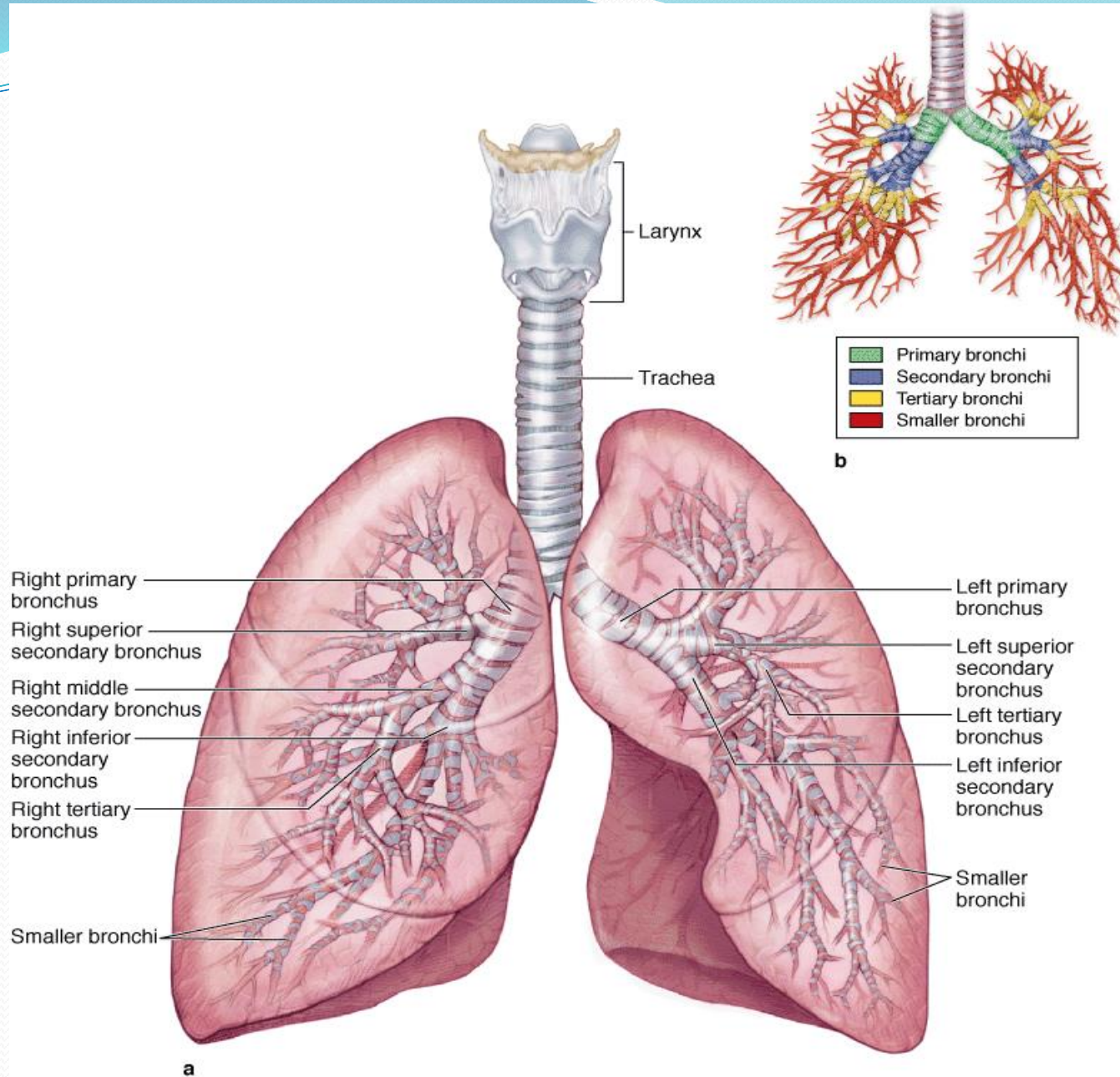


- Date 19/12/2022
- Subject :histology
- Lecture2 :RespiratorySystem
- second year
- Time(8-9)
- Dr. Sabreen Saleem AL –Sayigh(Ph.D.)
- Outline the histological features of a respiratory portion.
- Differentiate between bronchial
- Outline the lung

Bronchial Tree & Lung

The trachea divides into two **primary bronchi** that enter the lungs at the hilum, along with arteries, veins, and lymphatic vessels. After entering the lungs, the primary bronchi course downward and outward, giving rise to **three secondary (lobar) bronchi in the right lung** and **two in the left lung**, each of which supplies a pulmonary lobe. These lobar bronchi again divide, forming tertiary (segmental) bronchi. Each of these tertiary bronchi, together with the smaller branches it supplies, constitutes a bronchopulmonary segment—approximately 10–12% of each lung with its own connective tissue capsule and blood supply.



Intrapulmonary bronchus (secondary and tertiary bronchi)

In the lung each principal bronchus divides into secondary or lobar bronchi which in turn divide into tertiary or segmental bronchi

Secondary and Tertiary Bronchi:

They are similar to the primary bronchus except for the following:

The number of goblet cells is further reduced in the epithelium.

The **number of glands** in the submucosa is also reduced.

The **cartilage is present** as irregular plate

a-Mucosa

It consists of epithelium and lamina propria.

The epithelium is **pseudostratified ciliated** columnar variety with **few goblet cells**.

The **lamina propria** is rich in elastic fibres (longitudinally oriented).

Mucosa is thrown into folds by the contraction of underlying smooth muscle.

(b) Smooth muscle layer

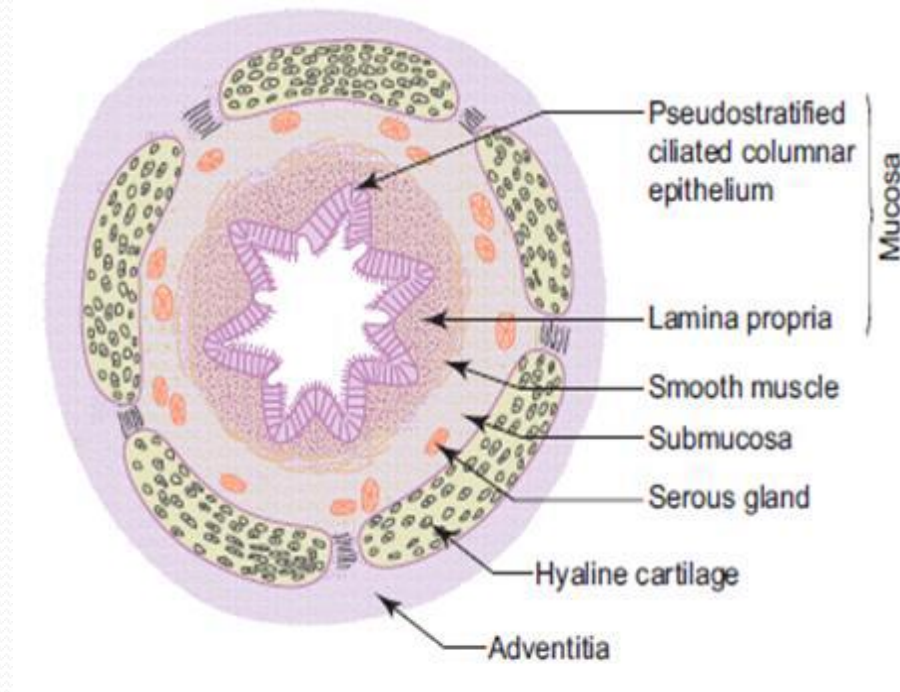
This layer consists of spirally running criss-cross bundles of smooth muscle. Thus, in section the muscle layer appears to be discontinuous.

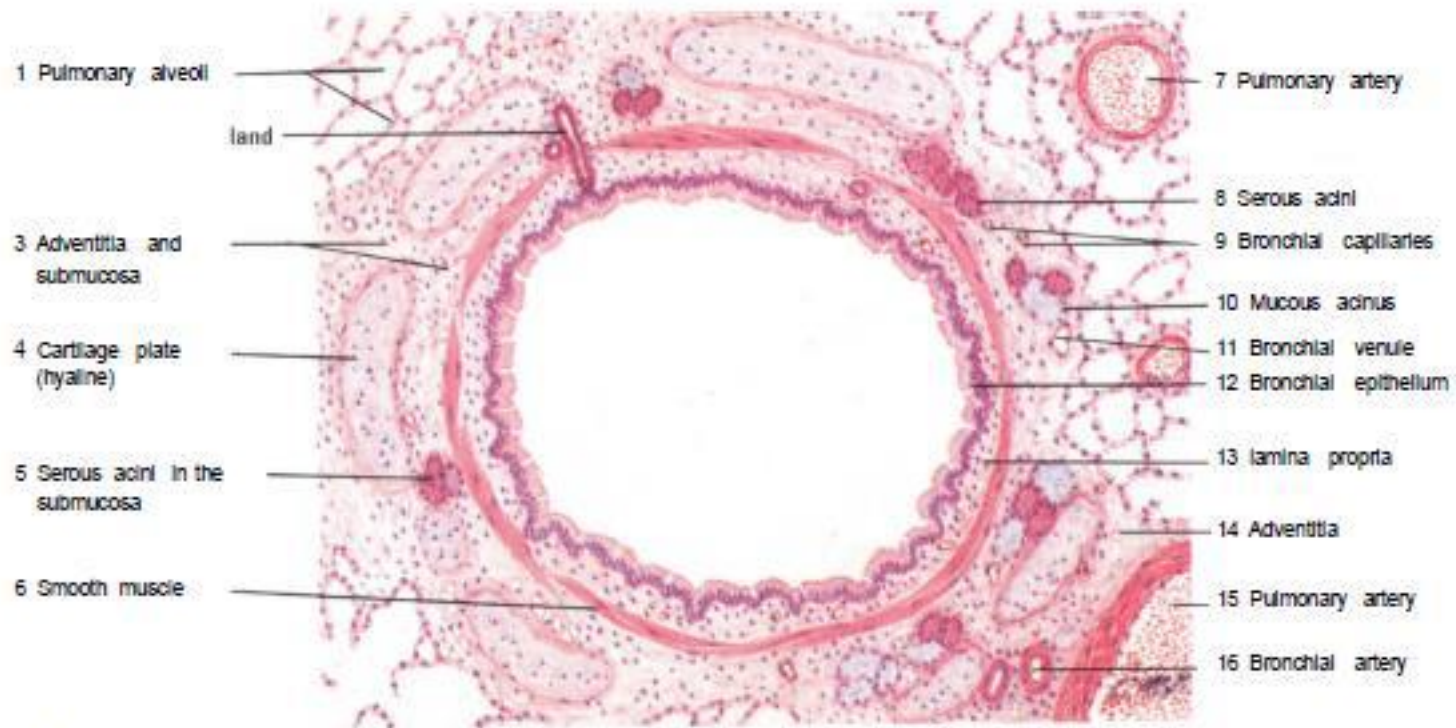
(c) Submucosa

It contains **few** seromucous glands.

(d) Cartilage layer and adventitia

In contrast to C-shaped cartilage present in the trachea, the intrapulmonary bronchus contains isolated **plates** of hyaline cartilage





15-9 **Intrapulmonary Bronchus.** Stain: hematoxylin-eosin, Low magnification

Bronchiole:

Bronchioles are formed by repeated division of the tertiary bronchi. Each bronchiole enters a pulmonary lobule, where it divides to form 5 to 7 **terminal bronchioles**.

The diameter of the terminal bronchiole is less than 1 mm.

Bronchioles are characterised by the presence of the following features :

1-Simple columnar or cuboidal ciliated epithelial lining with **no** goblet cells. Here goblet cells are replaced by **Clara cells** which secrete a glycoprotein that protects the bronchiolar lining against oxidative pollutants and inflammation.

2-Thick smooth muscle layers (under the control of vagus and sympathetic nerves). Stimulation of vagus causes bronchoconstriction. Stimulation of sympathetic nerve causes bronchodilation.

3-Many elastic fibres

4-No glands

5-No cartilage

- 1 Alveolar wall
(Interalveolar septum)
- 2 Adventitia
- 3 Smooth muscle
- 4 Mucosal folds
- 5 Columnar epithelium
- 6 Pulmonary artery
- 7 Pulmonary alveol

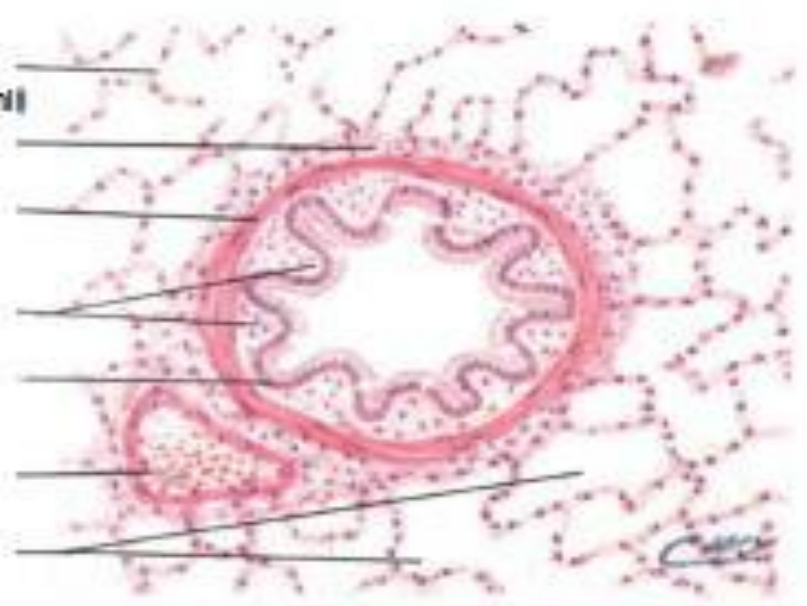


Fig. 15-10 **Terminal Bronchiole.** **Stain:**

2-respiratory portions of the respiratory system

1-Respiratory Bronchiole

The respiratory bronchiole is lined by **simple cuboidal epithelium**; these cells **lack** cilia.

Goblet cells are absent.

Epithelium is interrupted by alveoli, and at the opening of the alveoli the epithelium changes to simple squamous epithelium.

The **smooth muscle** forms a ring around the opening of the alveoli.

2-Alveolar Duct

The wall of the alveolar duct consists of alveoli, lined by **simple squamous epithelium**.

Underneath the epithelium, **smooth muscles** form rings at the opening of the alveolar sacs and alveoli, which are seen as a small bulge, in the wall in between two adjacent alveoli.

Smooth muscles disappear in the terminal parts of alveolar ducts.

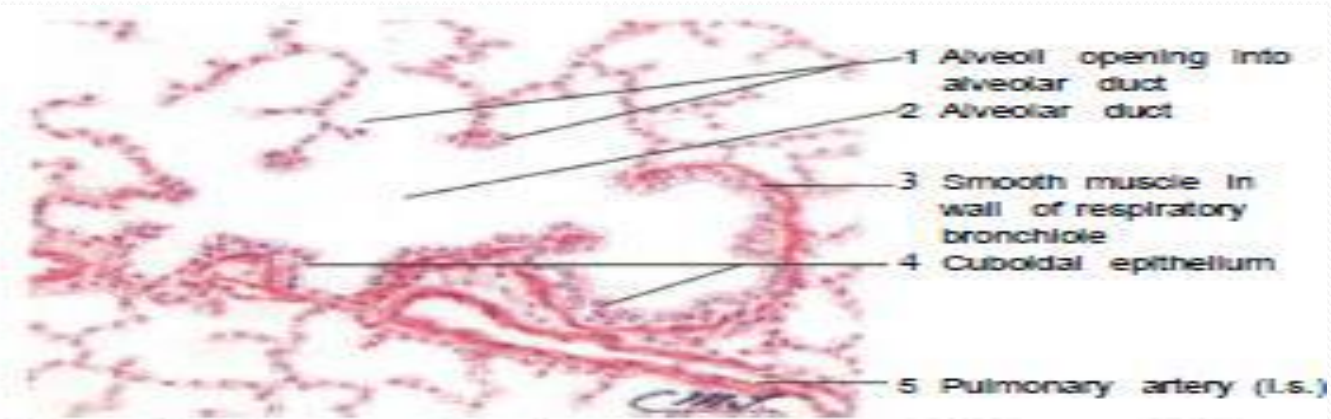
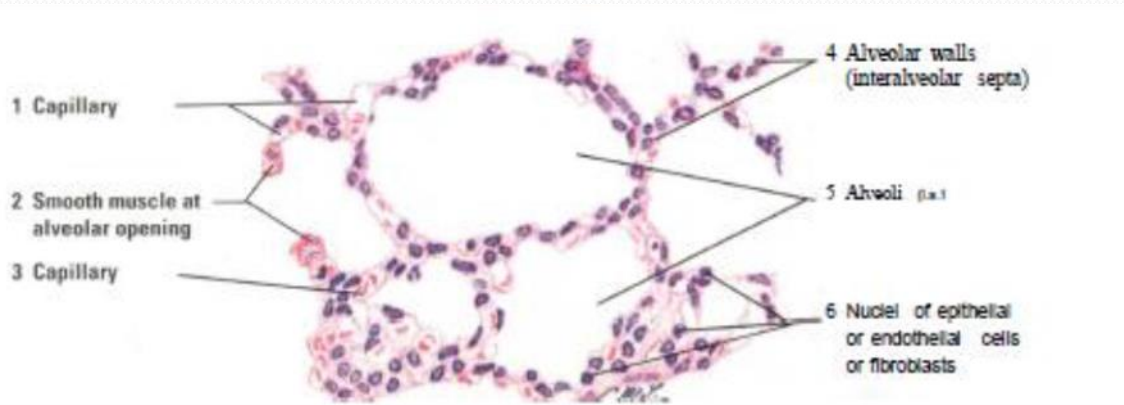


Fig. 15-11 Respiratory Bronchiole. Stain: hematoxylin-eosin. Low magnification.



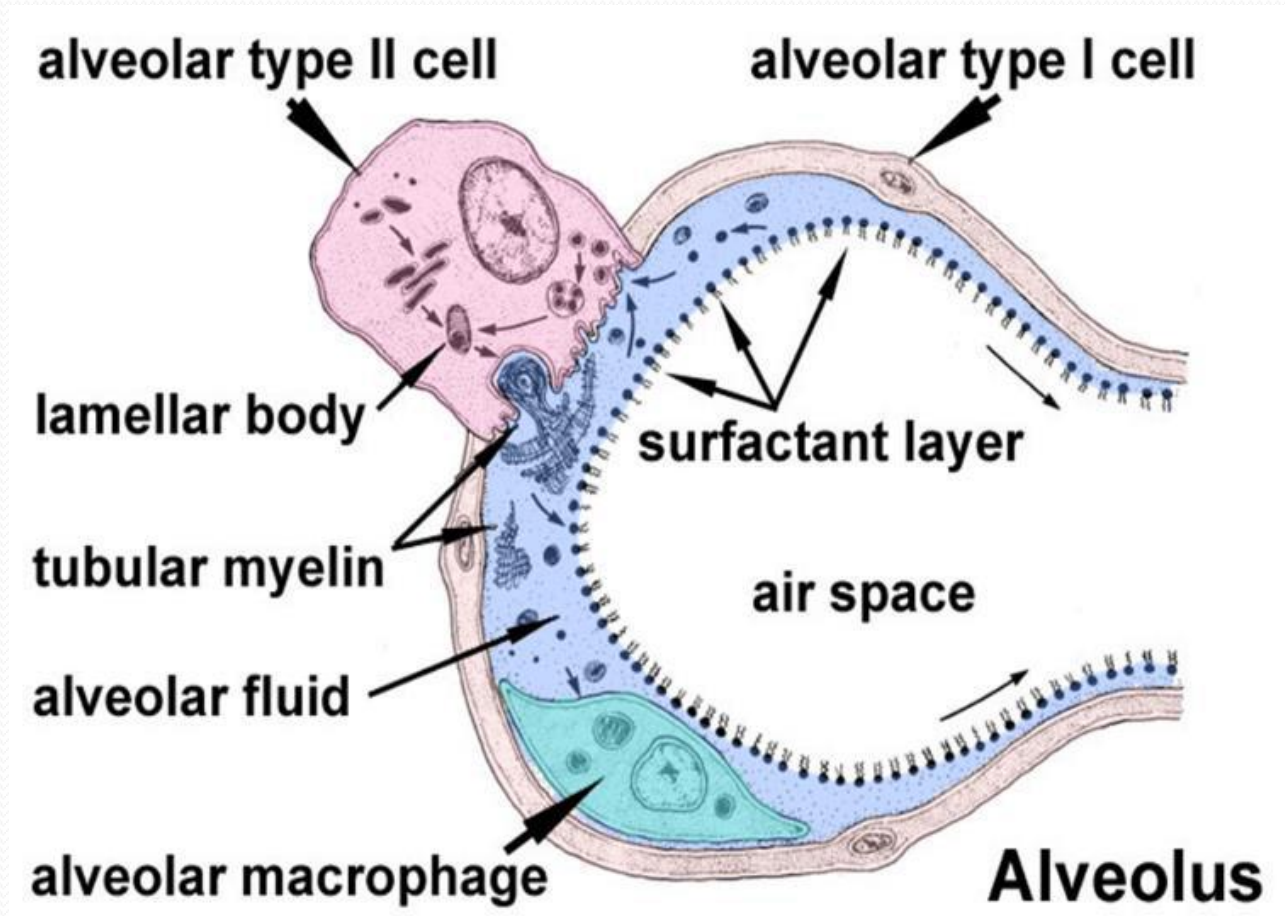
Alveolar Sac and Alveoli:

The **alveolar duct** opens into dead end sacs, the alveolar sacs, which have openings of the alveoli.

Alveoli increase the surface area for the gaseous exchange. Alveoli are surrounded by a **network of capillaries**. The gaseous exchange occurs between the air present in the alveoli and the blood in the capillaries across their walls.

Alveoli are thin-walled out pouchings, lined by a **single layer** of cells; these cells are of **two types**: **type I and type II cells**, also called pneumocytes or alveolar cells.

Alveoli are separated by interalveolar septum which lies between thin squamous epithelial linings of two adjacent alveoli.



(a) Type I pneumocytes'/squamous epithelial cells

Extremely thin squamous cells (25 nm thick).

Cover 97% of alveolar surface.

Contain abundant pinocytotic vesicles which play a role in absorption of surfactant and removal of particulate contaminants from the surface.

Form part of the blood-air barrier.

(b) Type II pneumocytes/great alveolar cells/septal cells

Roughly cuboidal in shape, found in groups of 2 or 3 cells between type I pneumocytes.

Cover 3% of alveolar surface.

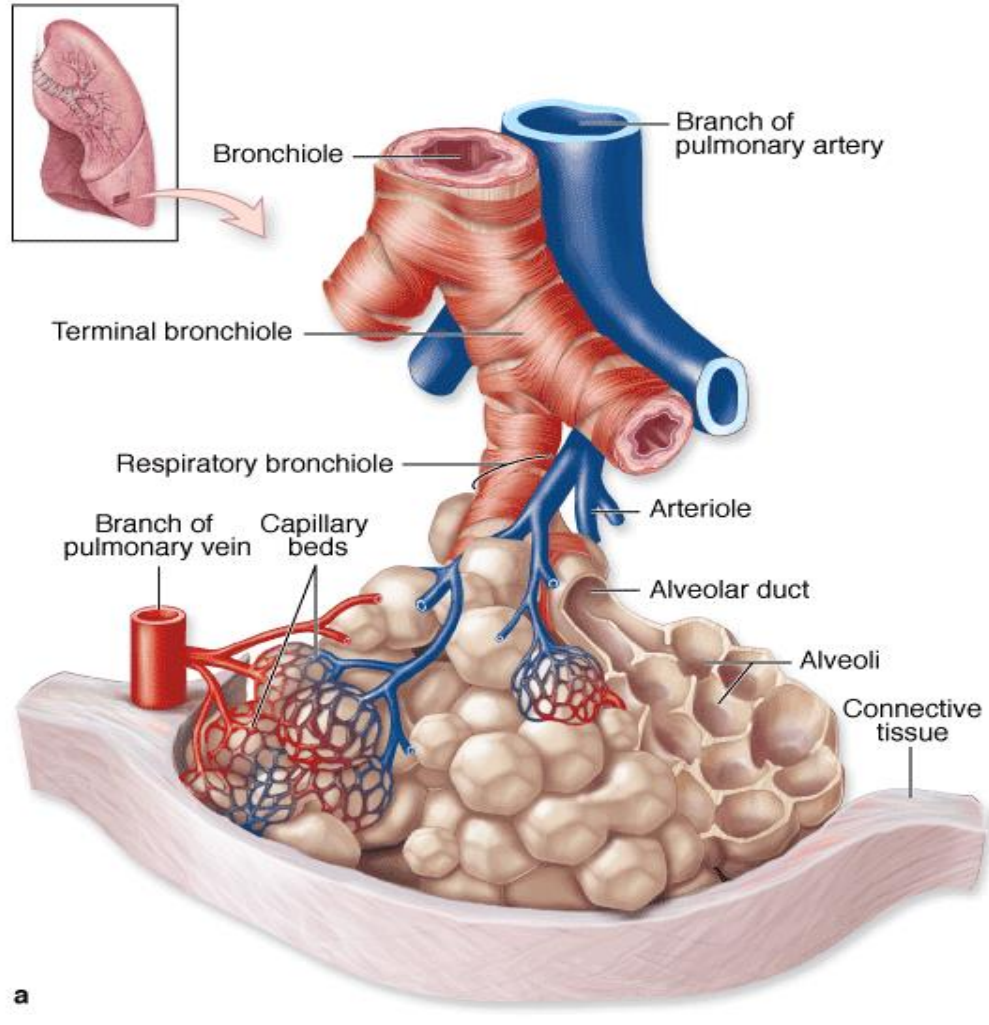
Bear microvilli on their free surfaces.

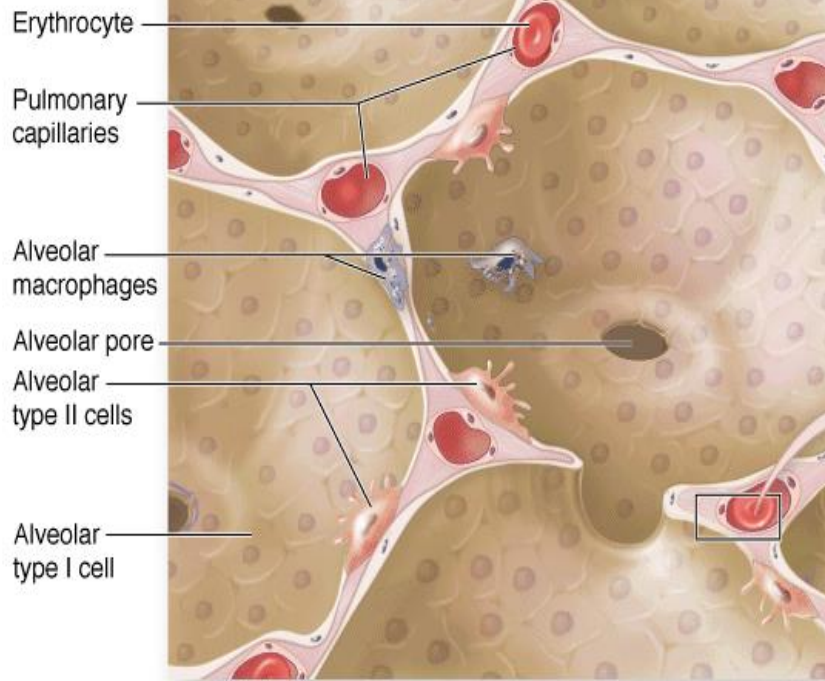
Contain foamy vacuolated cytoplasm due to presence of lamellated bodies.

These lamellated bodies contain a complex **lipoprotein** which on release spreads over the alveolar surface forming pulmonary surfactant that lowers the surface tension and prevents the alveoli from collapsing during expiration. The surfactant also has bactericidal properties. The surfactant layer is constantly being renewed

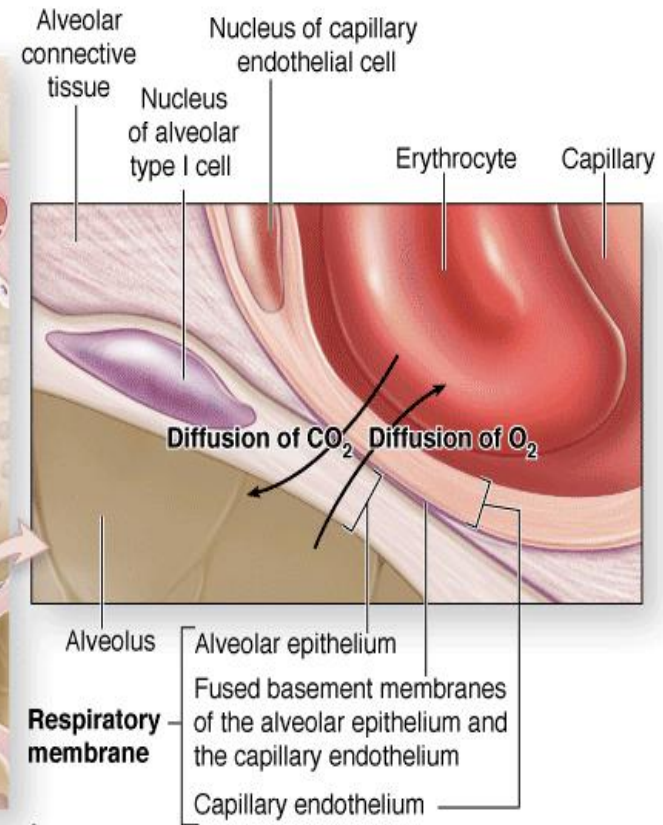
● **Pulmonary Circulation:**

- Lungs have dual blood supply through bronchial and pulmonary vessels.
- Bronchial vessels supply the conducting part of the lungs and pulmonary vessels supply the respiratory part.
- The blood vessels accompany the airways; they are present in the connective tissue that is present around the airways.
- At the level of the alveolar ducts, arterioles divide and form a capillary network around alveoli. These capillary networks are present in the interalveolar septum.
- **Air–Blood Barrier**
- The oxygen molecules present in the alveolus diffuse across the epithelial cells lining the alveolus, they used basement membrane of the alveolus and capillary, the endothelial cells of the capillary and finally into the red blood cell





a



b

Lymphatic Circulation:

Lymphatic vessels accompany the blood vessels.

No lymphatic vessels are present in the alveolar sac and interalveolar septa.

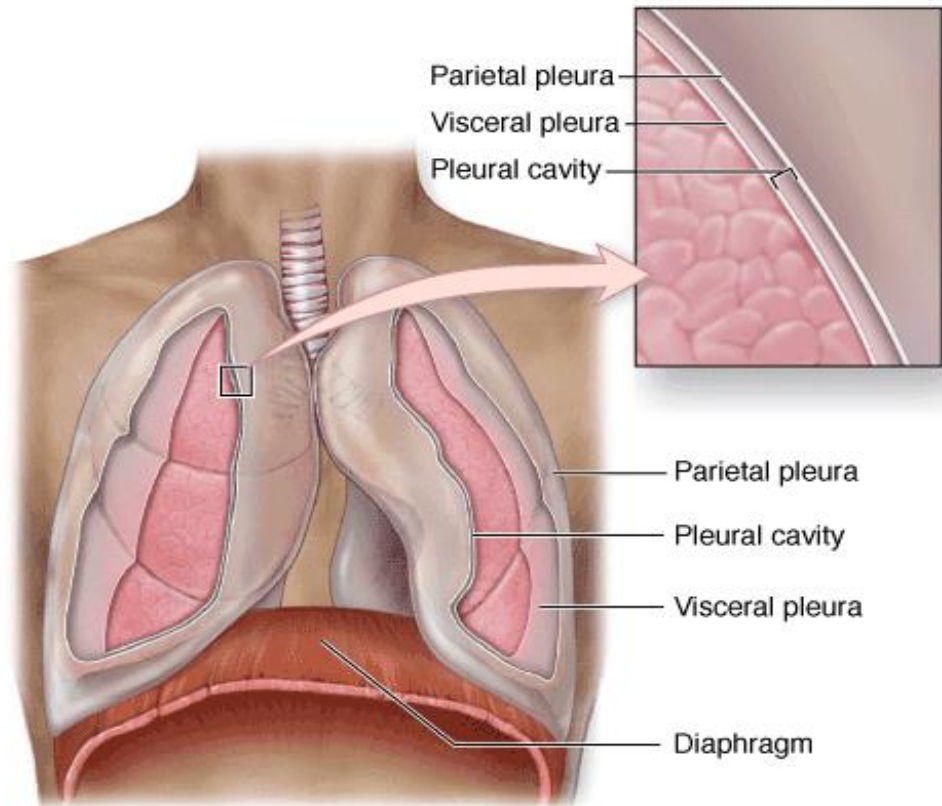
Pleura:

Pleura is a serous sac which covers the lungs.

It consists of visceral and parietal layers. Between the two layers is a potential space known as pleural cavity which contains pleural fluid.

The visceral layer lines the lungs and the parietal layer lines the interior of the thoracic cavity.

Histologically, pleura consists of mesothelium (simple squamous epithelium) overlying a thin layer of vascular connective tissue



a

Source: Mescher AL: *Junqueira's Basic Histology: Text and Atlas, 12th Edition*: <http://www.accessmedicine.com>
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Q1: Which cell is also called a septal cell?

- a. Clara cell
- b. Type I pneumocyte
- c. Type II pneumocyte
- d. Dust cell
- e. Brush cell

Q2: Which cell is a type of neuron?

- a. Basal cells
- b. Brush cells
- c. Olfactory cells
- d. Sustentacular cells
- e. All of the above