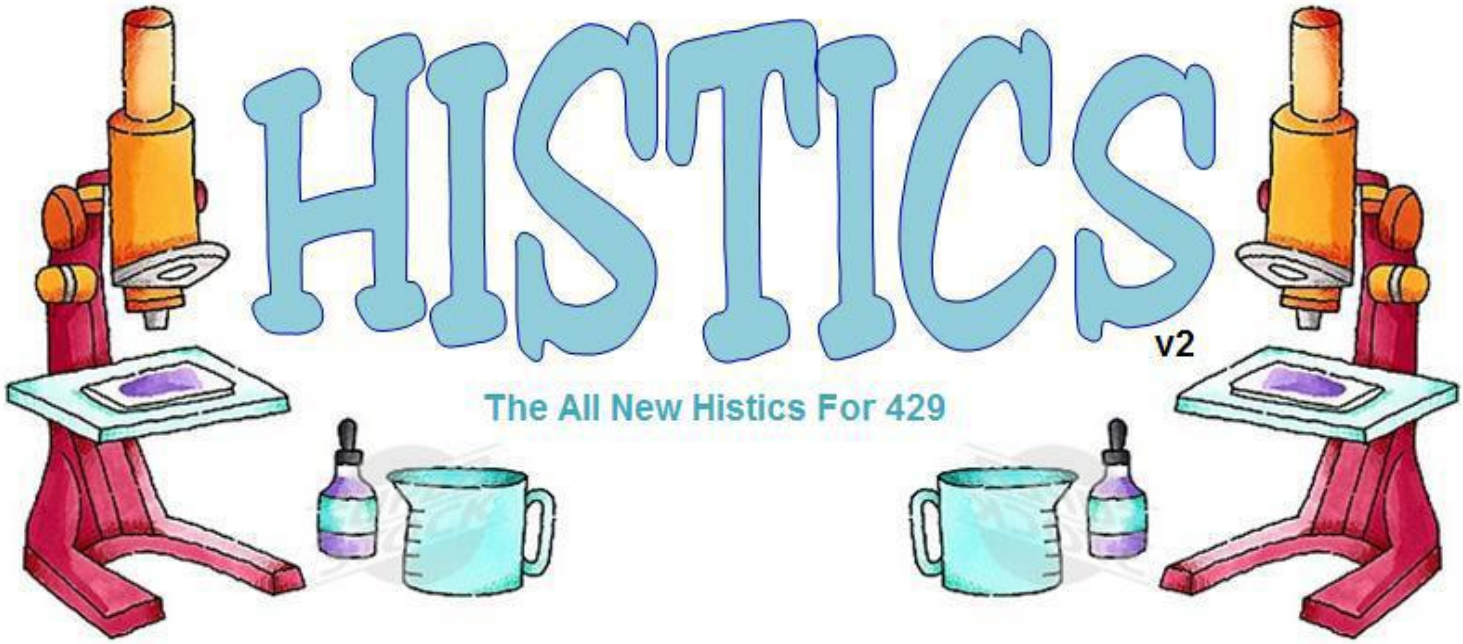

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Special thanks to:-

Histics team 428

PART TEN:

RESPIRATORY SYSTEM 2

Primary Bronchus (Extrapulmonary)

❖ Generally have the same histological appearance as the trachea.

Secondary & Tertiary Bronchi (Intrapulmonary)

It is consists of:

(1) Mucosa:

It has longitudinal mucosal folds and it consists of:

a- Epithelium: Respiratory epithelium.

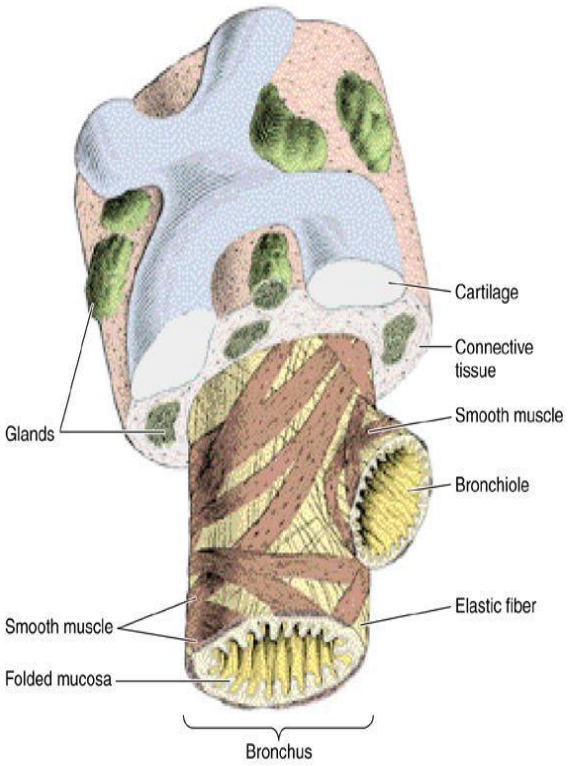
b- Lamina Propria:

- Fibroelastic Connective tissue (loose Connective Tissue. rich in *elastic fibers*).
- It contains:
  - Seromucous glands.
  - Lymphoid elements.

N.B. No elastic lamina.

(2) Muscle coat:

- Two distinct layers of smooth muscle fibers.
- Spirally arragned in different directions.



(3) Submucosa:

Connective tissue that contains:

a- Seromucous glands.

b- Lymphoid elements.

(4) Adventitia (has cartilages):

Contents**:**

a- Loose Connective tissue: Contains radially arranged elastic fibers to connect with counterparts of neighboring bronchial tree.

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

c- Solitary lymphoid nodules.

Notes

Any cartilage below the larynx is hyaline cartilage and elastic cartilage only in larynx.

In bronchi .. smooth muscle is helicle in shape

Intrapulmonary bronchi don't have C- shape

Bronchioles

Bronchioles " Preterminal or Primary":

- Diameter: 1 mm or less.
- Each bronciole supplies a pulmonary lobule.
- The **Preterminal Bronchioles** consist of:

(1) Mucosa: has longitudinal folds

a- *Epithelium*:

- *Simple ciliated columnar* epithelium with occasional goblet cells (in larger preterminal bronchioles).
- Later, *Simple cuboidal* mostly ciliated with occasional Clara cells **BUT NO goblet cells** (in smaller preterminal bronchioles).

b- *Lamina propria*: Fibroelastic Connective tissue (rich in elastic fibrous

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

(3) Adventitia: loose fibroelastic Connective tissue.

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

Terminal Bronchioles "secondary":

Similar structure to preterminal bronchioles, but:

Epithelium:

- Simple cuboidal epithelium.
- partially ciliated.
- With **Clara cells**.

N.B. Terminal Bronchioles are less than 0.5mm in diameter.

N.B. Each supplies lung acinus.

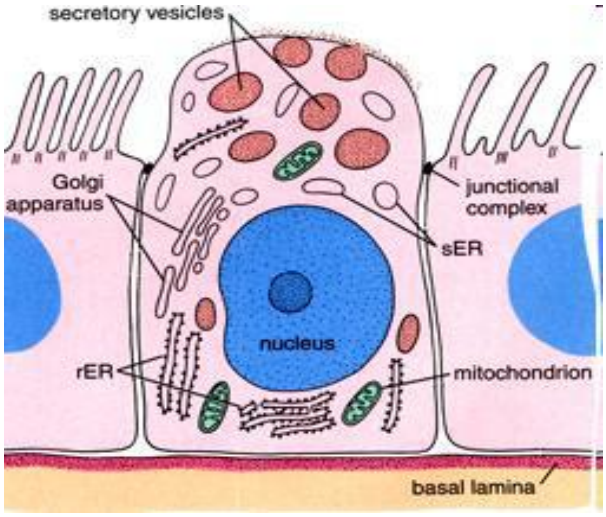
Respiratory Bronchioles "Tertiary":

Similar in structure to terminal bronchioles, **except**:

- Their walls are interrupted by a few pulmonary alveoli.

Clara cells

Structure:



- Columnar non-ciliated cells.
- Dome-shaped apices with microvilli.
- Numerous apical secretory granules (glycoproteins).
- Abundant rER.

Function:

- Protect the bronchiolar epithelium by their secretions.
- Degrade toxins in inhaled air by cytochrome P-450 enzymes (produced by sER).
- Divide to regenerate the bronchiolar epithelium.
- May produce surfactant-like material.

Notes

in bronchiole (all the 3 division) in adventia ...NO cartilage NO serumucose glands NO lymphatic nodules NO goblet cells (but exist in pre-terminal "primary" bronchiole)

by the cartilage... we can differentiate between intrapulmonary bronchus and bronchiole

Clara cells never exist out of the bronchiole

In terminal bronchiole 50% of cells are clara. Respiratory bronchiole 90% are clara cells.

Alveolar Ducts

The walls of alveolar ducts consist almost of pulmonary alveoli.
Alveolar ducts do NOT have walls of their own; They are merely linear arrangement of pulmonary alveoli.

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

Alveoli

Pulmonary Alveoli

They are small outpouchings of respiratory bronchioles, alveolar ducts & alveolar sacs.

Interalveolar Septa:

It is the region between 2 adjacent alveoli.

Components:

(a) Alveolar Epithelium: lines both sides of interalveolar septum.

- **Type I Pneumocytes:**

  line **95% of the alveolar surface**.

  Count: less numerous than type II pneumocytes.

  L/M: simple squamous epith. , highly attenuated cells.

  E/M: Abundant pinocytotic vesicles are connected together and with type II cells by occluding junctions.

  Function: Exchange of gases.

- **Type II Pneumocytes**:

  Line **5% of the alveolar surfaces**.

  Are **more numerous** than type I pneumocytes.

  L/M:

  Are **cuboidal cells** (other textbooks: rounded cells).

  Usually found in groups of 2-3 cells.

  Usually found at sites of union of septa.

  Foamy or vesicular cytoplasm.

  Nucleus: central, rounded, vesicular.

  E/M:

  - connected with type I cells by occluding junctions
  - Dome-shaped apical surface.
  - Short apical microvilli.
  - Abundant mitochondria, RER , Well-developed Golgi.
  - Membrane-bound **Lamellar bodies** (contain concentric or parallel lamellae limited by a unit membrane) (contain pulmonary surfactant).

  Function:

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

A- It reduces effort to inflate pulm. Alveoli.

B- It has bactericidal effect.

2- Phagocytosis of pulmonary surfactant.

3-Renewal of alveolar epithelial cells: Type II cells can divide to regenerate both type I & type II pneumocytes.

(b) Interstitium.

(1) Continuous Pulmonary Capillaries:

- The richest capillary network in the body
- Continuous blood capillaries.
- Endothelium shows numerous pinocytotic vesicles.

(2) Interstitial Connective tissue:

a- Connective tissue Fibers: elastic fibers & type III collagen (reticular fibers).

b- Connective tissue Cells: Fibroblasts, Macrophages, Mast cells, Lymphocytes.

- Blood-Gas Barrier "Blood-Air Barrier"

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

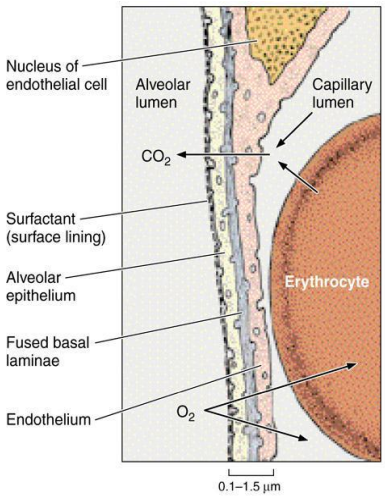
Components:

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 Macrophages "Dust Cells"

Sites:

- In lumen of pulmonary alveoli.
- In pulmonary interstitium.

Function:

1- Phagocytose particulate matter (e.g. dust & bacteria)in the lumen of pulm. alveoli & in the interalveolar septa.

2- Phagocytose part of the surfactant.

Notes

to differentiate between Respiratory bronchiole and alveolar duct by the amount of open alveolus .. which seen more greater in alveolar duct...

type II alveolar cells can do regeneration of type I alveolar cells

the lamellar JUST in type II alveolar cells