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.

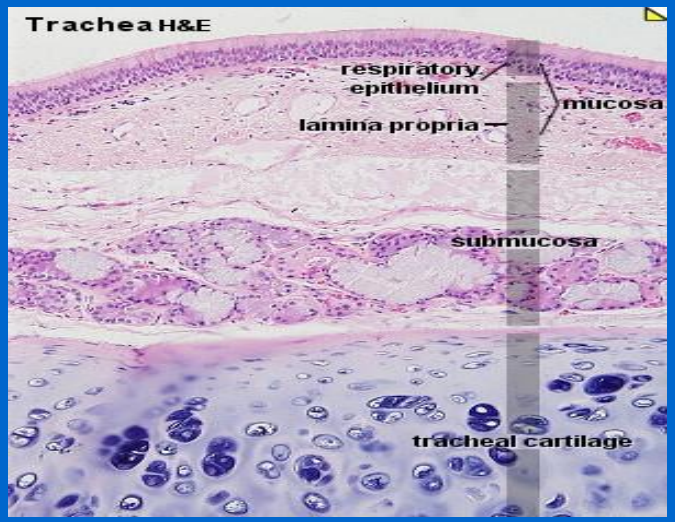
TRACHEA

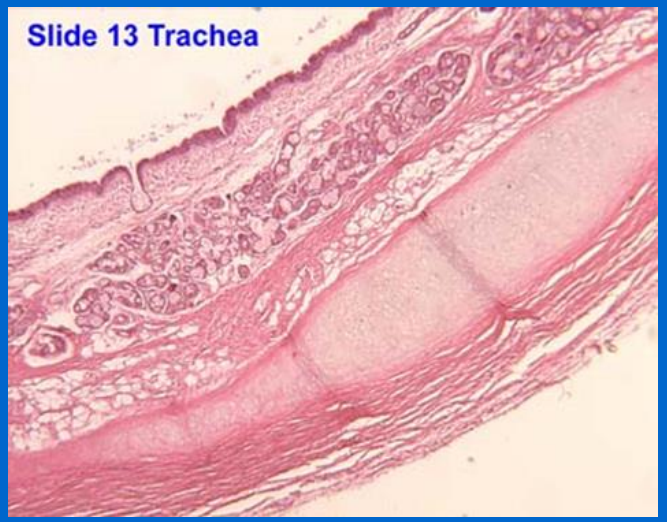
The wall of trachea is formed of:

(1) Mucosa.

(2) Submucosa.

(3) Adventitia.





MUCOSA OF TRACHEA

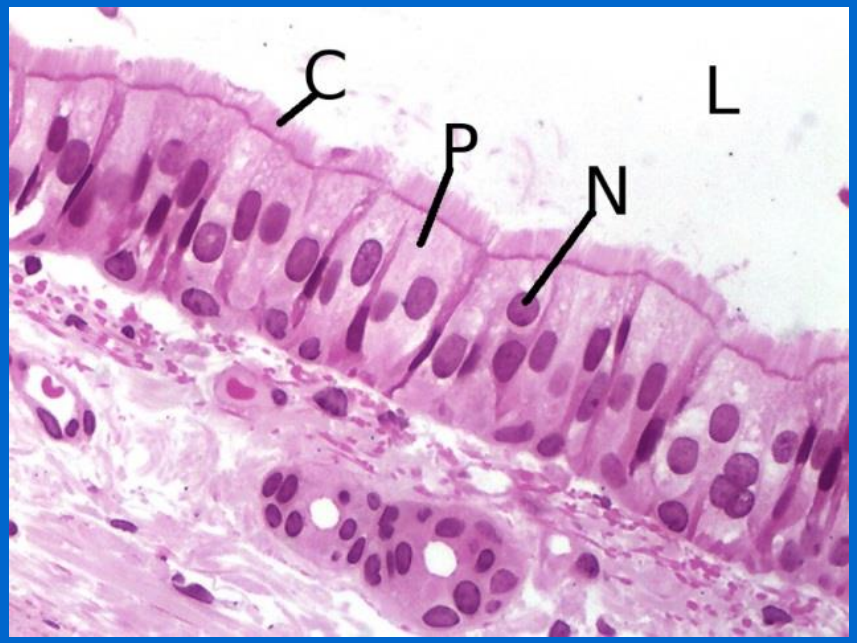
(1) **Epithelium:** Respiratory epithelium

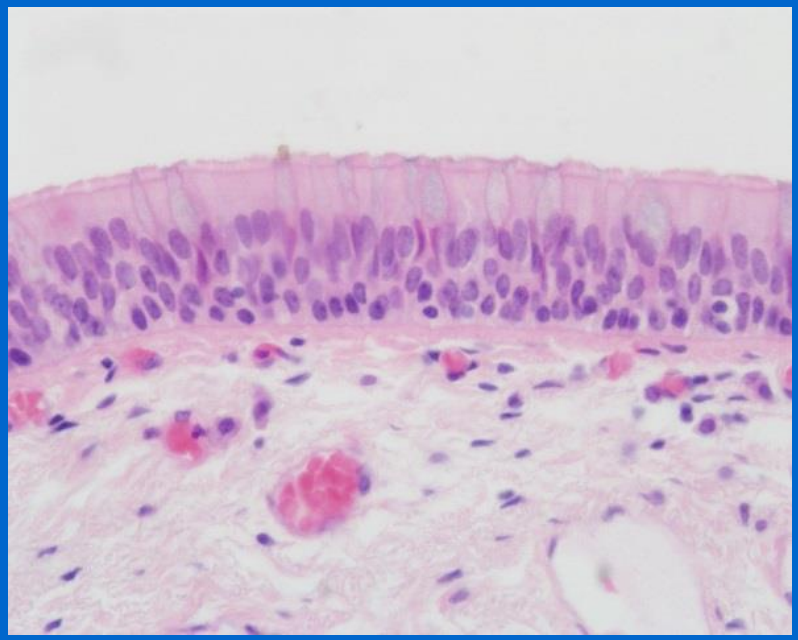
(2) **Lamina propria.**

(3) Elastic lamina:

It is formed of elastic fibers.

It separates lamina propria from submucosa.





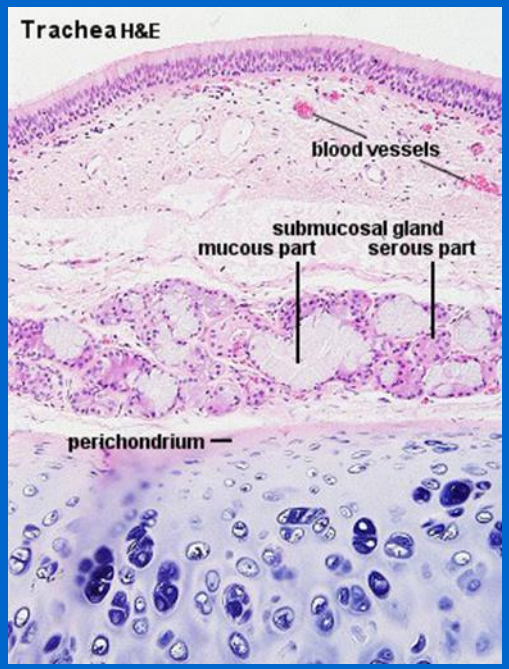
SUBMUCOSA OF TRACHEA

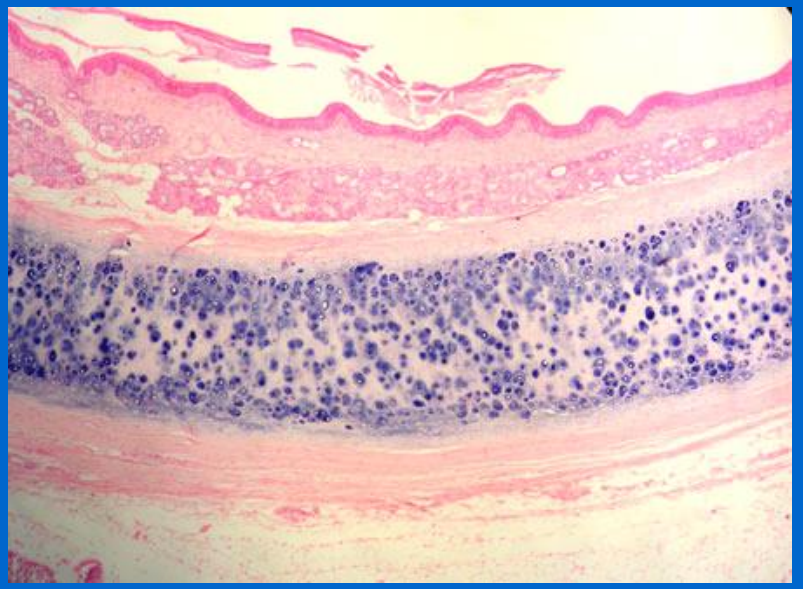
Contents:

1- C.T.

2- Numerous mucous & seromucous glands.

3- Lymphoid elements.





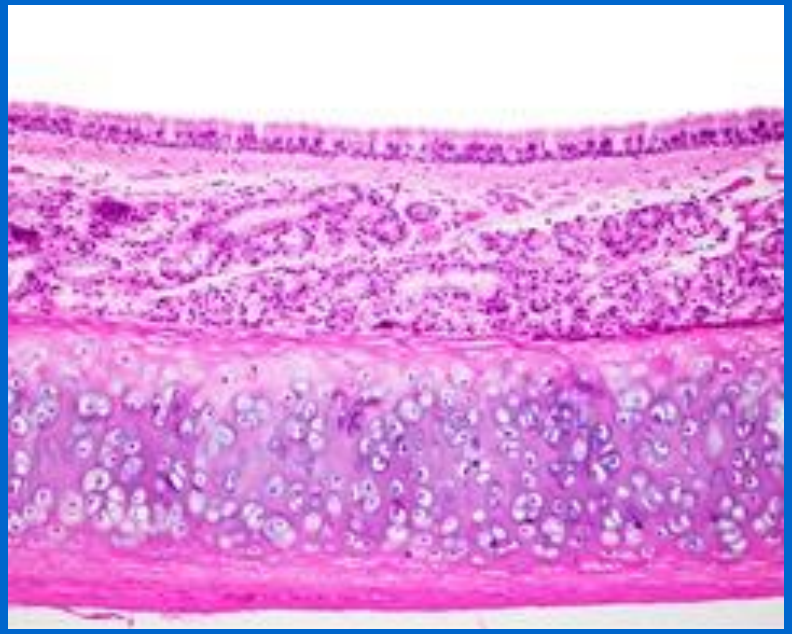
ADVENTITIA OF TRACHEA

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.

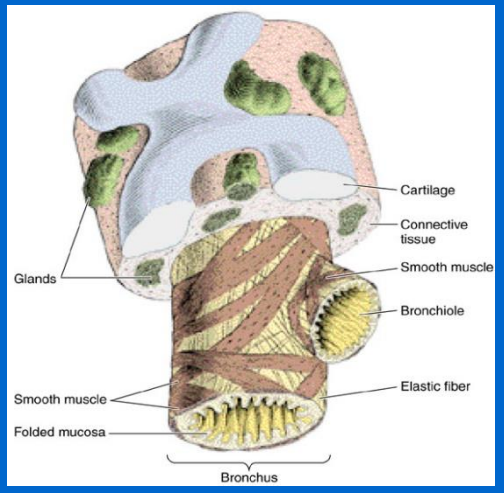


EXTRAPULMONARY BRONCHUS (1ry BRONCHUS)

Generally have the same histological appearance as the trachea.

INTRAPULMONARY BRONCHI (2ry & 3ry BRONCHI)

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



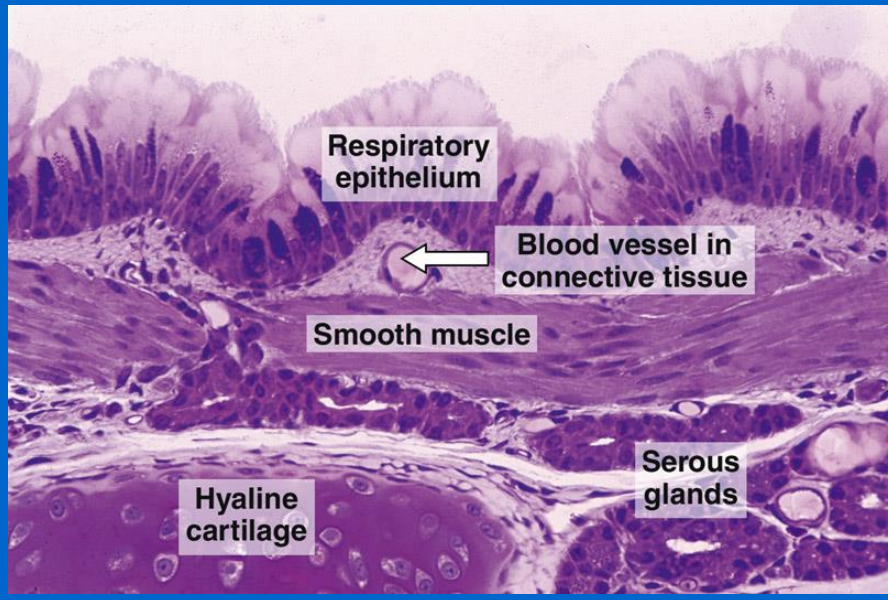
INTRAPULMONARY BRONCHUS

(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.

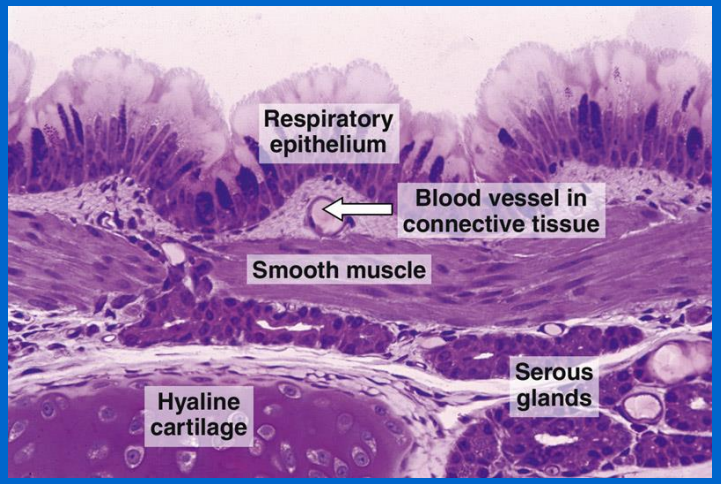
INTRAPULMONARY BRONCHUS

(3) Submucosa:

C.T. contains:

a- Seromucous glands.

b- Lymphoid elements.

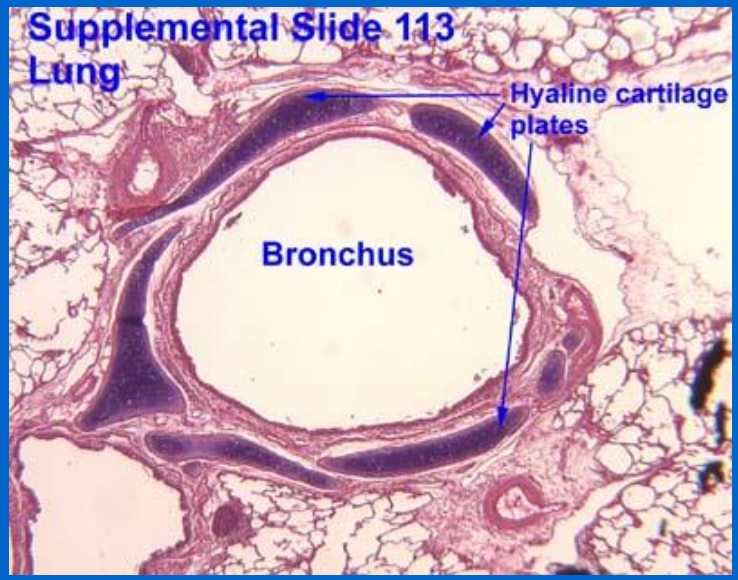


(4) Adventitia:

Contents: a- Loose C.T.

b- Irregular plates of hyaline cartilage (complete layer).

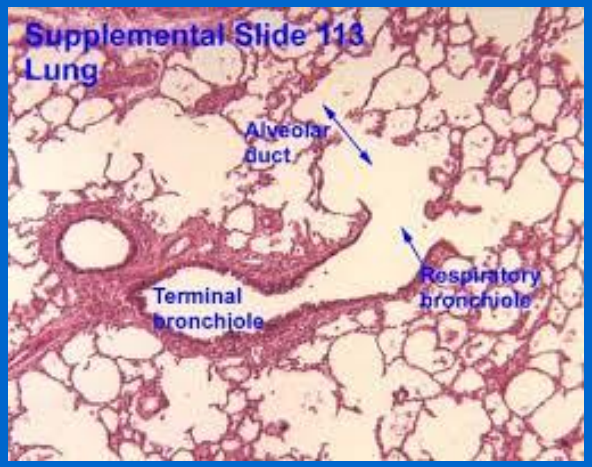
c- Solitary lymphoid nodules.



BRONCHIOLES

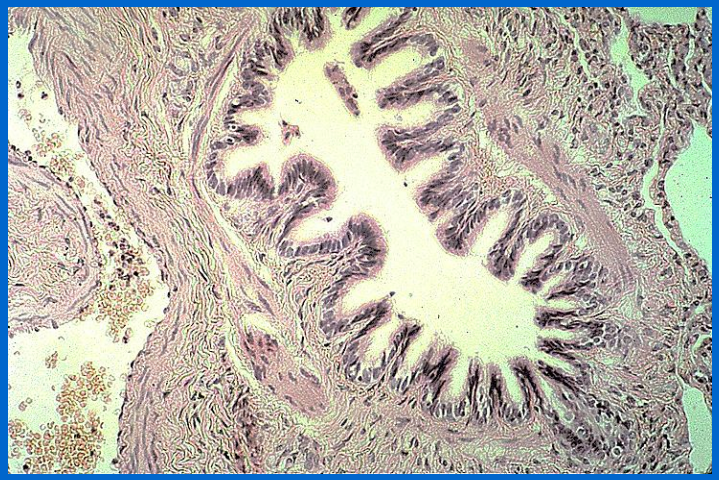
1- Preterminal (1ry) Bronchioles (Bronchioles):

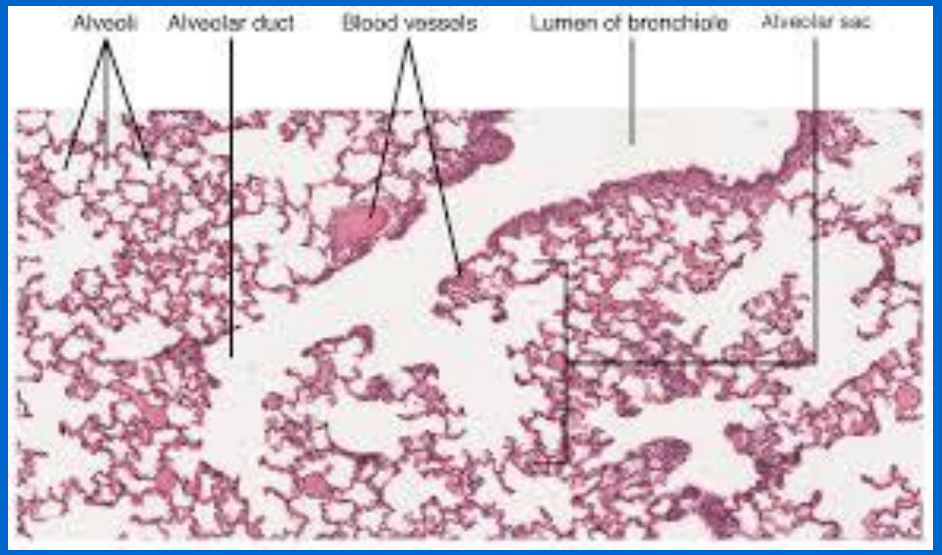
Are less than 1mm in diameter.



2- Terminal (2ry) Bronchioles.

3- Respiratory (3ry) Bronchioles.



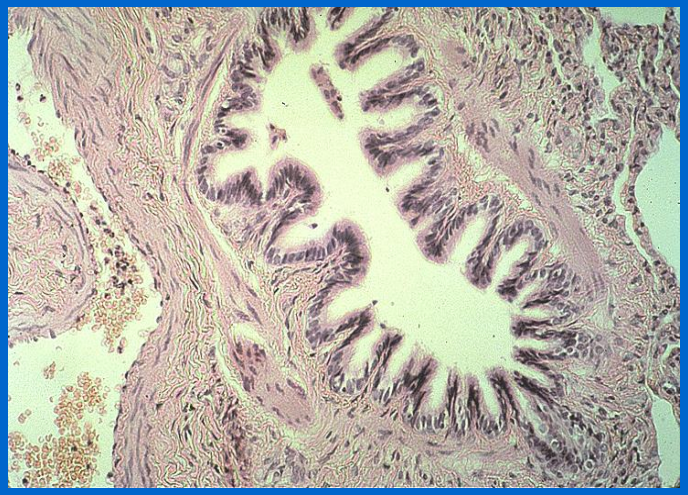


Preterminal Bronchioles

(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

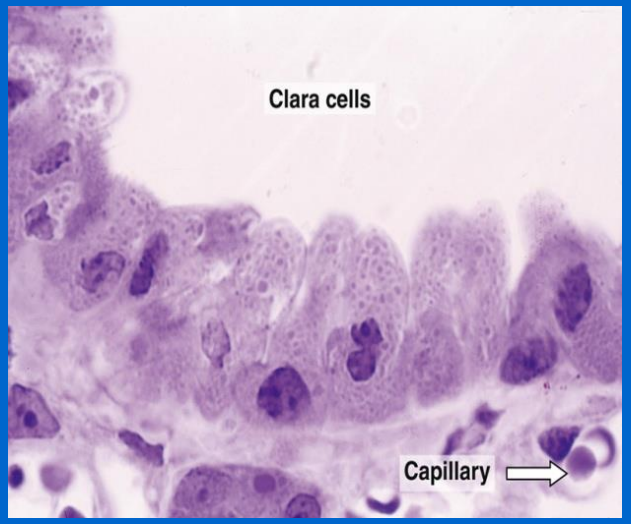
Similar structure to preterminal bronchioles, but:

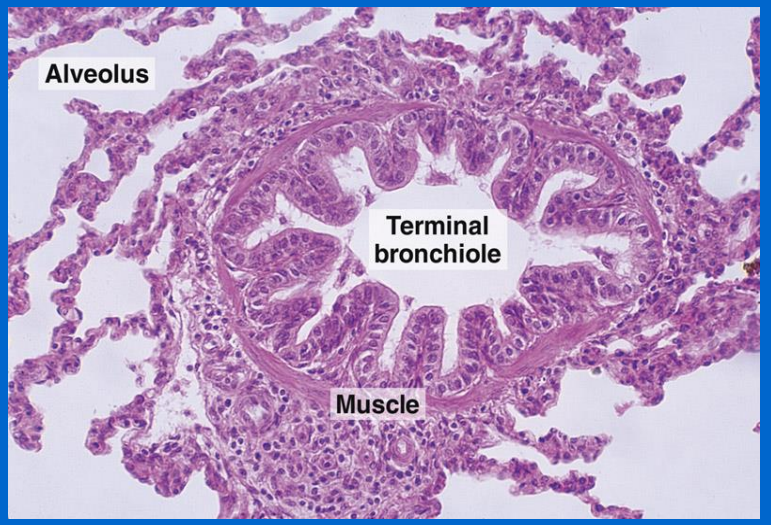
Epithelium:

Simple cuboidal partially ciliated epithelium

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

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

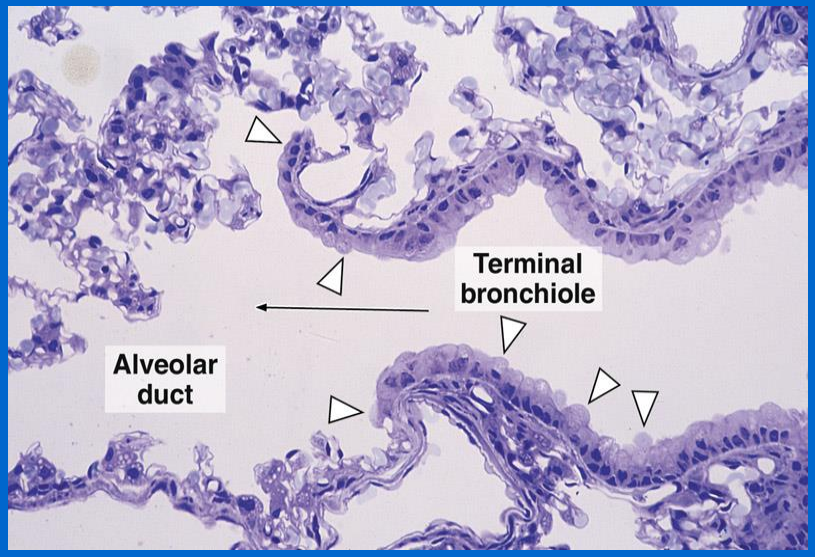




Respiratory Bronchioles

Are similar in structure to terminal bronchioles **But:**

their walls are interrupted by the presence of few pulmonary alveoli.



CLARA CELLS

Structure:

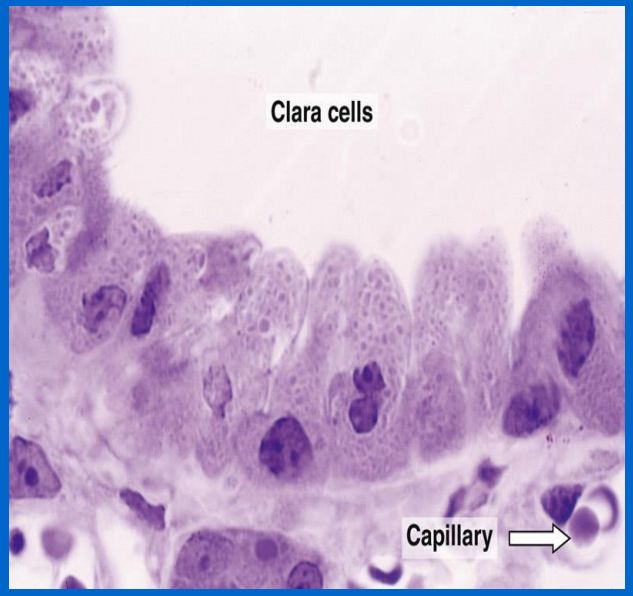
columnar cells (non ciliated).

Function:

1- Degrade toxins in inhaled air.

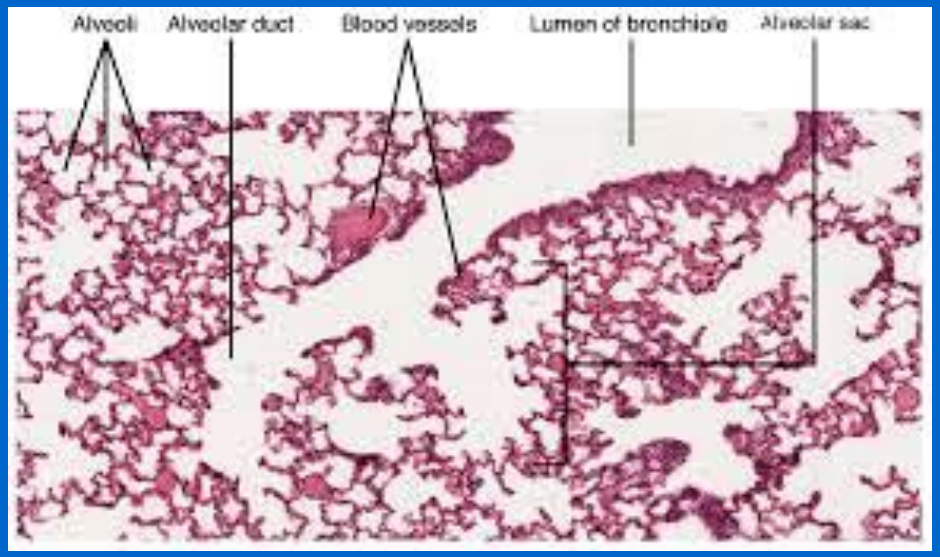
2- Divide to regenerate the bronchiolar epith.

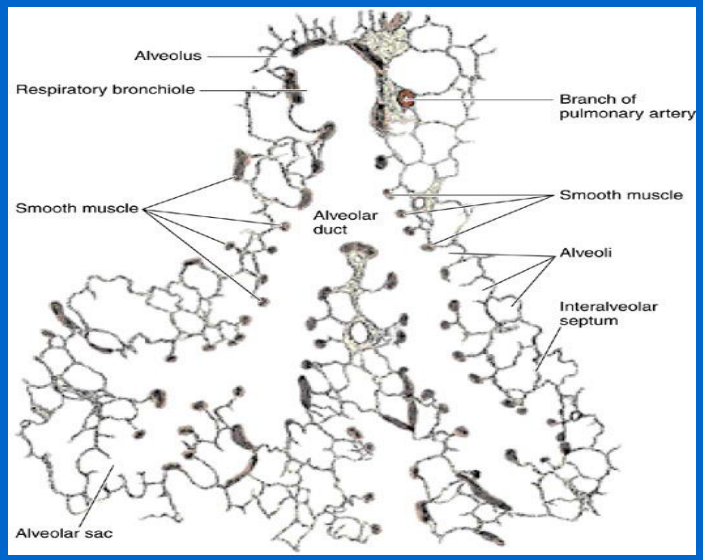
3- Produce surfactant-like material.



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:

*Interalveolar septa.

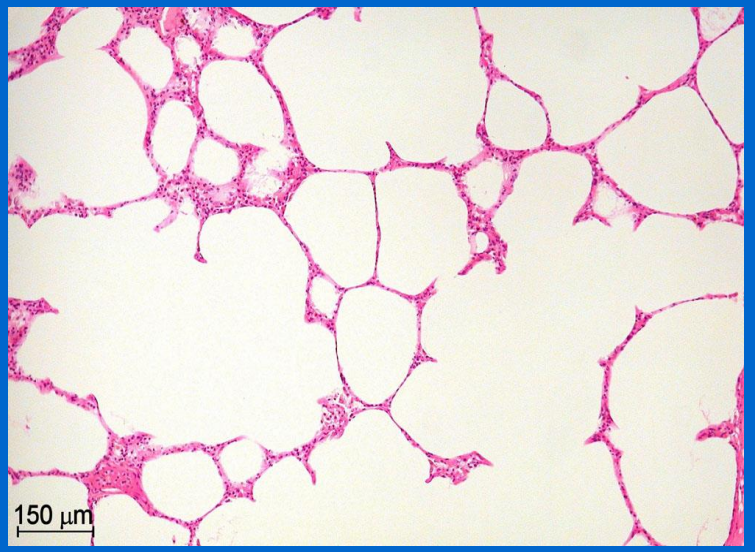
*Alveolar epithelium.

* Alveolar phagocytes (Lung macrophages).

INTERALVEOLAR SEPTA

Definition:

The region between 2 adjacent alveoli.



Components:

(A) Alveolar Epithelium:

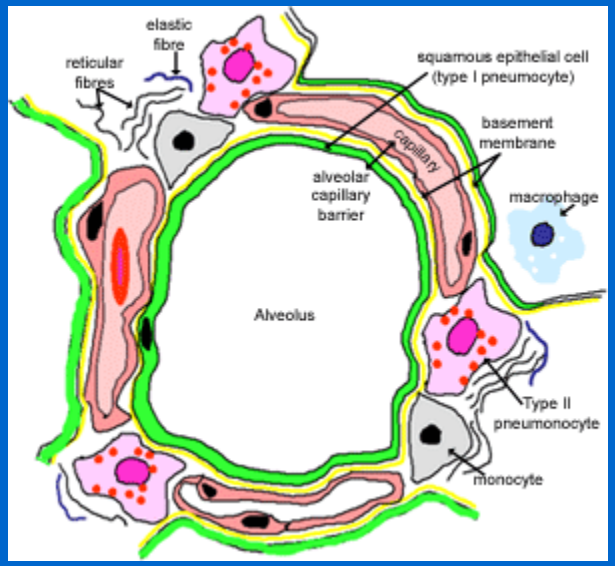
lines both sides of interalveolar septum.

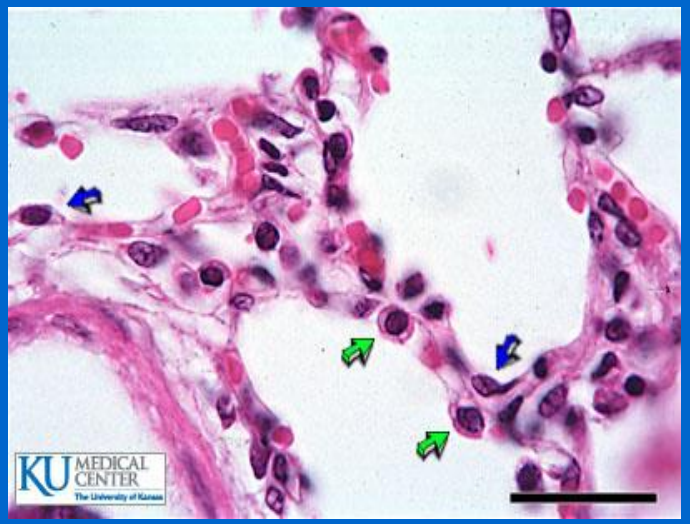
(B) **Interstitium.**

ALVEOLAR EPITHELIUM

(1) Type I Pneumocytes

(2) Type II Pneumocytes





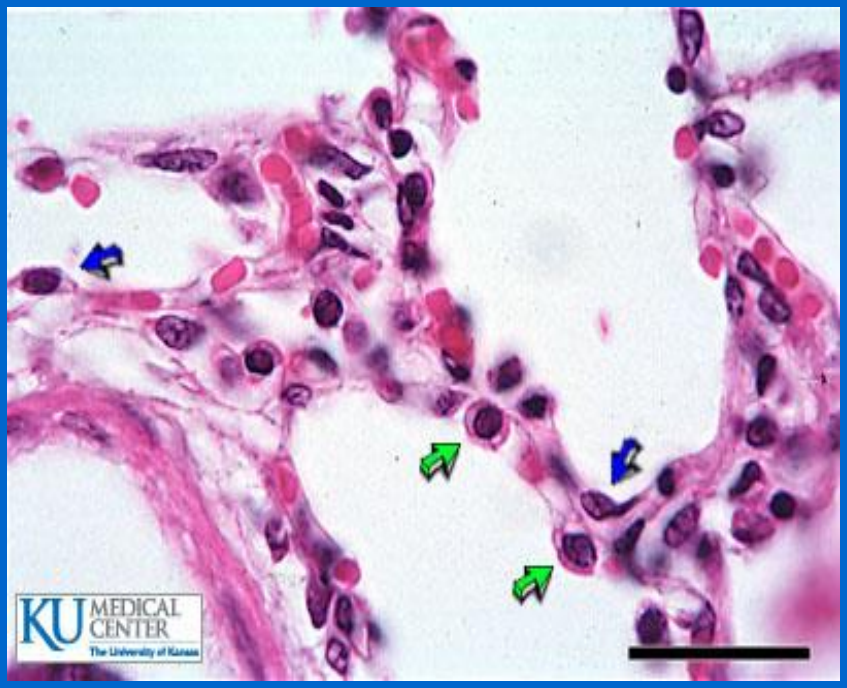
ALVEOLAR EPITHELIUM

(1) Type I Pneumocytes:

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

-Function:

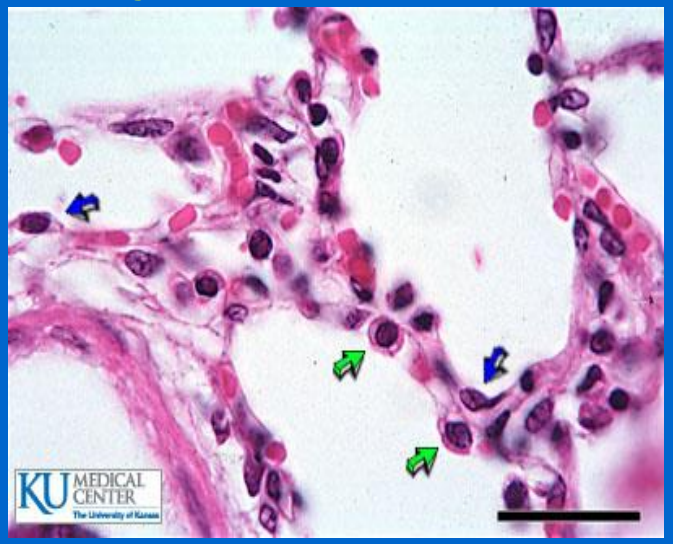
Exchange of gases.

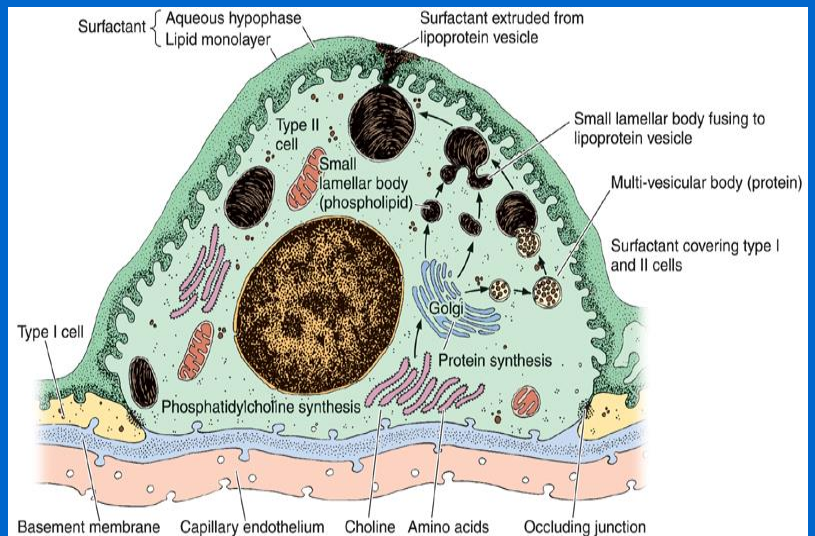


(2) Type II Pneumocytes:

- 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) <u>Continuous</u> Pulmonary Capillaries.

(2) Interstitial C.T.:

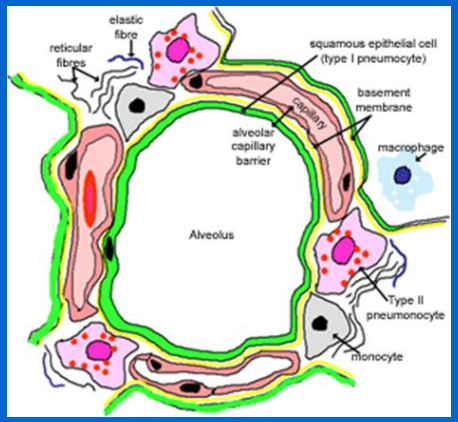
a- C.T. Fibers: elastic fibers &
type III collagen (reticular fibers).

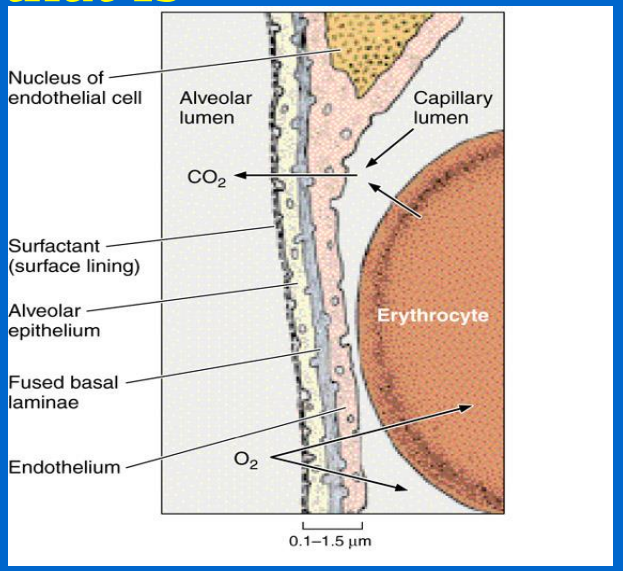
b- C.T. Cells: Fibroblasts, Macrophages,
Mast cells, Lymphocytes.

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)

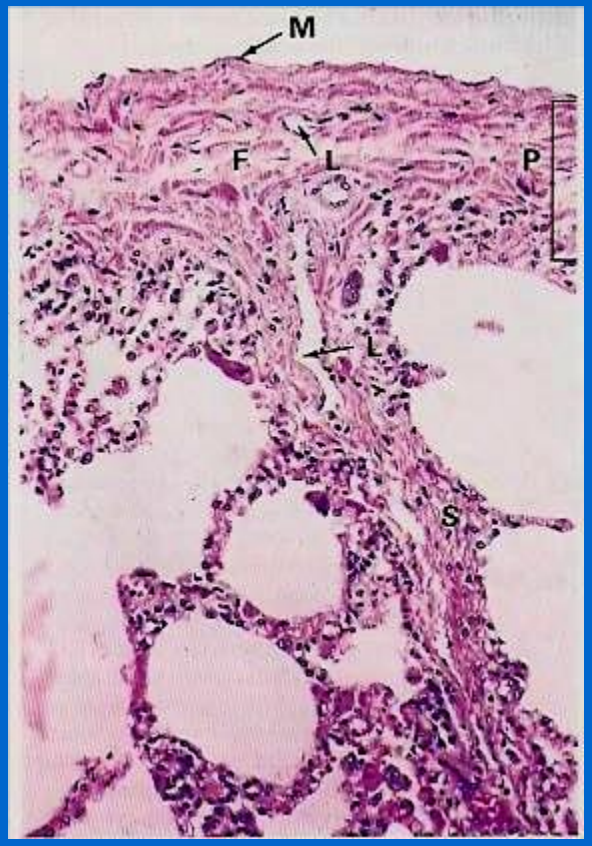
Sites:

(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