

LUNGS- HISTOLOGY



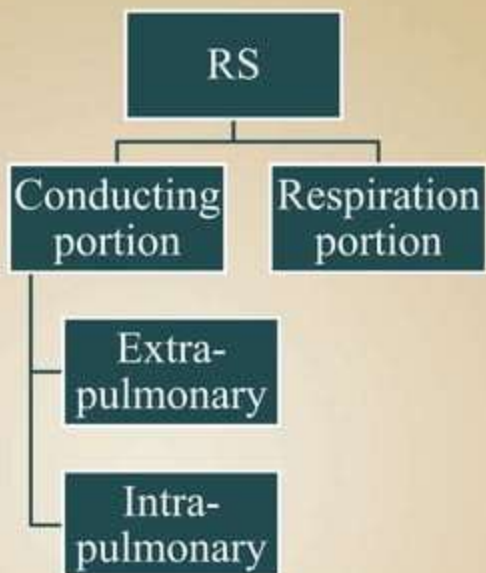
Gurvinder kaur
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GADVASU

Respiratory system

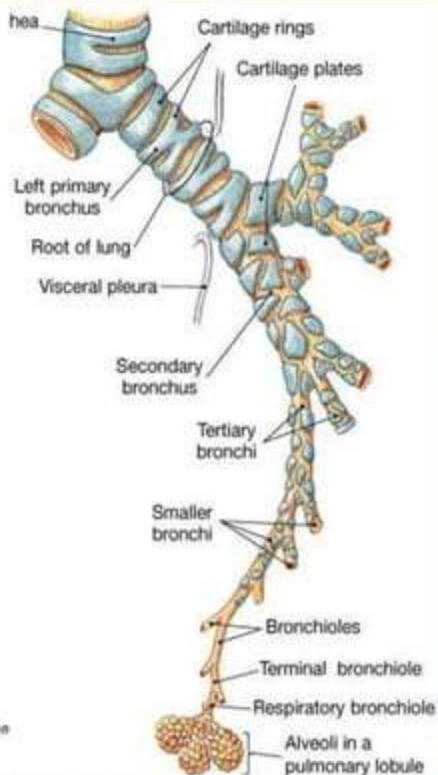
- Series of organs – responsible for taking in oxygen & expelling CO₂
- RS- Lungs and a system of tubes, that links the sites of gas exchange with the external environment.
- **Functions**
 - Oxygenation
 - Elimination of CO₂
 - Excretion of water and volatile substances



Respiratory system



		Generation	
Conducting airways	Trachea		0
	Bronchi	Cartilage, bronchial glands	1
			2
	Bronchioles	Nonrespiratory	7
			8
			9
			15
16			
Terminal respiratory units	Respiratory	17	
		18	
	Alveolar ducts	19	
		20	
		21	
		22	
		23	



Source: McPhee SJ, Ganong WF: *Pathophysiology of Disease: An Introduction to Clinical Medicine*, 5th Edition; <http://www.accessmedicine.com>

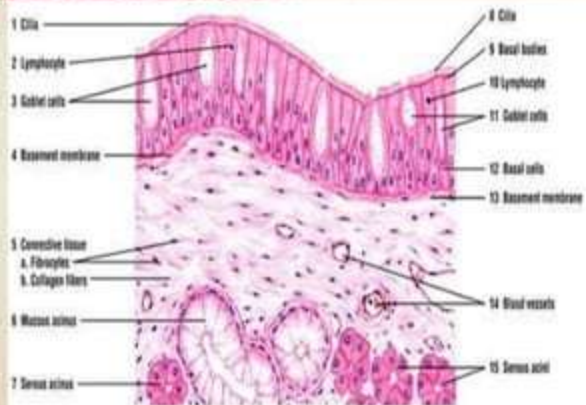
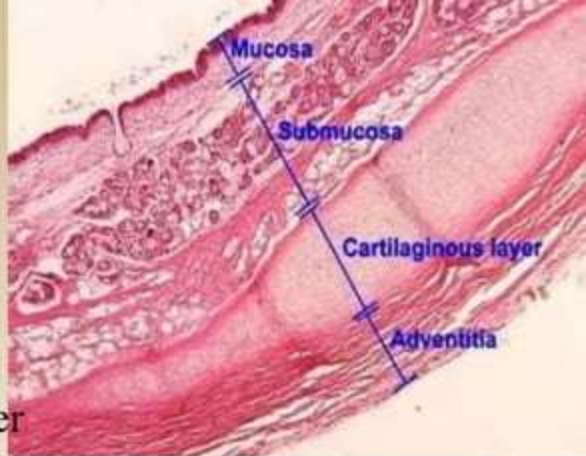
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Respiratory system Histology

- Trachea
- Bronchus
 - Primary bronchus
 - Secondary bronchus
 - Tertiary bronchus
- Bronchiole
- Lung

Trachea

- Mucosa
 - Epithelium
 - Lamina propria
- Sub mucosa
- Cartilage and muscle layer
- Adventitia



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Trachea Mucosa

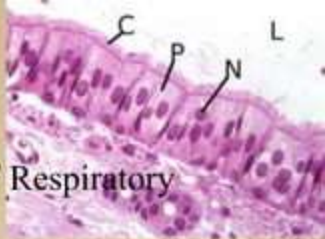
- **Epithelium** -Pseudo stratified ciliated columnar/ Respiratory epithelium

Cells -Ciliated columnar cells

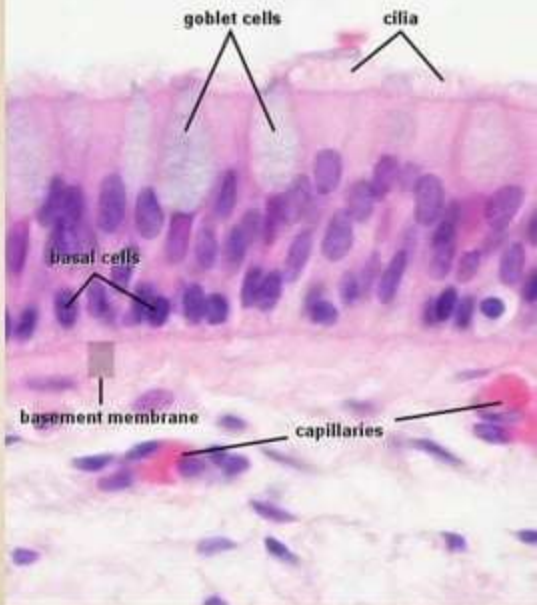
- Goblet cells
- Brush cells
- Basal cells
- Granule (kulchitsky) cells

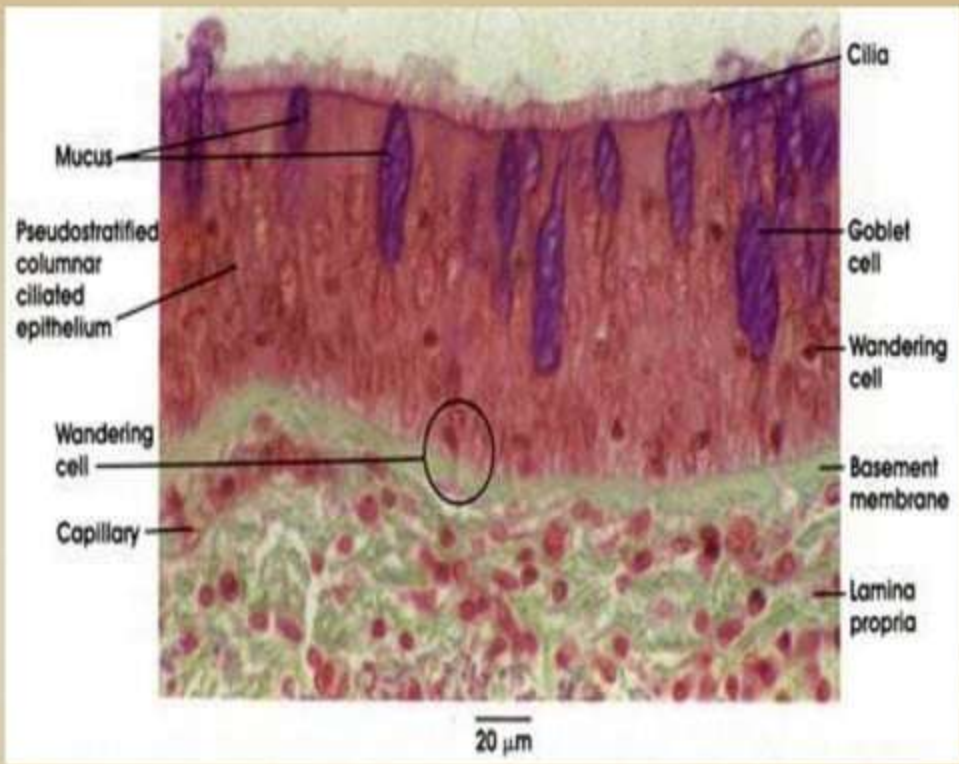
Secretory cells -Clara cells
(bronchiolar cells) surfactant.

- **Lamina propria** - Elastic fibre, Lymphocyte, Mast cells, Blood vessels

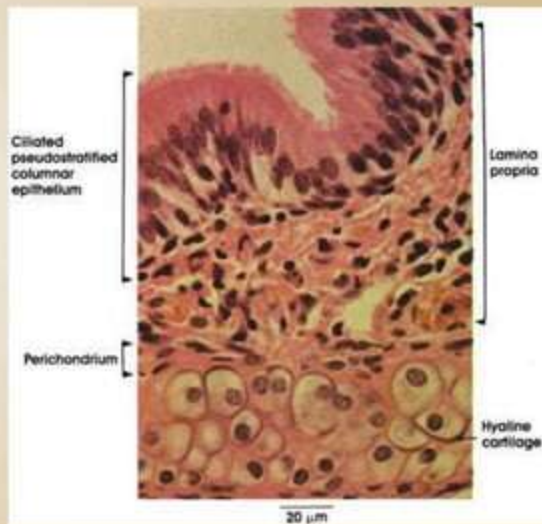
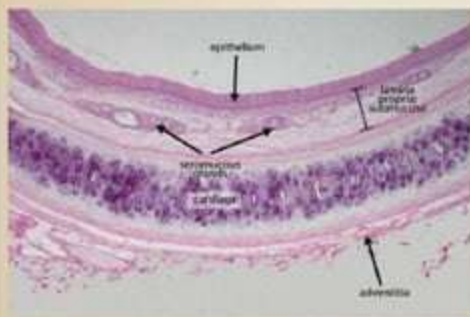


Trachea H&E



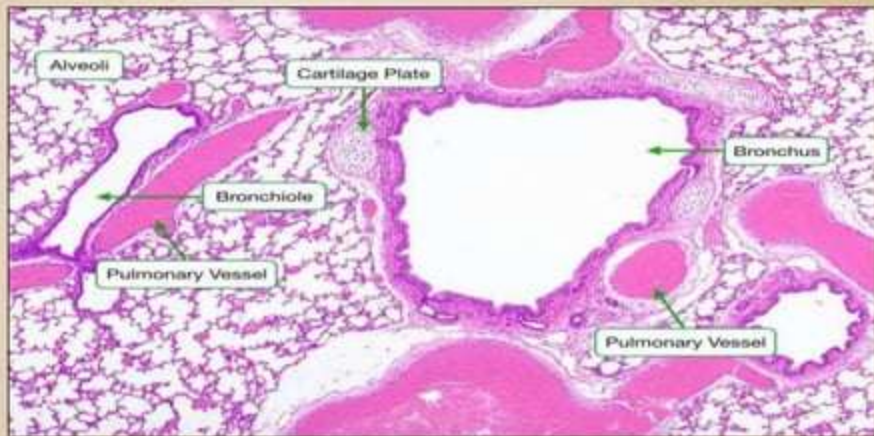


- **Sub mucosa**- Loose connective tissue
Tracheal glands-Mixed (serous & mucus) glands
Blood vessels and ducts
- **Cartilage & smooth muscle layer**- "C" Shaped hyaline cartilage having perichondrium and chondrocytes
Ends of cartilage connected by smooth muscles
- **Adventitia**-fibro elastic tissue

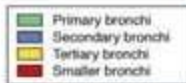
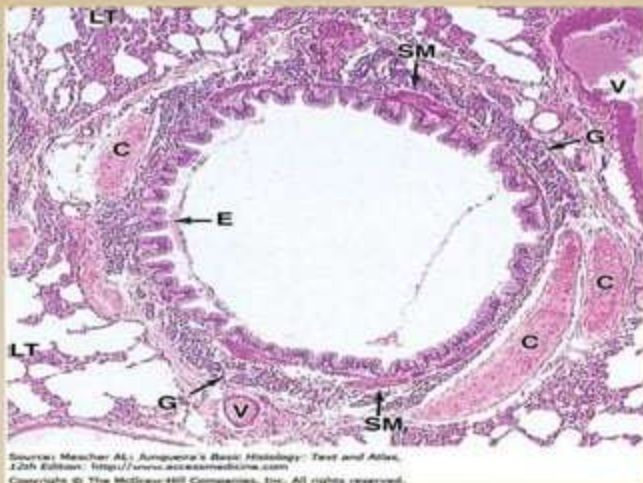


BRONCHUS

- **Principal bronchus** -same as trachea
- **Secondary /Lobar bronchus** -Irregular hyaline cartilage, Pseudo stratified ciliated columnar
- **Tertiary /Segmental bronchus** -Columnar epithelium, Patches of cartilage



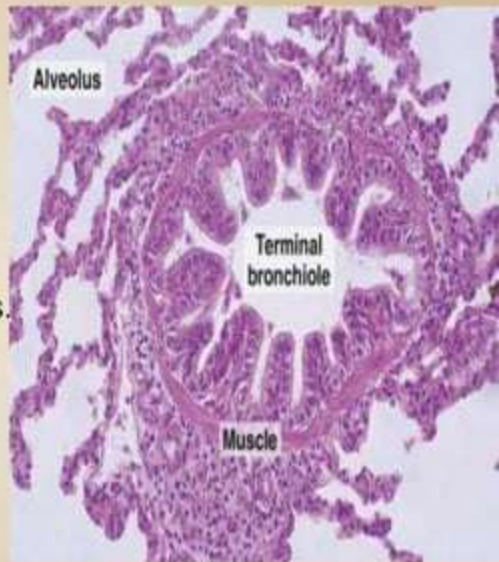
Tertiary/segmental Bronchus

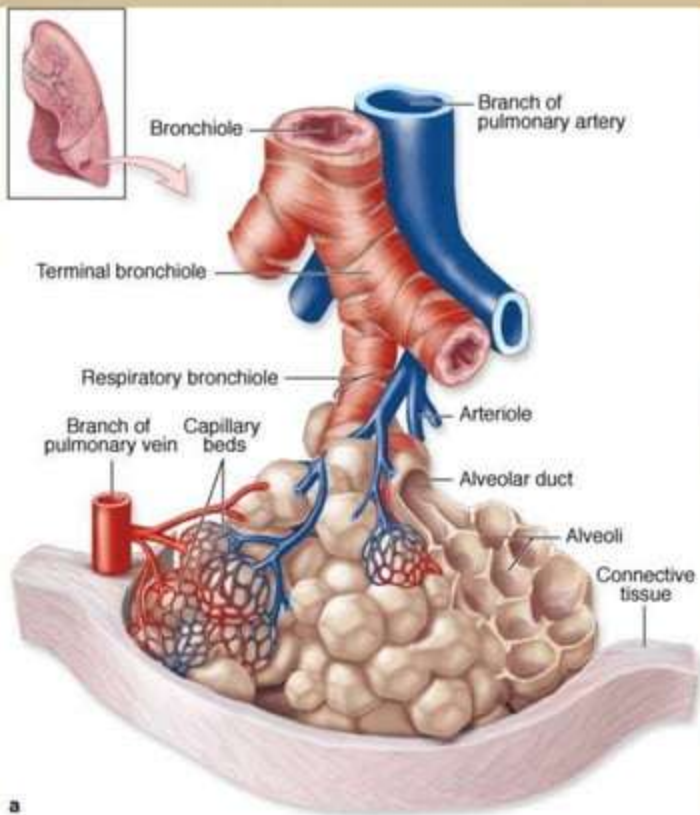


- The number of goblet cells reduced.
- The number of glands reduced.
- The cartilage is present in the irregular plates.

Bronchiole

- The tertiary bronchi repeatedly divide, at minimal 10 times and bronchioles arise, conduct air into pulmonary lobule.
- Bronchioles > 5mm diameter
- No cartilage or glands in mucosa
- Epithelium changes from pseudo-stratified to cuboidal epithelium.
- Scattered goblet cells initially.
- Clara cells secrete protective proteins.
- Lamina propria smooth muscle and elastic fibers. Vagus nerve, sympathetic neuron



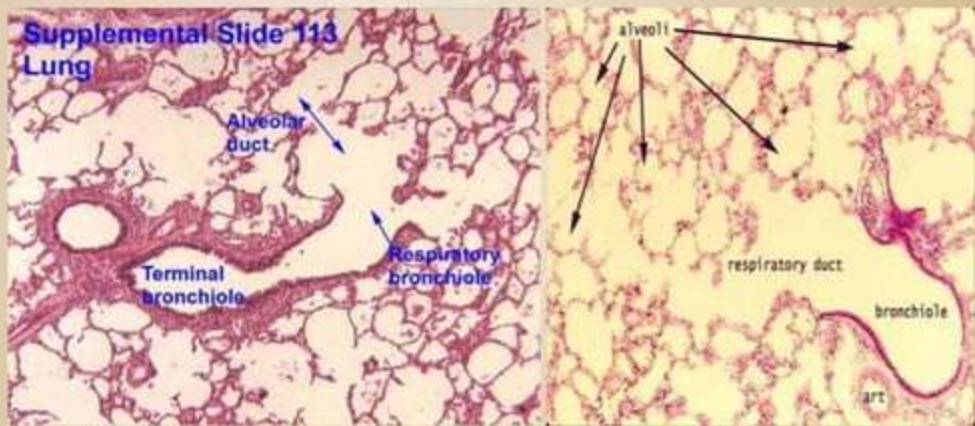


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Source: Mescher AL: *Junqueira's Basic Histology: Text and Atlas*,
12th Edition: <http://www.accessmedicine.com>
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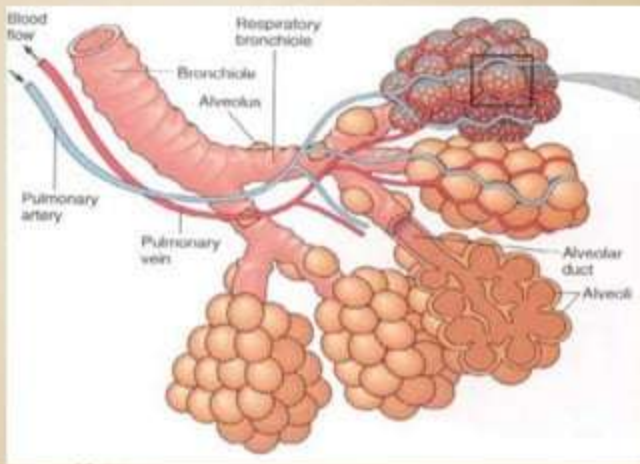
Respiratory bronchiole

- Each bronchioles divides into 5-7 terminal bronchioles,
- Each TB subdivides into 2 or more respiratory bronchioles
- Sites of transition between the conducting and respiratory portion of RS.
- Cuboidal epithelium
- No mucus gland



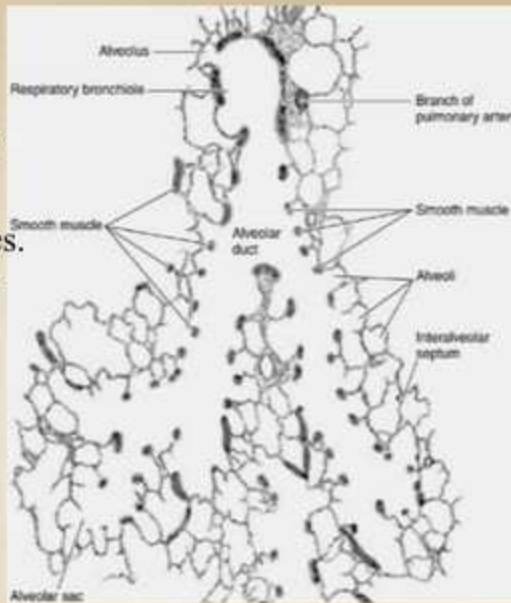
Alveolar duct-Alveolar sacs

- **Alveolar ducts:** Arise by branching of respiratory bronchioles; walls made up of alveolar sacs and alveoli.
- **Alveolar sacs:** Cluster of alveoli that open into the lumen of the alveolar ducts. Composed of squamous epithelial cells, basement membrane, and capillaries. Site of respiratory exchange

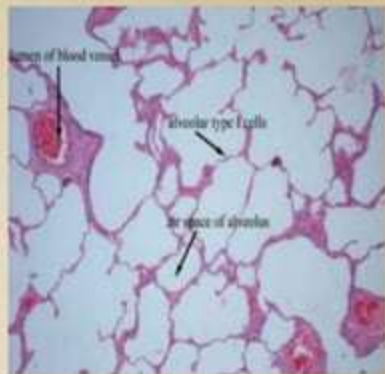
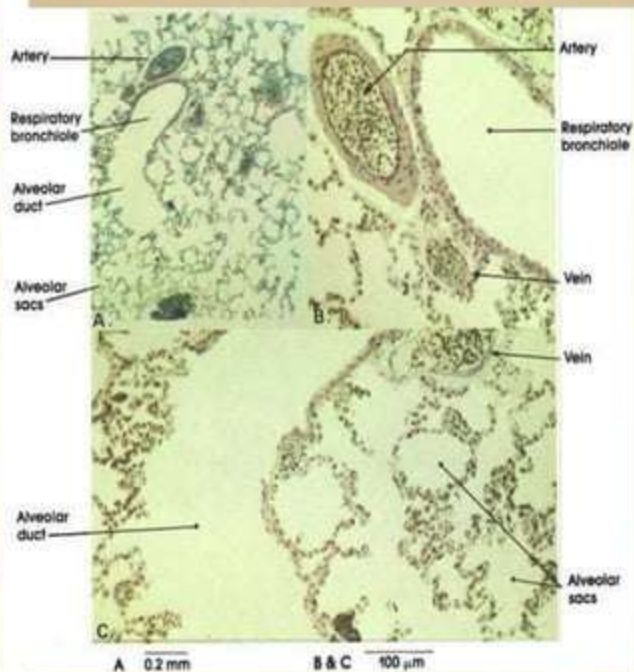


Alveolar duct-Alveolar sacs

- Duct lined by simple squamous epithelium
- Increase the surface area of gaseous exchange
- Surrounded by network of capillaries.
- Smooth muscles only at opening of alveolar ducts

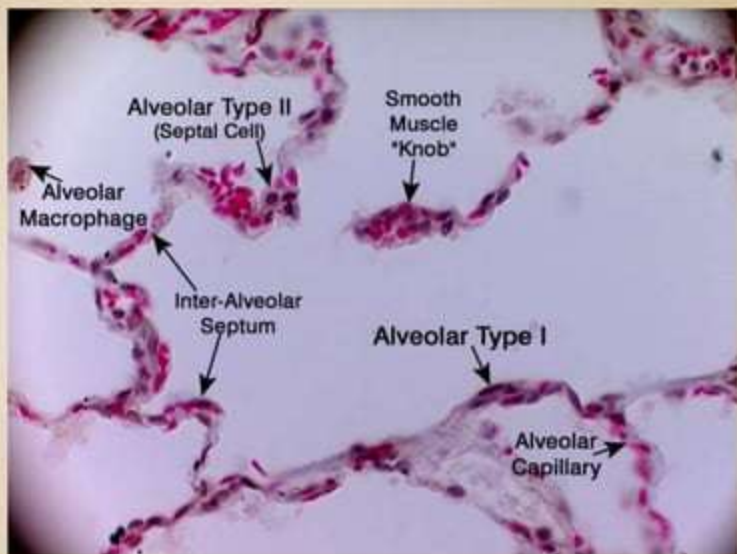


RESPIRATORY BRONCHIOLE, DUCT, AND ALVEOLI



Rat, glutaraldehyde-osmium fixation, toluidine blue stain, A. 50 x, Band C. 162 x

- **Inter alveolar septum-** wall present in between the two adjacent alveoli.
- Consists of epithelial cells of each alveolus on both sides
- Connective tissues contain capillaries, collagen, elastic fibres, fibroblasts and macrophages(dust cells).



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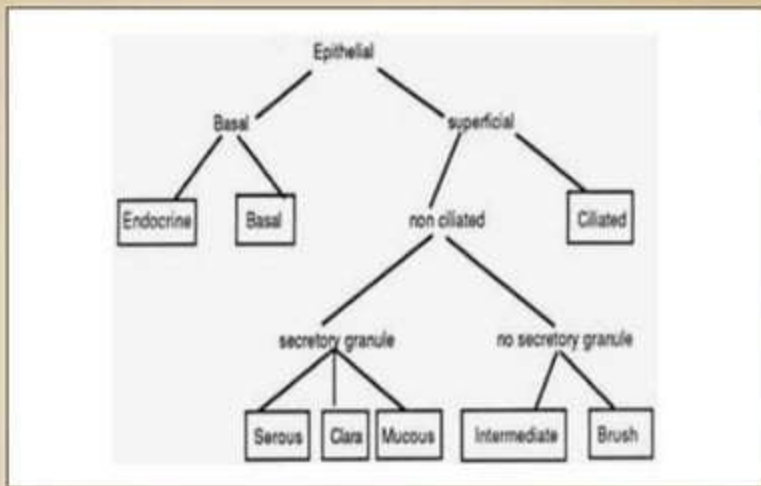
Alveolar cells

- Alveoli are thin walled outpouchings , lined by a single layer of cells.
- **Type I alveolar cells.**
 - Simple squamous cells
 - adjacent cells joined by tight junctions.
- **Type II cells**
 - Surfactant - Cuboidal cells, scattered among type 1 cells.
 - Secrete Pulmonary surfactant which lowers the surface tension and prevents alveoli from collapsing.
- Alveolar **macrophages** or Dust cells – Remove debris.



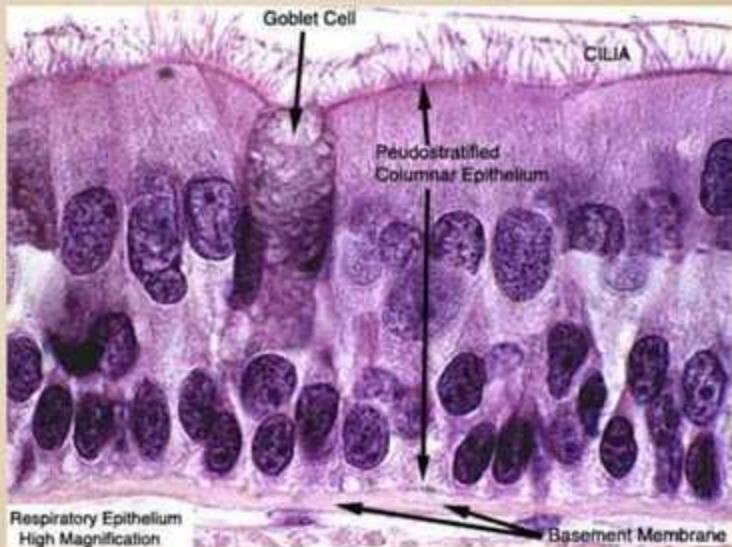
Different types of cells

- In progressing from trachea to bronchioles, eight different cell types are found within the epithelium



Different types of cells

- Ciliated cells
- Goblet (Mucous) cells
- Basal short cells



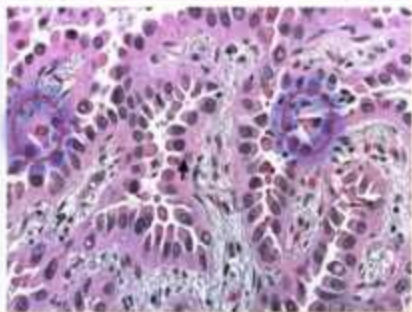
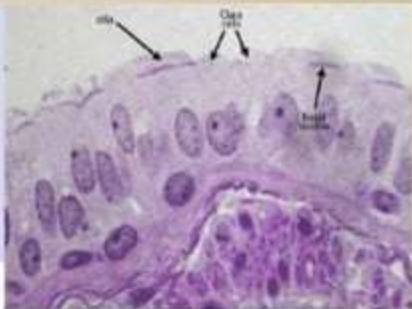
Different types of cells

- Clara cells (Bronchiolar Epithelial cells)

Clara Cells

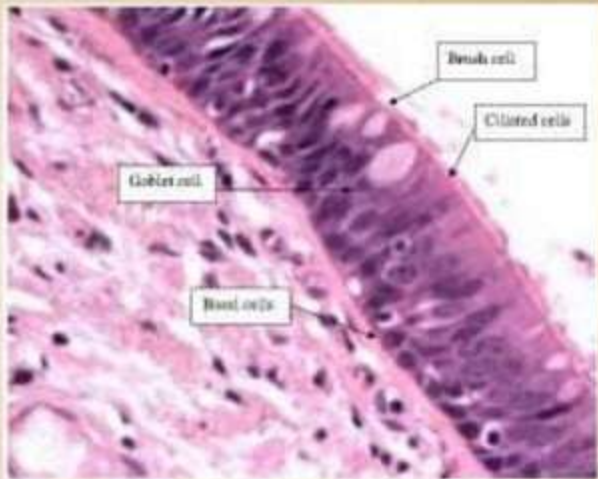
Found:

- Terminal bronchiole
- AS WELL AS
- Respiratory bronchiole (less)



Different types of cells

- Brush cells
- Dense core granule cells
- Serous cells
- Intermediate



Epithelial transitions

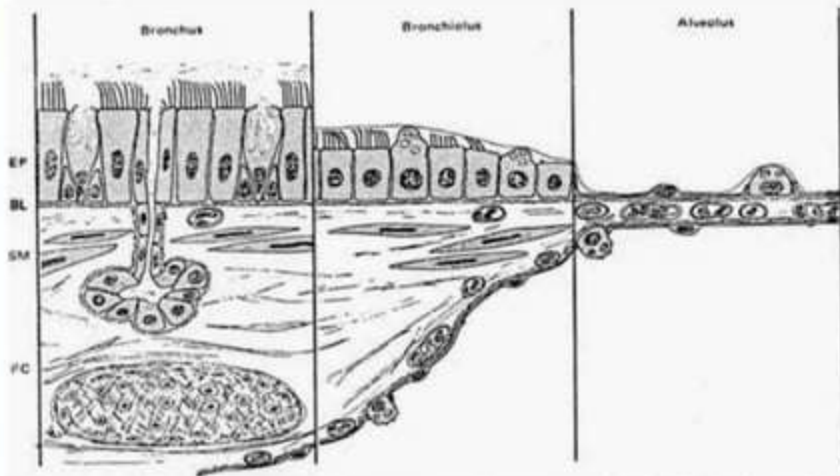



Figure 3. Change of airway wall structure at three principal levels in the lung. The epithelium (EP) gradually reduces from pseudostratified to cuboidal and then to squamous, but retains its organization as a mosaic of lining and secretory cells. The smooth-muscle layer (SM) disappears in the alveoli. The fibrous coat (FC) contains glands and cartilage only in the bronchi and gradually becomes thinner as the alveolus is approached. BL = Basal Lamina.



Thank you