



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

Color code: ● Important ● Extra & Doctor notes



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Objectives:

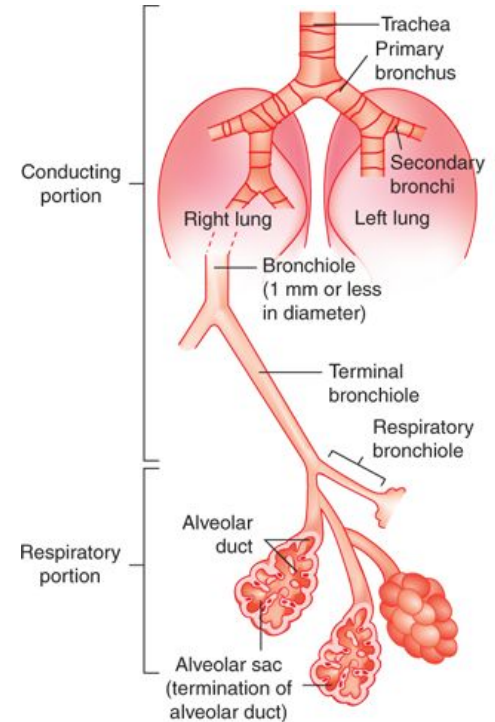
By the end of this lecture, the student should be able to describe:

- **The microscopic structures of the wall of:**

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

- **The microscopic structures of :**

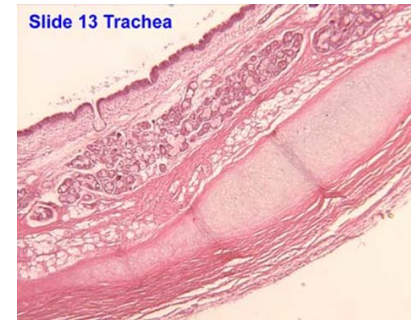
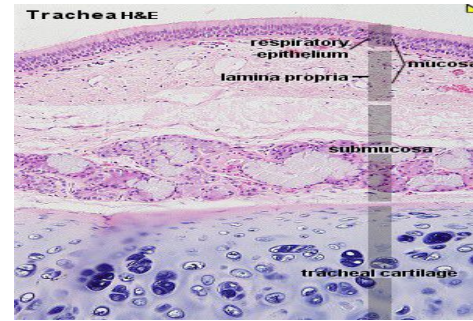
- Inter-alveolar septum.
- Alveolar phagocytes.
- Pleura.



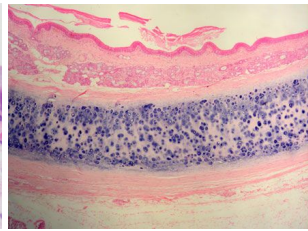
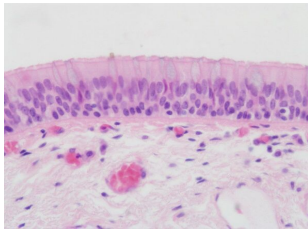
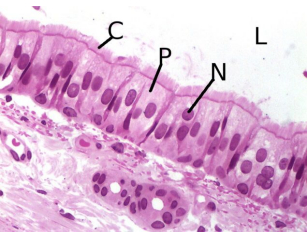
Trachea

The wall of trachea is formed of:

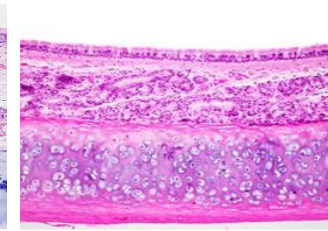
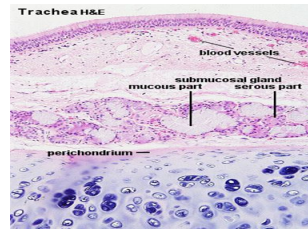
- **Mucosa.**
- **Submucosa.**
- **Adventitia.**



MUCOSA



SUBMUCOSA



ADVENTITIA

- (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.

- (1) **Epithelium:** Respiratory epithelium
- (2) **Lamina propria.**
- (3) **Elastic lamina:**
 - It is formed of **elastic fibers.**
 - It separates lamina propria from submucosa.

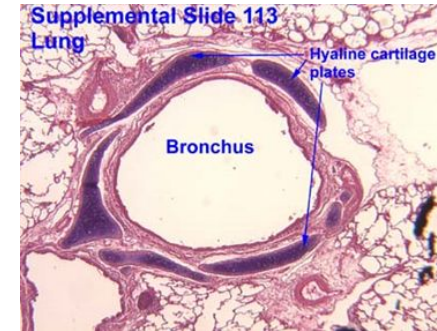
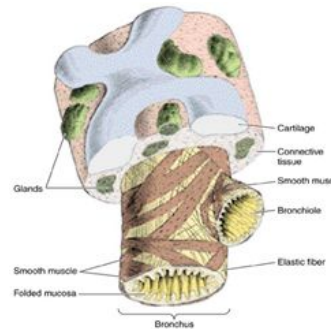
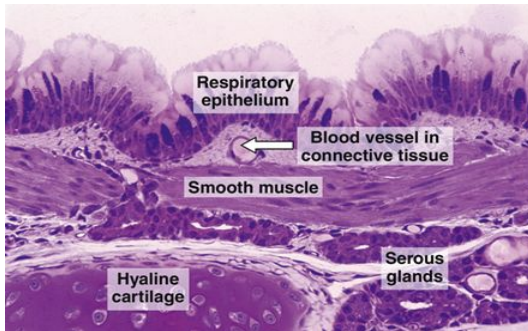
- (1) **C.T.**
- (2) **Numerous mucous & seromucous glands.**
- (3) **Lymphoid elements.**

EXTRAPULMONARY BRONCHUS (1ry BRONCHUS)

Generally have the **same** histological appearance as the **trachea** (but different in diameter.)

INTRAPULMONARY BRONCHUS (2ry & 3ry BRONCHI)

Mucosa	Muscle coat (complete)	Submucosa	Adventitia
<ul style="list-style-type: none">◦ Epithelium: Respiratory epith.◦ Lamina propria No elastic lamina	<p><u>Two</u> distinct layers of smooth muscle fibers spirally (to contract more surface) arranged in opposite direction.</p>	<p>C.T. contains:</p> <ul style="list-style-type: none">◦ Seromucous glands.◦ Lymphoid elements.	<ul style="list-style-type: none">◦ Loose C.T.◦ Irregular plates of hyaline cartilage (complete layer).◦ Solitary lymphoid nodules

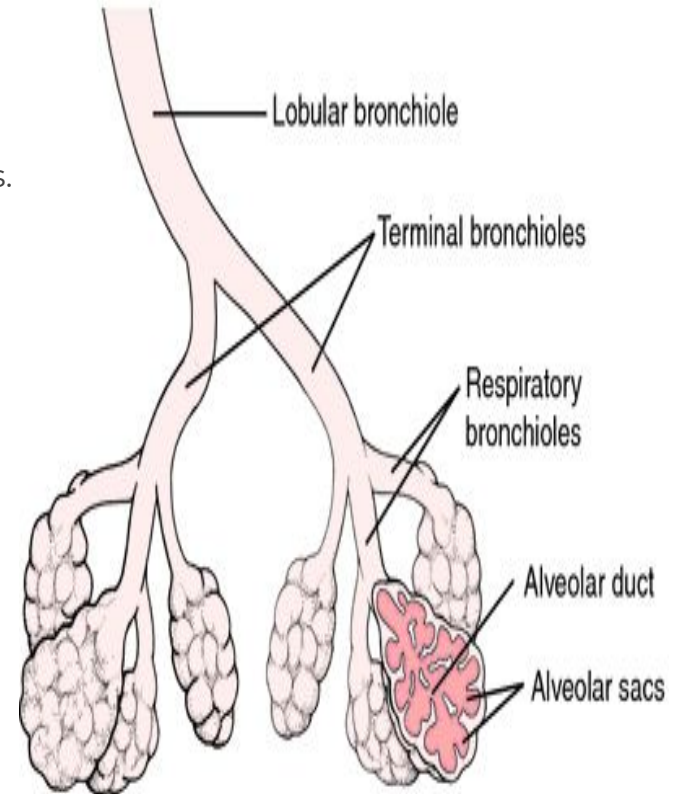
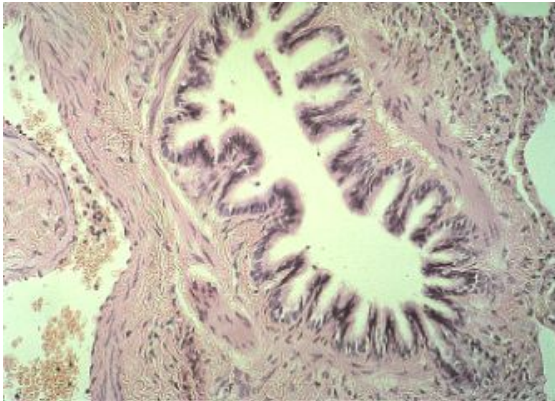


BRONCHIOLES

Preterminal (1ry) Bronchioles
Are less than 1mm in diameter.

- (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.

No cartilage, No seromucous glands, No lymph nodules.



BRONCHIOLES

Terminal (2ry) Bronchioles

Less than 0.5mm in diameter.

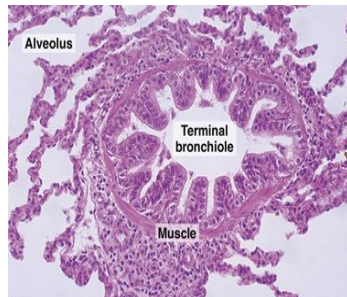
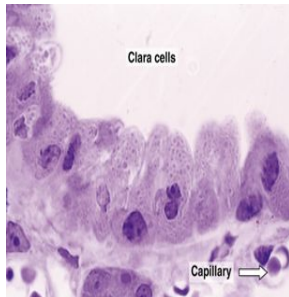
Similar structure to preterminal bronchioles, but:
Epithelium: Simple cuboidal partially ciliated epithelium With **Clara cells (With NO goblet cells)**.

CLARA CELLS

Structure: columnar cells (non ciliated).

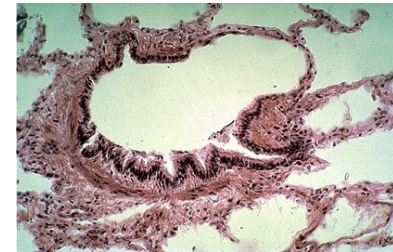
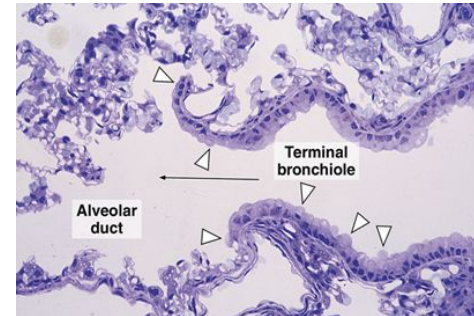
Functions:

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



Respiratory (3ry) Bronchioles

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



PULMONARY ALVEOLI

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

INTERALVEOLAR SEPTA: The region between 2 adjacent alveoli.

Components:

Alveolar Epithelium: lines both sides of interalveolar septum.

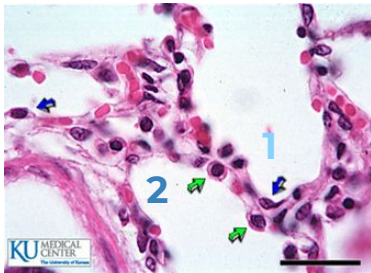
Interstitium

Type I Pneumocytes

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

Function:

Exchange of gases.

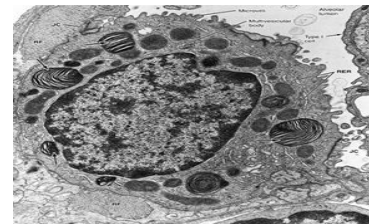


Type II Pneumocytes

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

Function:

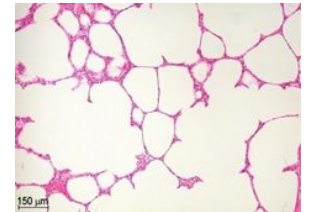
- 1- Synthesis & secretion of **pulmonary surfactant**.
- 2- Renewal of alveolar epithelial cells:
Type II cells can divide to **regenerate both type I & type II pneumocytes**.



1- **Continuous** Pulmonary Capillaries.

2- Interstitial C.T.:

- C.T. Fibers: elastic fibers & type III collagen (reticular fibers).
- C.T. Cells: Fibroblasts, Macrophages, Mast cells, Lymphocytes.



PULMONARY ALVEOLI

Alveolar phagocytes (Lung macrophages)

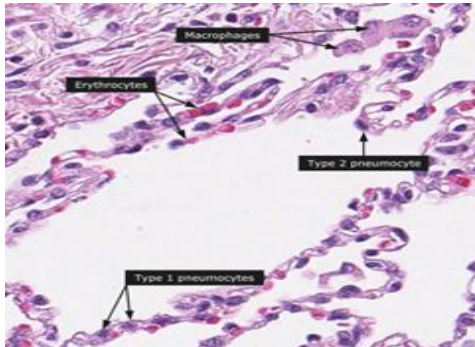
(Dust Cells)

Sites:

- In the **lumen** of pulmonary alveoli.
- In the **interstitium** of interalveolar septa.

Function:

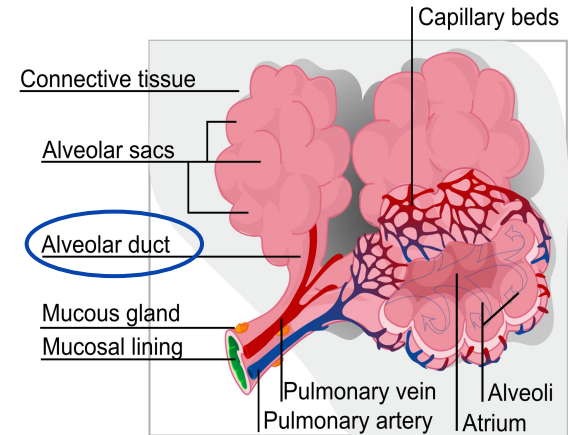
Phagocytose particulate matter (e.g. dust) & bacteria in the lumen of pulmonary alveoli and in the interstitium of interalveolar septa.



ALVEOLAR DUCTS:

The wall of alveolar ducts consist of **pulmonary alveoli**.

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

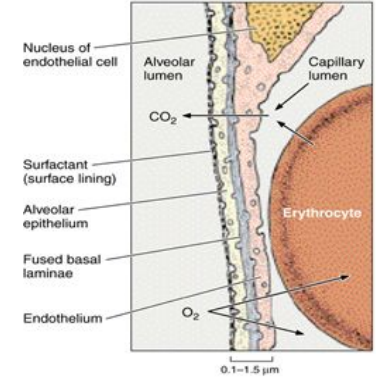
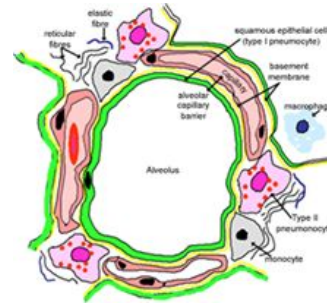


BLOOD-GAS BARRIER (BLOOD-AIR BARRIER)

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

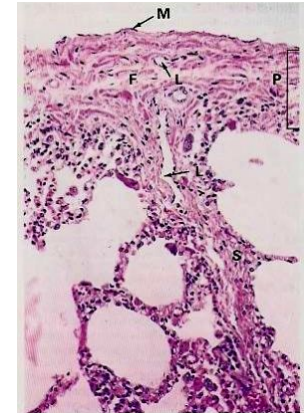
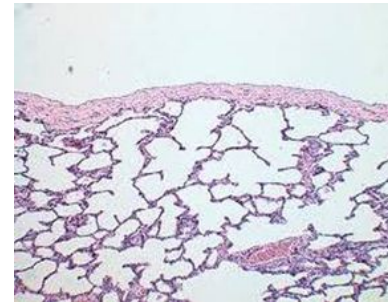
Components:

- 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.



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.





Quiz



1. The intrapulmonary smooth muscle have shape.
 - a. transverse
 - b. longitudinal
 - c. spiral
 - d. irregular
2. How many C-shaped rings the trachea have?
 - a. 4-6
 - b. 6-10
 - c. 10-12
 - d. 12-16
3. Which of the following have less than 0.5mm diameter?
 - a. Trachea
 - b. Preterminal Bronchioles
 - c. Terminal bronchiole.
 - d. Respiratory bronchiole.

4-Exchange of gases is the function of :

- a. Type I Pneumocytes
- b. Type II Pneumocytes
- c. Dust cells
- d. All The above

5-Phagocytosis of particulate matter is the function of :

- a. Type I Pneumocytes
- b. Type II Pneumocytes
- c. Dust cells
- d. All The above

6-Pleura has layer/s.

- a. One
- b. two
- c. three
- d. four

1-C-2-D-3-C-4-A-5-C-6-B

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