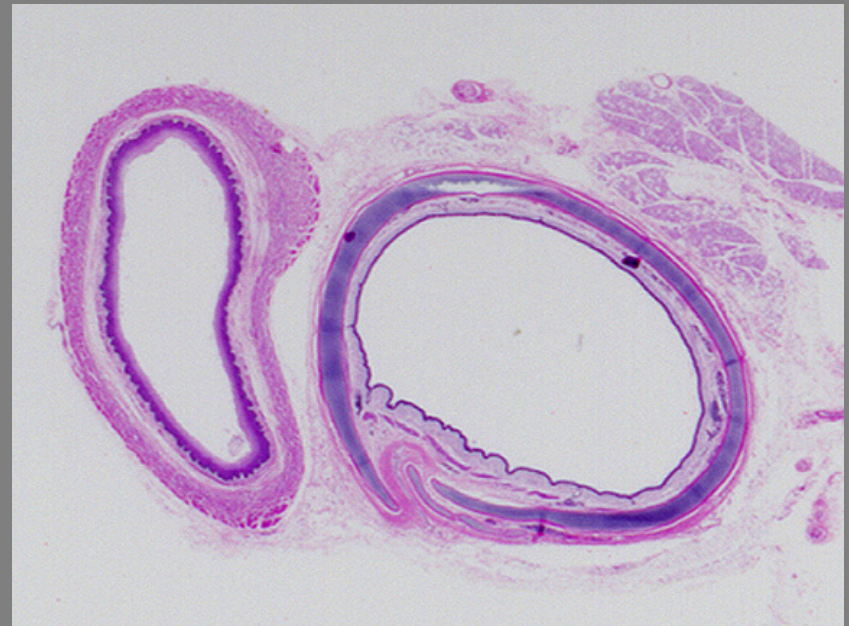
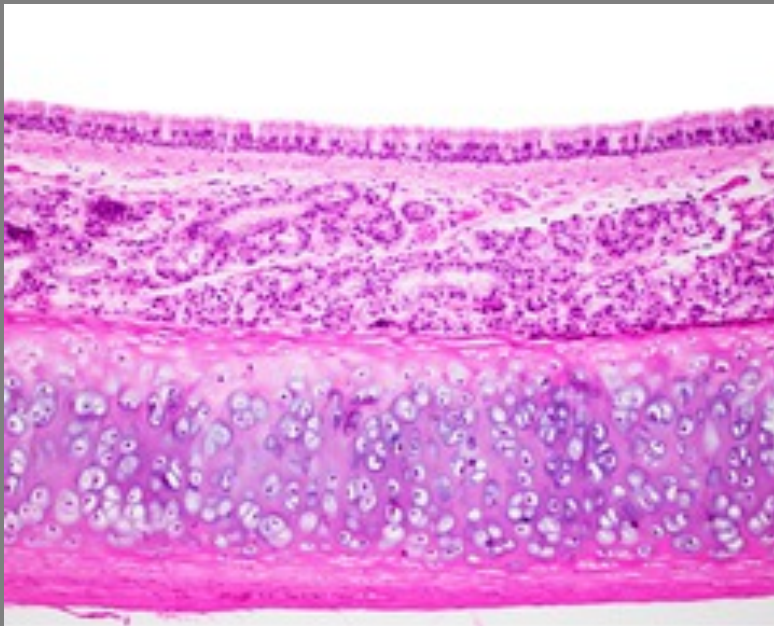
ADVENTITIA OF TRACHEA

Contents:

1- Fibroelastic C.T.

2- C-shaped rings (12-16) of hyaline cartilage.

Trachealis muscle (bundle of smooth muscle fibers) connects the 2 ends of each C-shaped (incomplete) rings of cartilage.



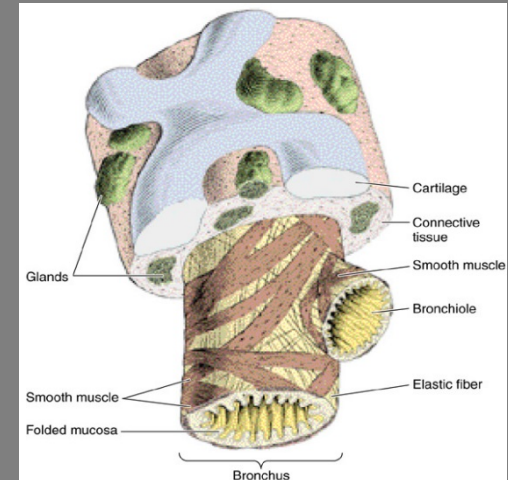
EXTRAPULMONARY BRONCHUS *(Iry BRONCHUS)*

Generally have the same histological appearance as the trachea.

INTRAPULMONARY BRONCHI

(2ry & 3ry BRONCHI)

- 1- Mucosa.
- 2- Muscle coat.
- 3- Submucosa.
- 4- Adventitia.



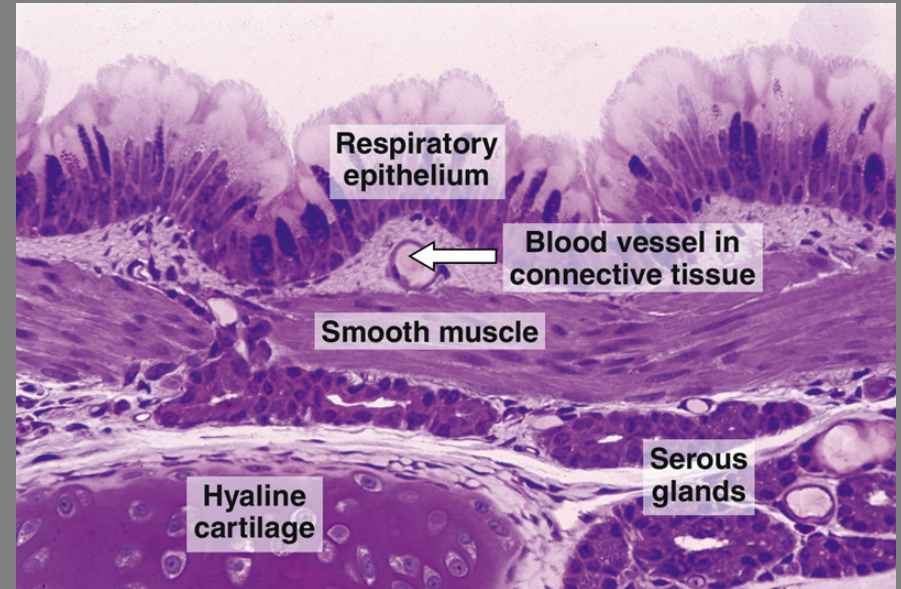
INTRAPULMONARY BRONCHUS

(1) Mucosa:

a- Epithelium: Respiratory epith.

b- Lamina propria.

N.B. No elastic lamina.



(2) Muscle coat (complete):

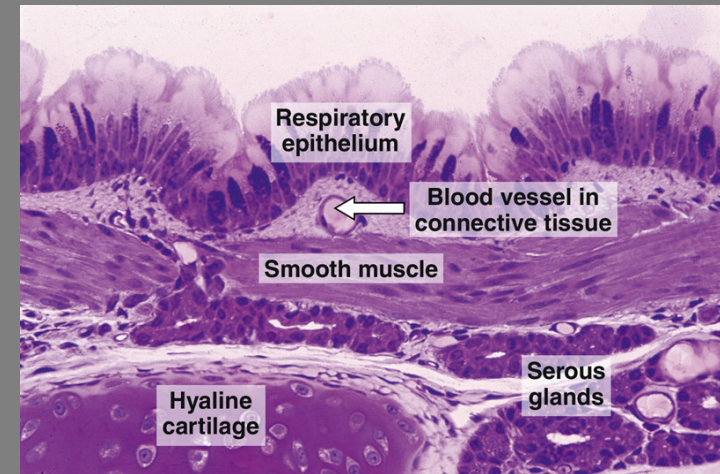
Two distinct layers of smooth muscle fibers spirally arranged in opposite direction.

INTRAPULMONARY BRONCHUS

(3) Submucosa:

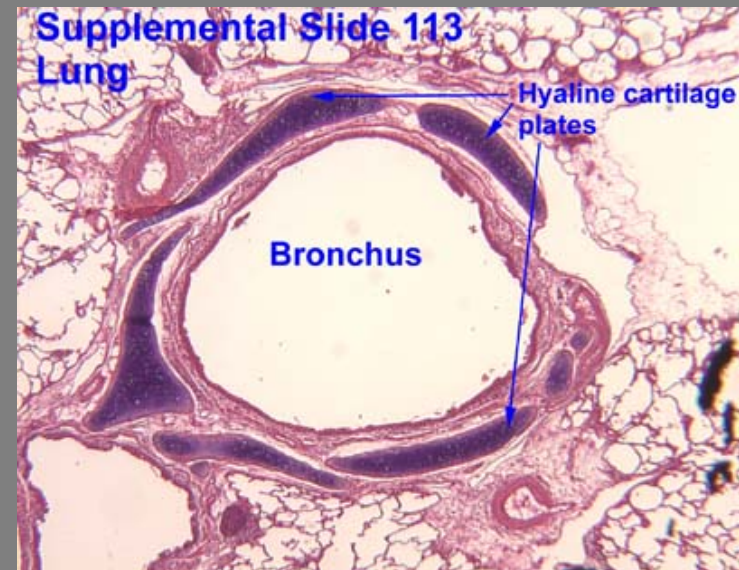
C.T. contains:

- a- Seromucous glands.
- b- Lymphoid elements.



(4) Adventitia:

- Contents:
- a- Loose C.T.
 - b- Irregular plates of hyaline cartilage (complete layer).
 - c- Solitary lymphoid nodules.



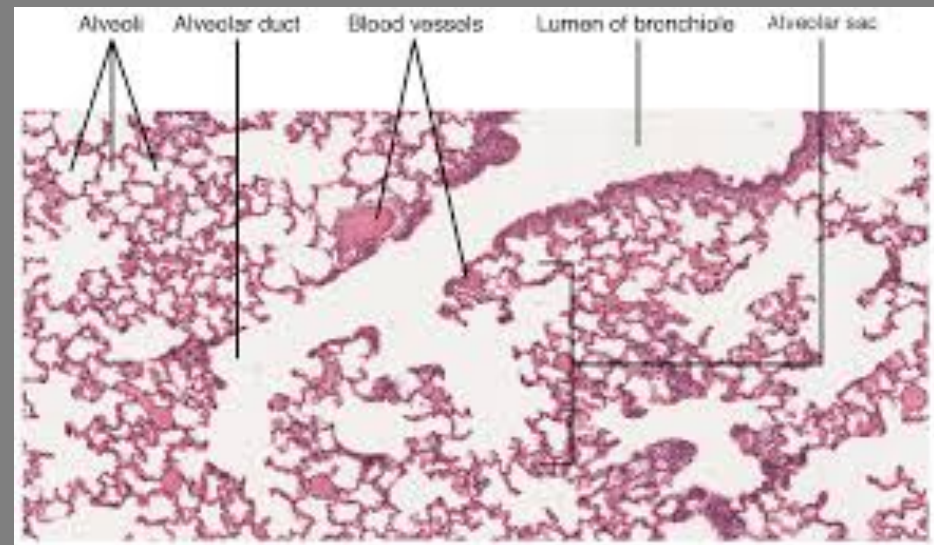
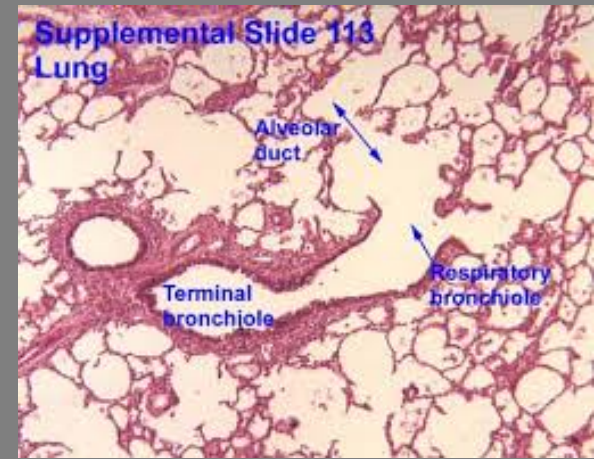
BRONCHIOLES

1- Preterminal (1ry) Bronchioles (Bronchioles):

Are less than 1mm in diameter.

2- Terminal (2ry) Bronchioles.

3- Respiratory (3ry) Bronchioles.



Preterminal Bronchioles

(1) Mucosa: has longitudinal folds:

A- Epithelium:

Simple ciliated columnar epith.
with occasional goblet cells.



B- Lamina propria: C.T. rich in elastic fibers.

(2) Smooth muscle: 2 helically arranged smooth muscle layers.

(3) Adventitia: C.T.

N.B. No cartilage, No seromucous glands, No lymph nodules.

Terminal Bronchioles

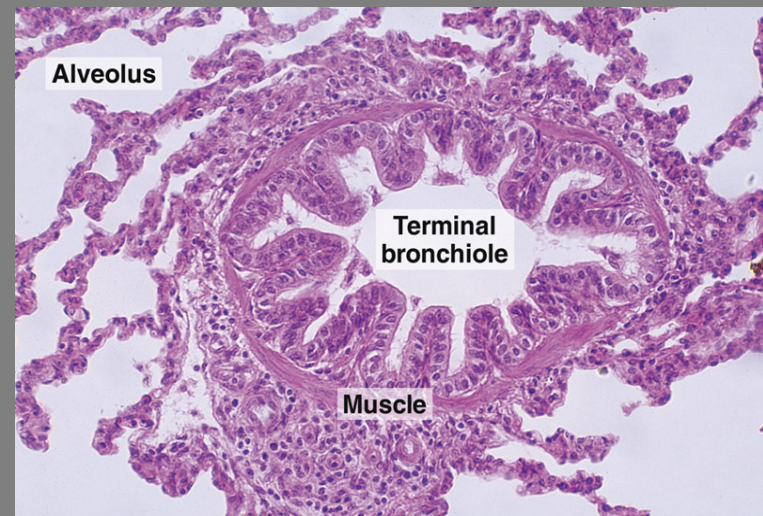
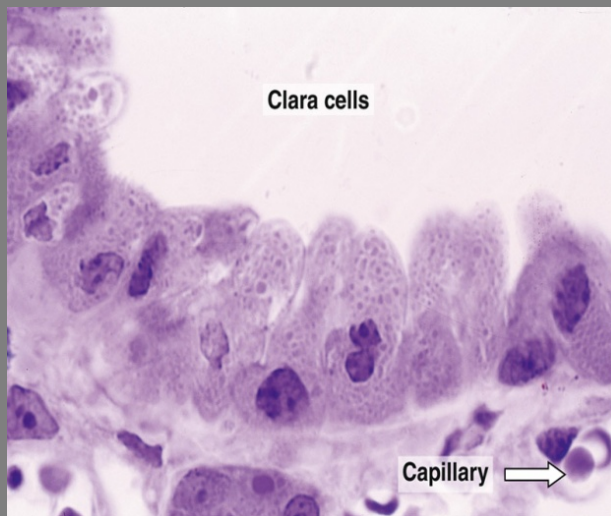
Similar structure to preterminal bronchioles, but:

Epithelium:

Simple cuboidal partially ciliated epithelium

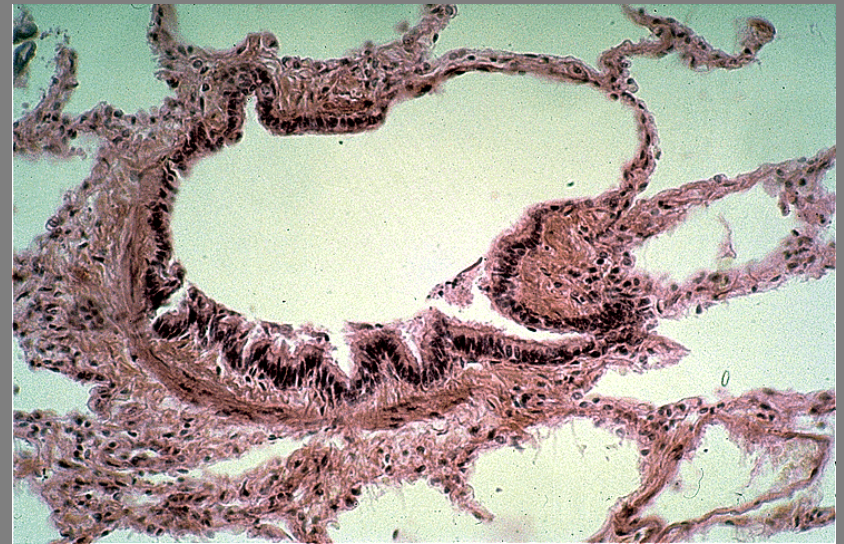
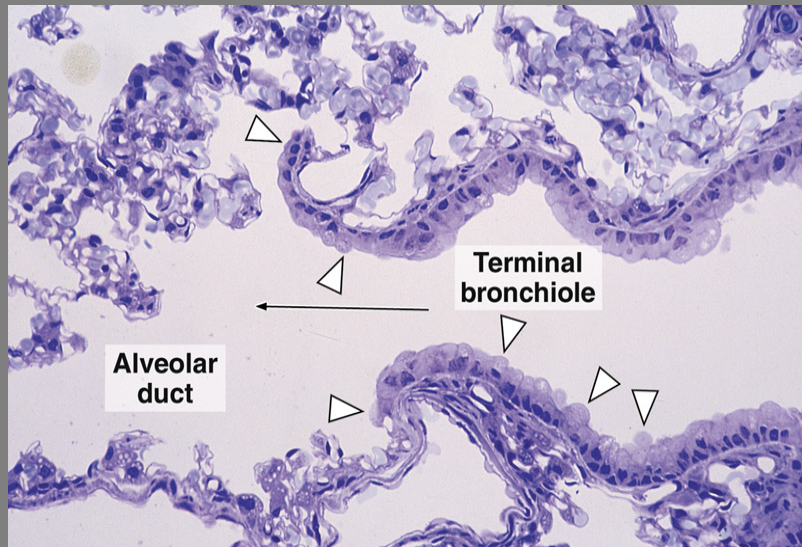
With **Clara cells** (**With NO goblet cells**).

N.B. Are less than 0.5mm in diameter.



Respiratory Bronchioles

Are similar in structure to terminal bronchioles **But:**
their walls are interrupted by the presence of
few pulmonary alveoli.



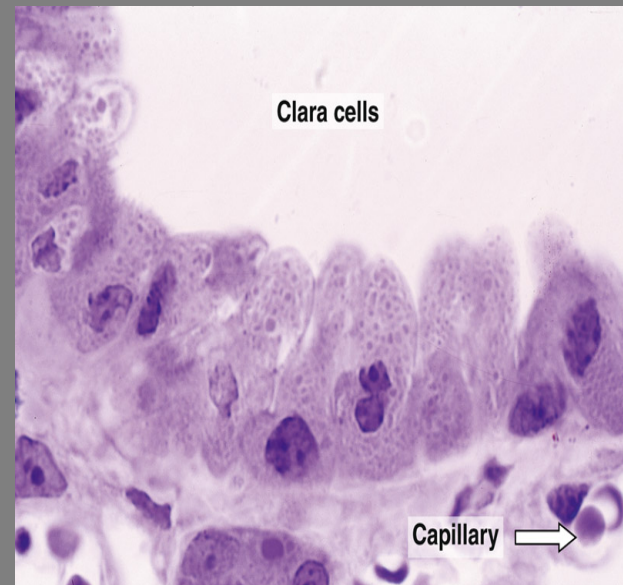
CLARA CELLS

Structure:

columnar cells (non ciliated).

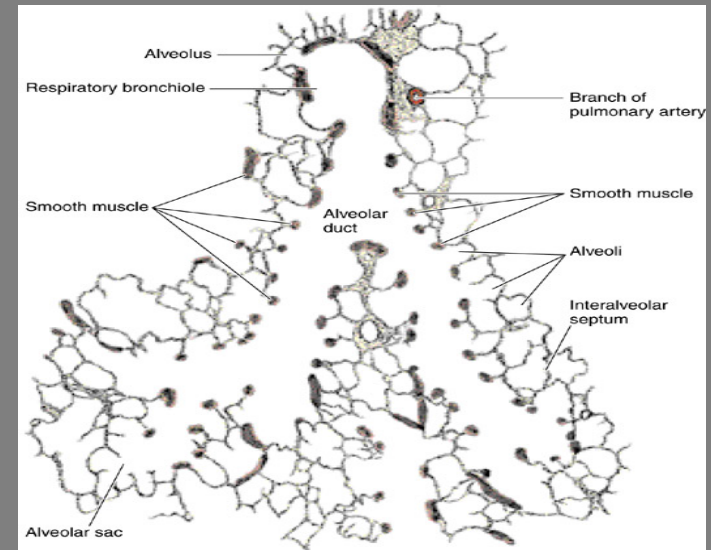
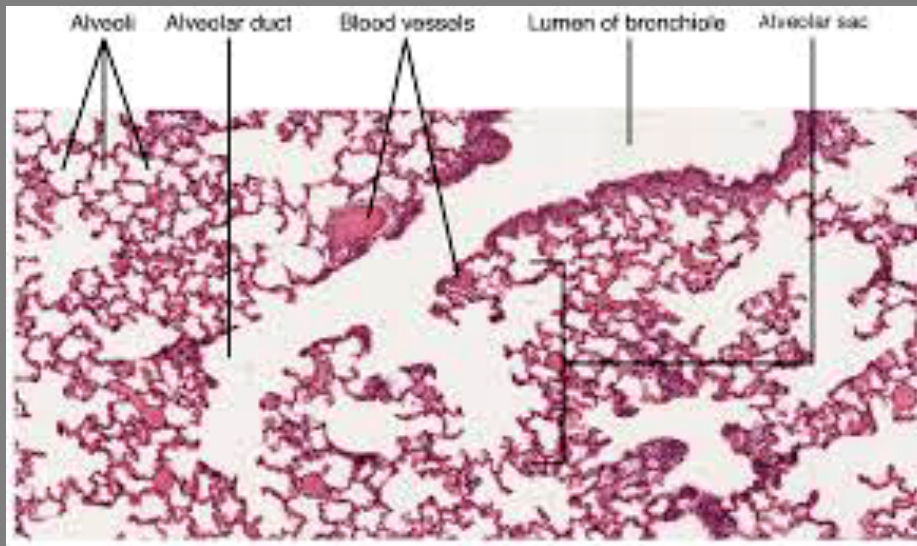
Function:

- 1- Degrade toxins in inhaled air.
- 2- Divide to regenerate the bronchiolar epith.
- 3- Produce surfactant-like material.



ALVEOLAR DUCTS

The wall of alveolar ducts consist almost of pulmonary alveoli.



N.B. Alveolar duct → ends by: atrium →
communicates with: 2-3 alveolar sacs

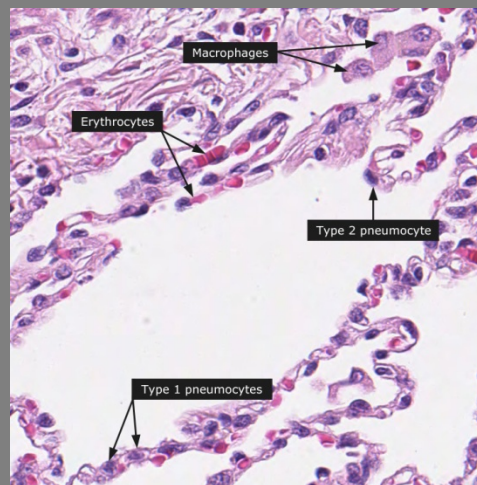
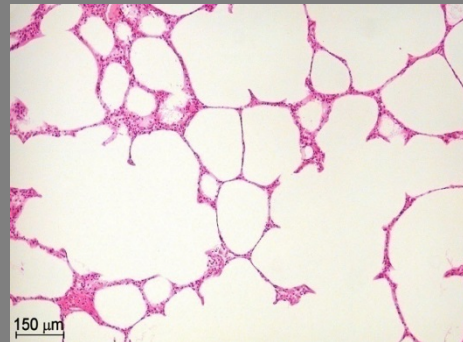
PULMONARY ALVEOLI

Definition:

They are small out-pouching of respiratory bronchioles, alveolar ducts & alveolar sacs.

Topics:

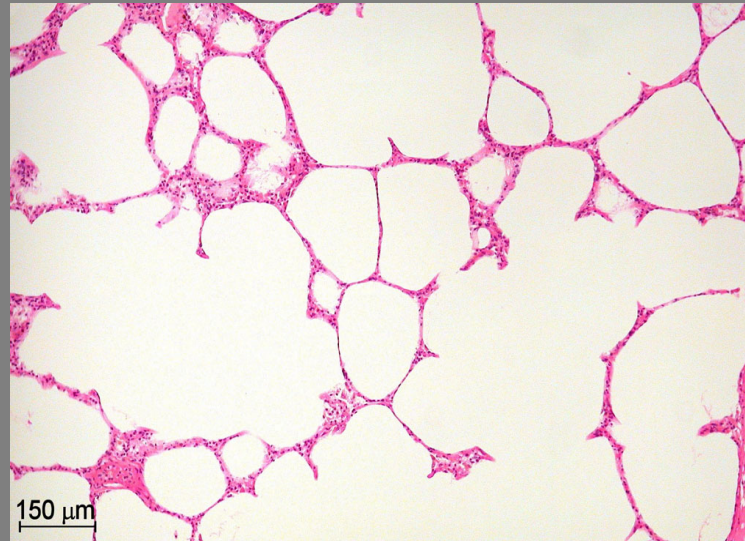
- * Inter-alveolar septa.
- * Alveolar epithelium.
- * Alveolar phagocytes (Lung macrophages).



INTERALVEOLAR SEPTA

Definition:

The region between 2 adjacent alveoli.



Components:

(A) Alveolar Epithelium:

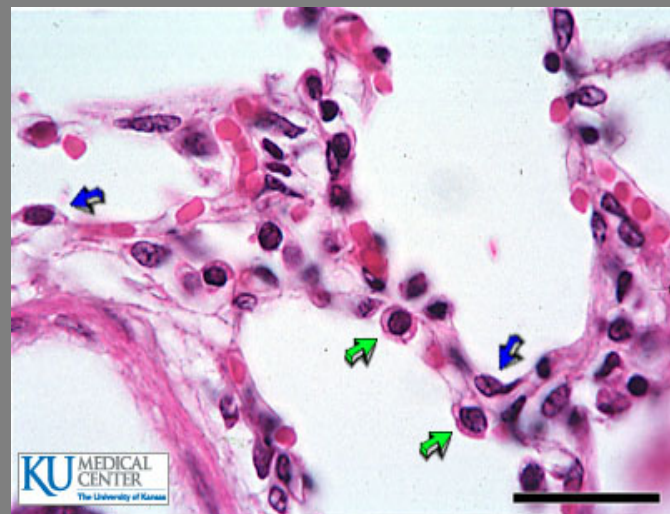
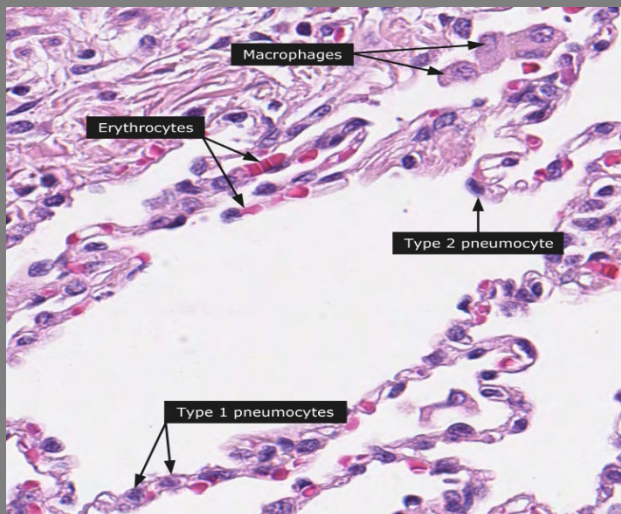
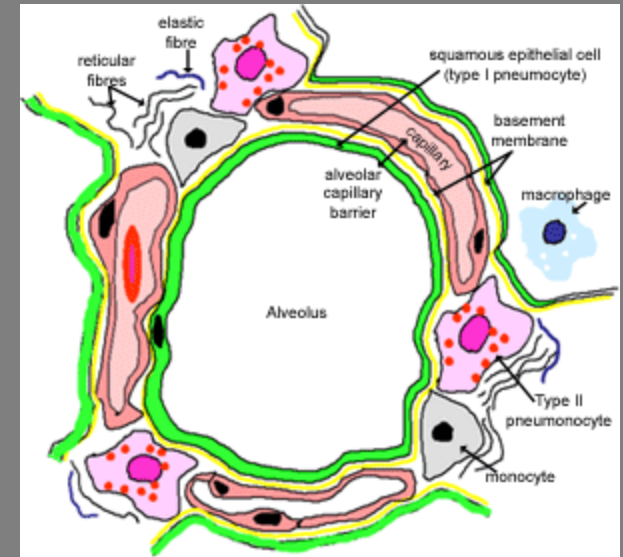
lines both sides of interalveolar septum.

(B) Interstitium.

ALVEOLAR EPITHELIUM

(1) Type I Pneumocytes

(2) Type II Pneumocytes



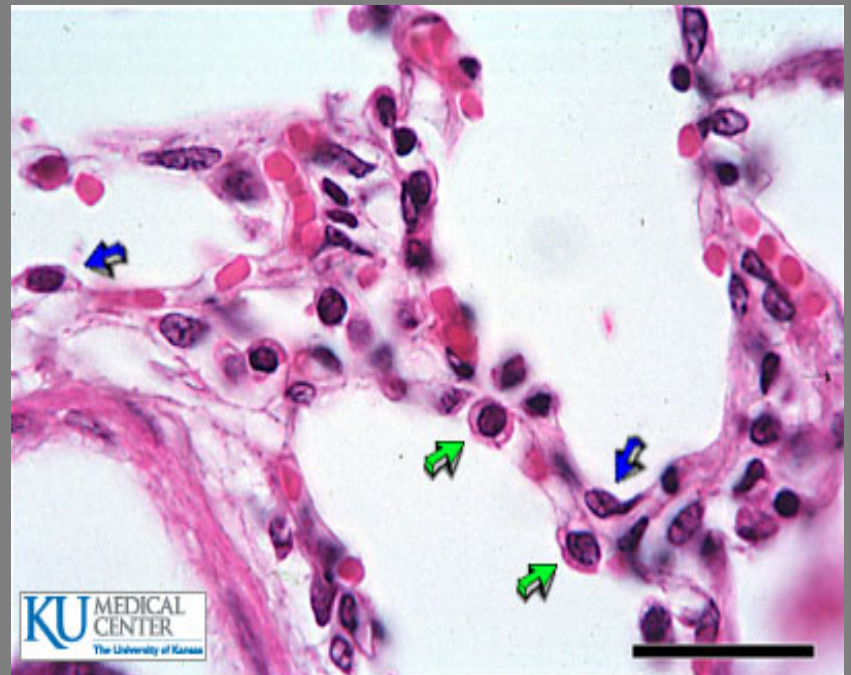
ALVEOLAR EPITHELIUM

(1) Type I Pneumocytes:

- line **95% of the alveolar surface**.
- **Count:** less numerous than type II pneumocytes.
- **L/M:** simple squamous epith.

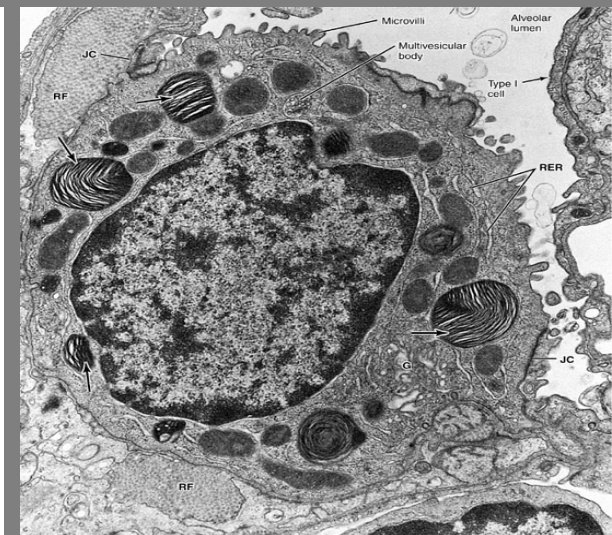
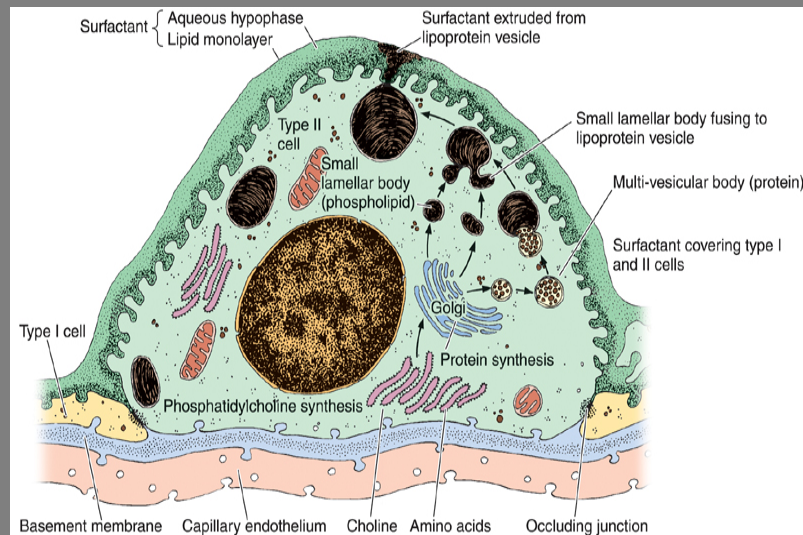
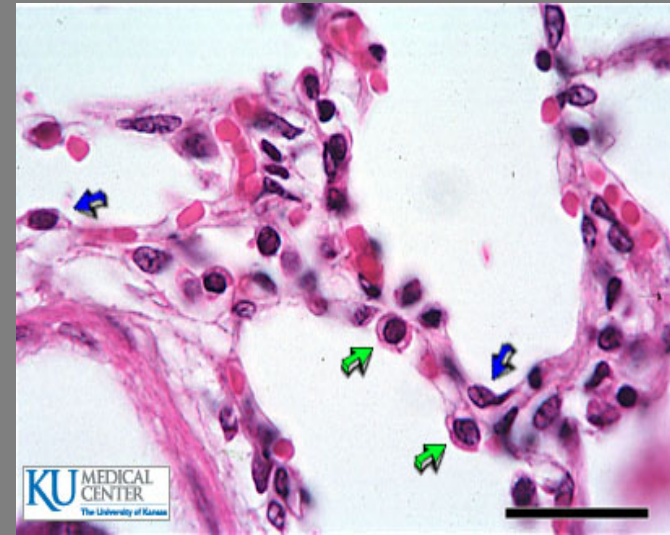
-**Function:**

Exchange of gases.



(2) Type II Pneumocytes:

- Line 5% of the alveolar surfaces.
- Are more numerous than type I pneumocytes.
- Are cuboidal or rounded cells, With Foamy cytoplasm.
- Nucleus: central & rounded.
- The cytoplasm contains membrane-bound Lamellar bodies (contain pulmonary surfactant).



Type II Pneumocytes:

Function:

1- Synthesis & secretion of **pulmonary surfactant.**

2- Renewal of alveolar epithelial cells:

Type II cells can divide to regenerate both type I & type II pneumocytes.

Interstitium of interalveolar septa

(1) Continuous Pulmonary Capillaries.

(2) Interstitial C.T.:

a- C.T. Fibers: elastic fibers &
type III collagen (reticular fibers).

b- C.T. Cells: Fibroblasts, Macrophages,
Mast cells, Lymphocytes.

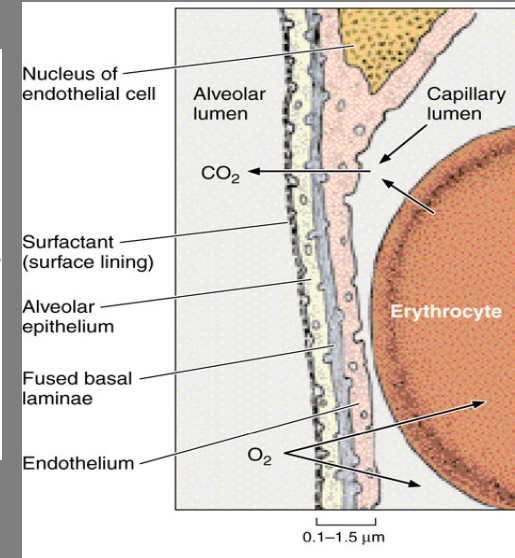
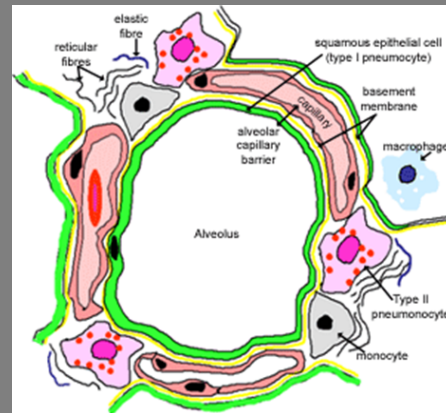
BLOOD-GAS BARRIER ***(BLOOD-AIR BARRIER)***

Definition:

It is the region of the interalveolar septum that is traversed by O₂ & CO₂

Components:

- 1- Thin layer of surfactant.
- 2- Type I pneumocyte.
- 3- Fused basal laminae of type I pneumocytes & endothelial cells of the pulmonary capillary.
- 4- Endothelial cells of the pulmonary capillary.



Alveolar phagocytes

(Alveolar Macrophages)
(Dust Cells)

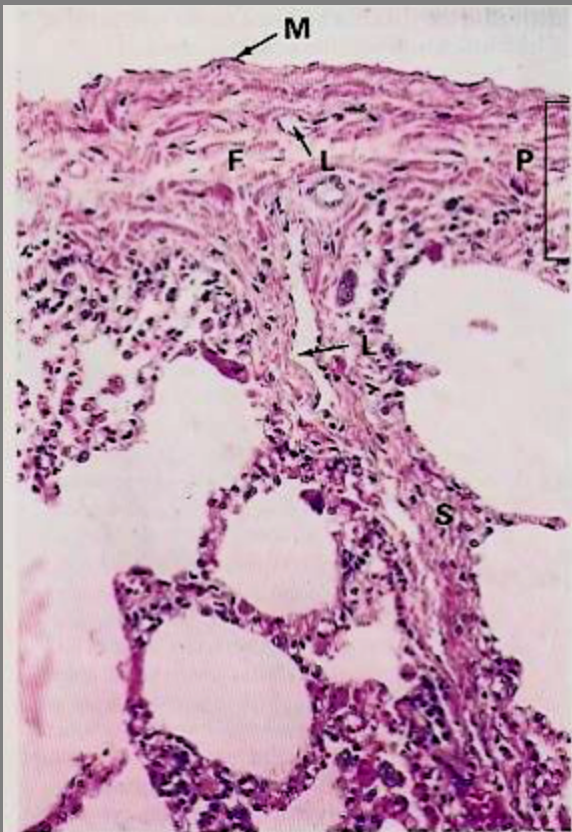
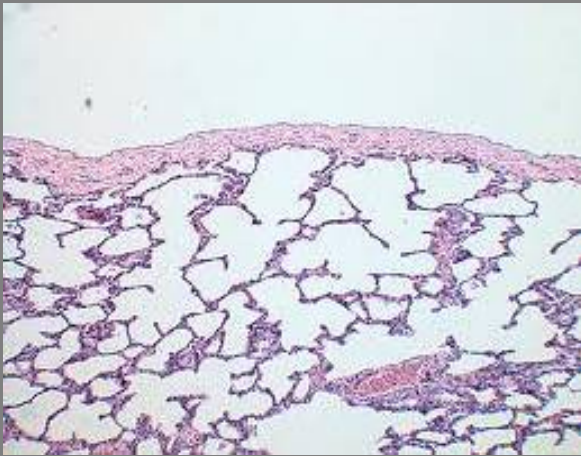
Sites:

- (1) In the lumen of pulmonary alveoli.
- (2) In the interstitium of interalveolar septa.

Function:

Phagocytose particulate matter (e.g. dust) & bacteria in the lumen of pulmonary alveoli and in the interstitium of interalveolar septa.

Pleura



Is formed of two layers:

Parietal and visceral.

It is formed of simple squamous mesothelium. The two layers are separated by serous fluid. The visceral layer has sub-epithelium loose C.T that extends into the lung tissue

THANK YOU

