

HISTOLOGY SHEET

Doctor 2021 -mercy- | medicine | MU

DONE BY:

Amatulshafi

Aya Abu Samra

Shahd Alayouben

Corrected by

Emran Younis

DOCTOR

Dr. Ferdous star

Histology of Respiratory System

Function

Inspiration of air, gas exchange,

expiration of CO₂

Chemoreceptors of sense of

Smell **Olfactory area**

Phonation **That found in larynx for production of voice**

The parts of the respiratory system

The respiratory system is divided into two parts:

Upper respiratory tract:

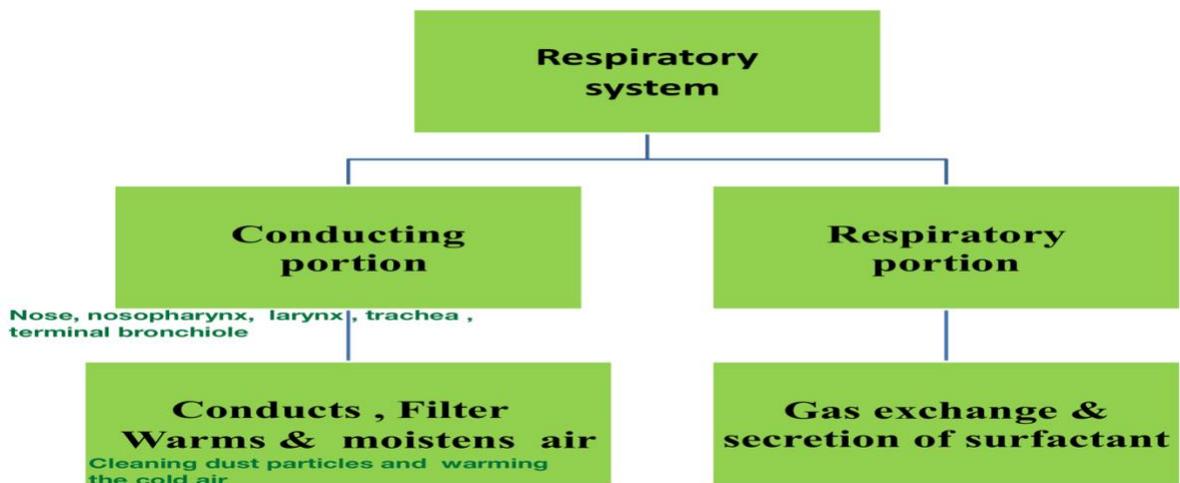
This includes :

- Nose, mouth, **Nosopharynx**
- and the beginning of the trachea.

Lower respiratory tract

It includes the trachea, the bronchi, bronchiole and the lungs.

- **The trachea** :It connecting the throat to the bronchi.
- **The bronchi** : It divides into two bronchi (tubes).
- **The bronchiole** :the bronchi branches off into smaller tubes called bronchiole which end in the pulmonary alveolus.
- **The Lungs**: The structure of the lungs includes the bronchial tree-air tubes branching off from the bronchi into smaller and smaller air tubes, each one ending in a pulmonary alveolus.



The conducting portion includes:

- Nasal cavity
- pharynx **Nosopharynx**
- Larynx
- Trachea
- Primary bronchi (RT +LT)
- 2ry , 3ry bronchi
- Bronchioles
- Terminal bronchioles

Function of conducting portion:

- Conduction of air (**It must always be opened**)
- Conditioning of air

Structure / Function of conducting portion:

1- Conduction of air:

- Cartilages to prevent collapse,
- Elastic & smooth ms. fibers for flexibility

2- Conditioning of air:

- Nasal hairs: clean & trap large particles **e.g. dust**
- Capillaries: adjust temperature
- Respiratory mucosa: adjust moisture & filters air

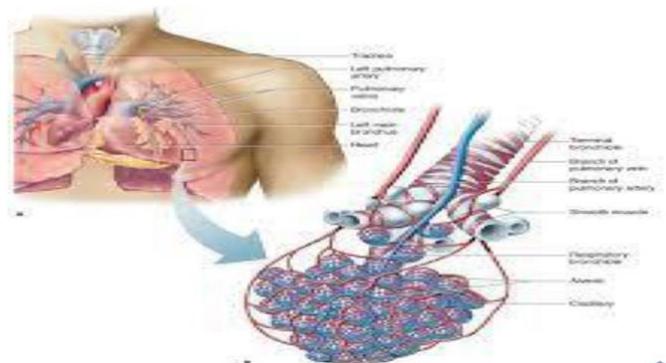
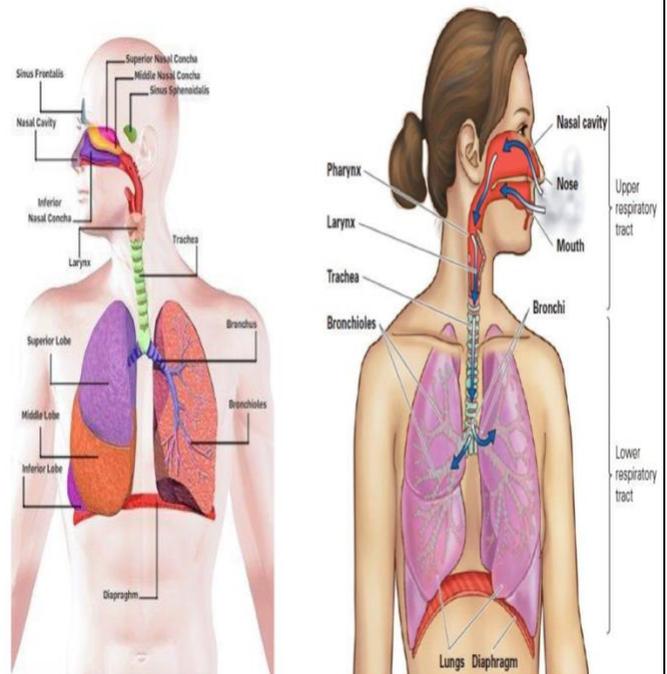
Thick tough hair which found in the first area from outside of nose

The respiratory portion includes:

- Respiratory bronchioles
- Alveolar ducts
- Alveolar sacs
- Alveoli

Function of respiratory portion:

O₂/CO₂ exchange take place between blood & inspired air



Nasal cavities

Consists of:

- Vestibule
- Respiratory area
- Olfactory area

Vestibule: Thick tough hair

- Is the anterior part
- Formed of skin + sebaceous gland + hair [To make trapping dust particles]
- Lined with keratinized stratified squamous epithelium

The Nasal Cavities

- 2 cavities separated by nasal septum
- Their lateral walls contain 3 bony projections (conchae) superior, middle, inferior

The conchae is irregular which causes to air takes its time of warming, cleaning and moistening

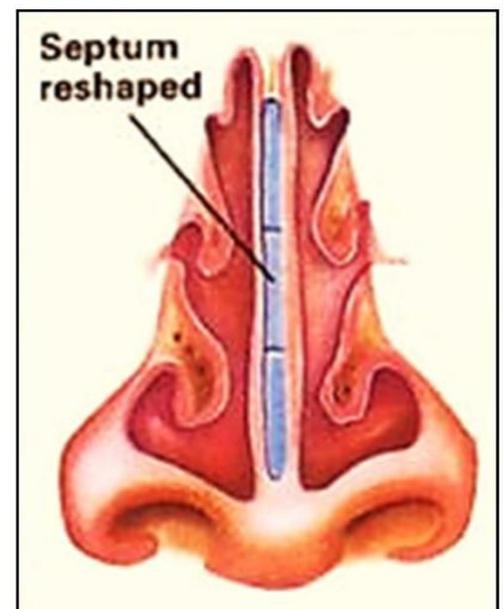
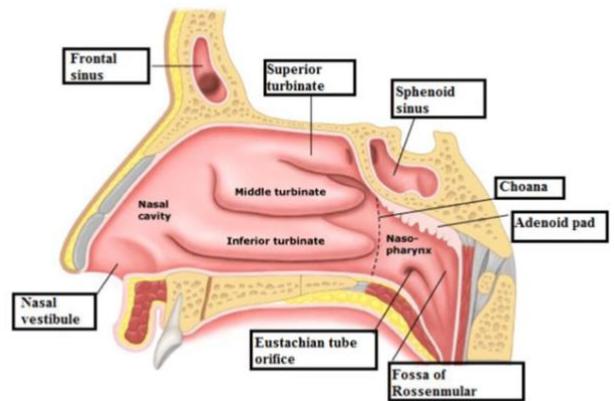
- The conchae increase the surface area for better conditioning of the inspired air

Olfactory epithelium found in the roof of nasal cavity and in superior conchae

- Superior one covered with **Olfactory epithelium**

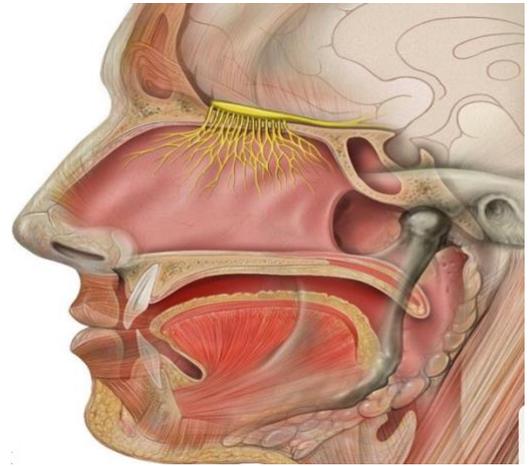
Which is another type of mucosa

- Middle & inferior covered with **Respiratory epithelium**= a ciliated pseudostratified columnar epithelium With goblet cell. It's filled with capillary which make warms the air but the person who has a defect or weak capillary walls will have a bleeding which is called epistaxis (رعاف)



The olfactory epithelium

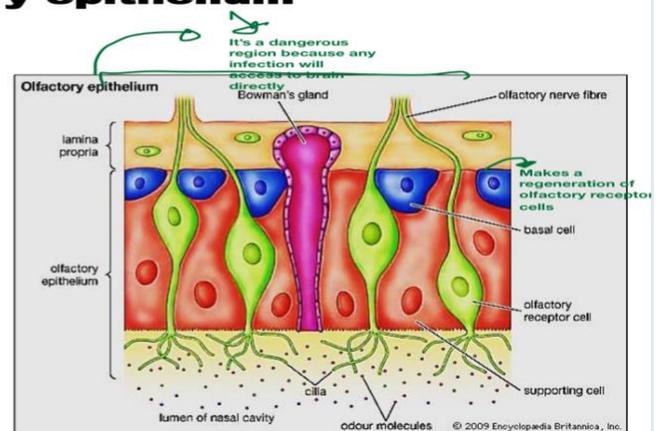
- Site : Covers the roof of nasal cavities & superior conchae.
- Contains chemoreceptors of smell
- 3 cell types are present:
 - **Olfactory receptor neurons** The cell which transports the sensation
 - **Supporting (sustentacular) cells**
 - **Basal cells** If in each time I had flu and the destroyed olfactory cells are not replaced by stem cells, I will not have smell sensation.
- The olfactory mucosa consists of:
 - 1- **The epithelium rests on lamina propria**
 - 2- **lamina propria which contains:** The C.T that under epithelium tissue
 - ✓ **Bowman's glands**, secret **serous fluid** (The odurent material must be dissolved to bind with olfactory receptor cell and start sensation) → surface
 - ✓ **BV & olfactory nerve fibers**



The olfactory epithelium



FIGURE 15.2 ■ Olfactory mucosa: details of a transitional area. Stain: hematoxylin and eosin. High magnification.



The respiratory epithelium

The respiratory epithelium is a tissue that lines the respiratory system.

Pseudo-stratified columnar ciliated + goblet cells

Role of the respiratory epithelium are:

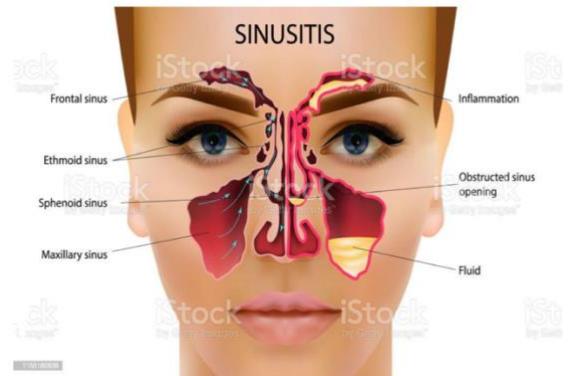
- 1- It serves as a protective barrier and
- 2- It also provides moisture.

The olfactory epithelium:

Specialized Pseudo stratified columnar +chemoreceptors & NO goblet cells

Paranasal sinuses

- Frontal, ethmoidal, sphenoidal maxillary (these cavities decrease the weight of the skull and to give resonance for voice)
- Skull cavities open in nasal cavity
- Lined with **thin** respiratory epithelium with **few goblet** cells which is **very adherent to the periosteum** (works as a source of nutrition for sinuses)



Here the epithelium tissue connected with periosteum instead of lamina that causes a severe pain during inflammations

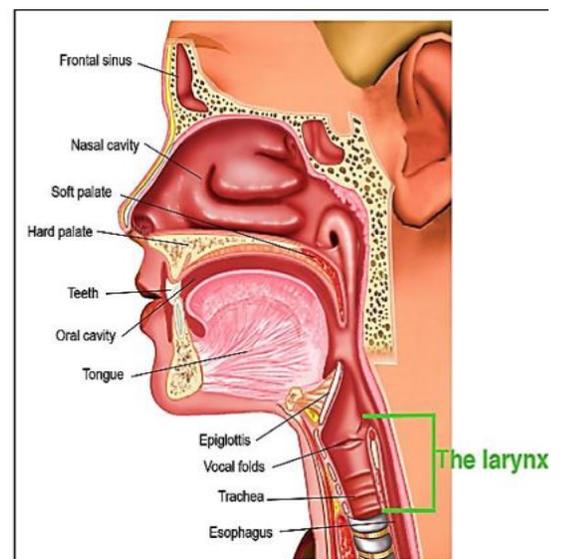
- Inflammation = sinusitis ---- ---severe pain

Larynx: Vocal cord which produces a voice.

- At the beginning of trachea
- Its beginning is guarded by epiglottis

Has 2 functions:

- ✓ production of voice (vocal cords)
- ✓ Prevent food from entering the trachea(epiglottis has **elastic** cartilage in its lamina propria)
- Lined with respiratory epithelium



Trachea

- Tube extends from larynx & ends by dividing into 2 bronchi
- Kept open by about 20 C- shaped Cartilage rings (hyaline cartilage)

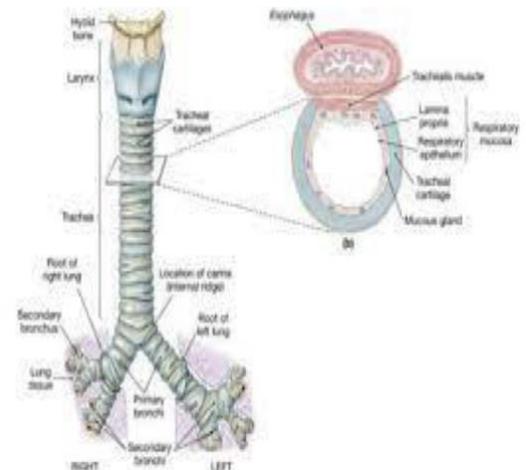
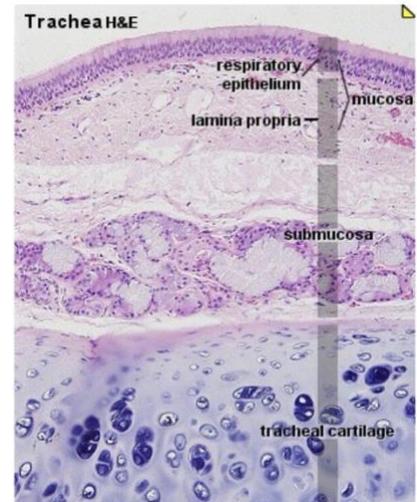
Its wall is formed of 4 layers:

1. Mucosa
2. Submucosa
3. Hyaline cartilage
4. adventitia

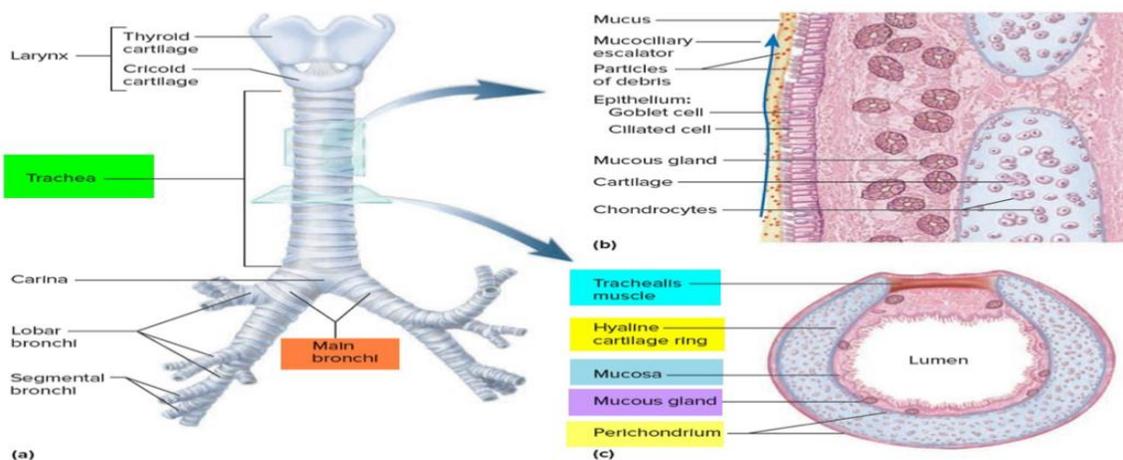
Trachea: (largest conducting section of RS)

- **Mucosa:** respiratory epithelium + lamina propria
- **Submucosa:** loose CT. contain tracheal glands (Which helps the goblet cell in trapping the dust material) (mucus gland)
- **Cartilage layer:** C- shaped cartilage rings, the gap between cartilage ends connected by elastic ligament & Trachealis ms (smooth ms)

Adventitia: loose CT



Trachea



Bronchial tree

- ✓ Primary (Extra pulmonary) bronchi
- ✓ Secondary (Intra-pulmonary) bronchi
- ✓ Bronchioles
- ✓ Terminal bronchioles
- 1ry bronchi: RT&LF—> similar to trachea (but cartilage is **complete ring**)
- 2ry bronchi: within the lung—> divide into 3ry bronchi

Its wall is formed of 4 layers (**No Submucosa**)

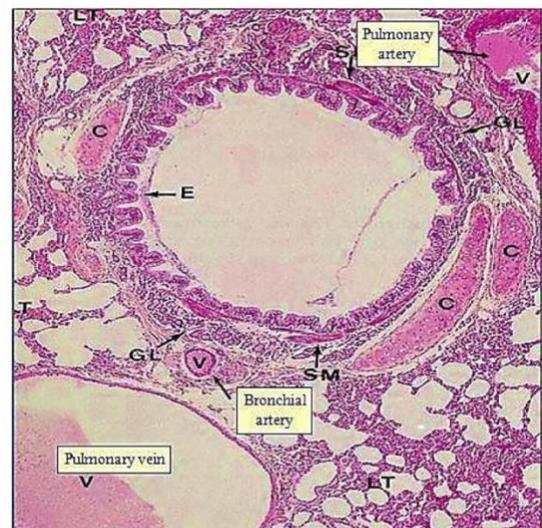
- Mucosa
- Musculosa Muscle layer (important layer, yet histamine is secreted during allergies leading to spasms in musculosa, as a result asthmatic attack occurs. Bronchial asthma is indicated with wheezing chest)
- Cartilage plates Here we don't need a cartilage for support because we have a supportive tissue
- Adventitia
- cartilage replaced by smooth muscles , bronchiole becomes narrower which causes whistling sound

Structure of 2ry & 3ry bronchi

- Mucosa: respiratory epith+decrease goblet cells

Lamina propria has MALT (**mucosa associated lymphatic tissue**)

- Musculosa: spiral layers of smooth ms. encircling the mucosa
- Cartilage plates:
- adventitia

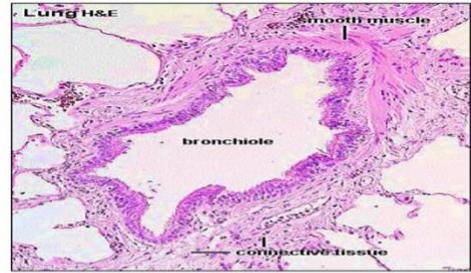


Structure of 2ry bronchi¹⁻³

Bronchioles Have a cartilage ==> bronchi

No cartilage. ==> bronchiole

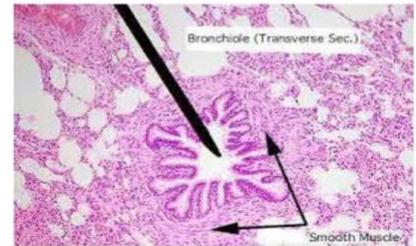
- Small airways less 0.5 mm
- Its wall has **No** (submucosa, cartilage, lymphatic nodules)
- Its wall formed of **3 layers**



Mucosa:

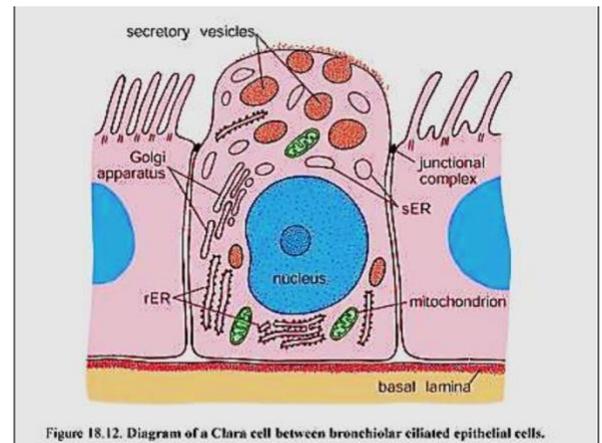
Simple columnar ciliated + **Clara cells**

- **Musculosa:** complete layer of circularly arranged s.ms.
- **Adventitia:** CT layer



Clara cells

- ❖ Secretory cells with Dome shaped apex
- ❖ They also present in terminal bronchioles
- ❖ Protein Secreting cell prevent alveolar collapse



▪ Terminal bronchioles:



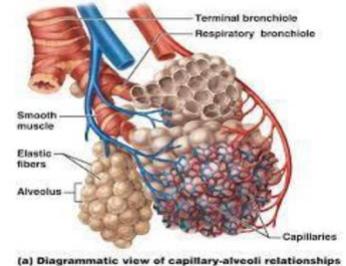
- The smallest & last part of conducting portion
- Lining epithelium: **simple cubical p. ciliated + Clara cells**

There is no goblet cell because it secrets a mocus which prevents the gas exchange process

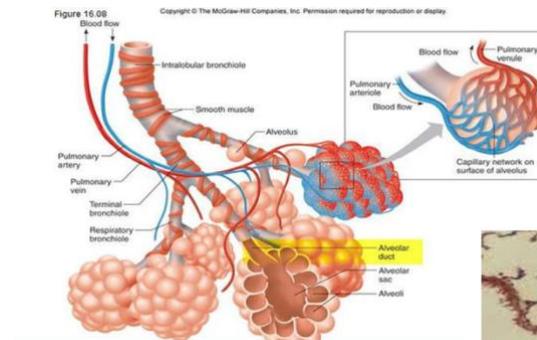
respiratory portion

where gas exchange takes place Includes:

- ✓ Respiratory bronchioles
- ✓ Alveolar ducts
- ✓ Alveolar sacs
- ✓ Alveoli

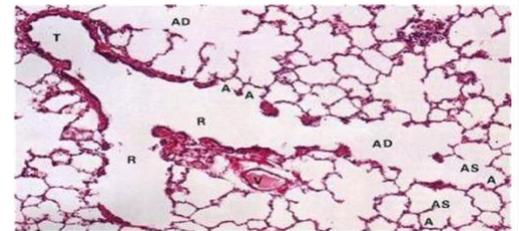
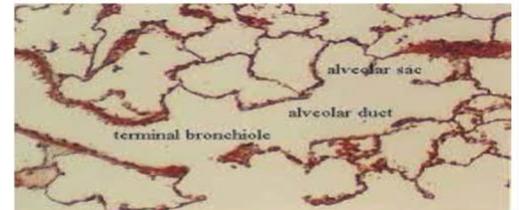


(a) Diagrammatic view of capillary-alveoli relationships



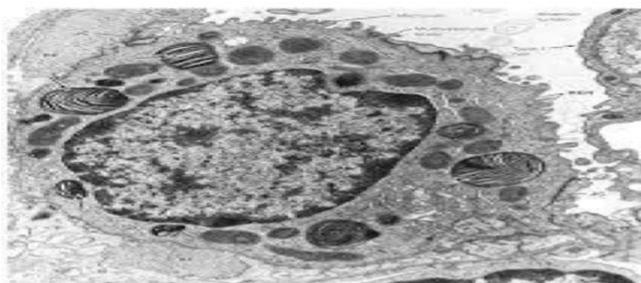
Alveoli

- Sac like structures
- Responsible for gas exchange
- They separated by thin septa called inter-alveolar septa
- The alveoli must be opened by so there type 2 of pneumocyte that secretes a surfactant which is a lipid in nature and makes lowering surface tension which prevent the collapse of alveoli , the Clara cell appears in bronchiole and secretes protein secretion in nature that helps the surfactant to keep the alveoli open
- Lined with 2 type of cells:



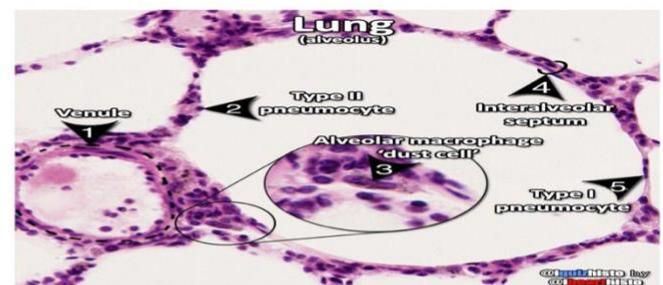
Type I pneumocyte

Type II pneumocyte



Type I pneumocytes

- Most cells (97%)
- Flat simple squamous cells e flat nuclei
- Function: Gas exchange



Type II pneumocytes

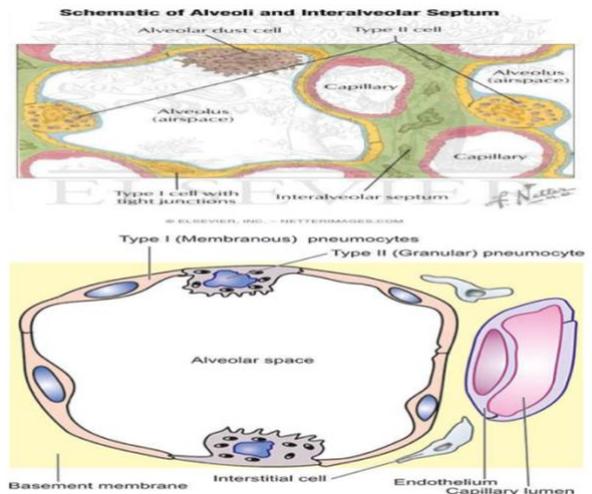
- 3%
- Cuboidal cells e central nuclei & foamy cytoplasm
- Function: Secrete surfactant + stem cells Repair type 1 pneumocyte if had injured

Interalveolar septum

Def : The wall between two adjacent alveoli

Content :

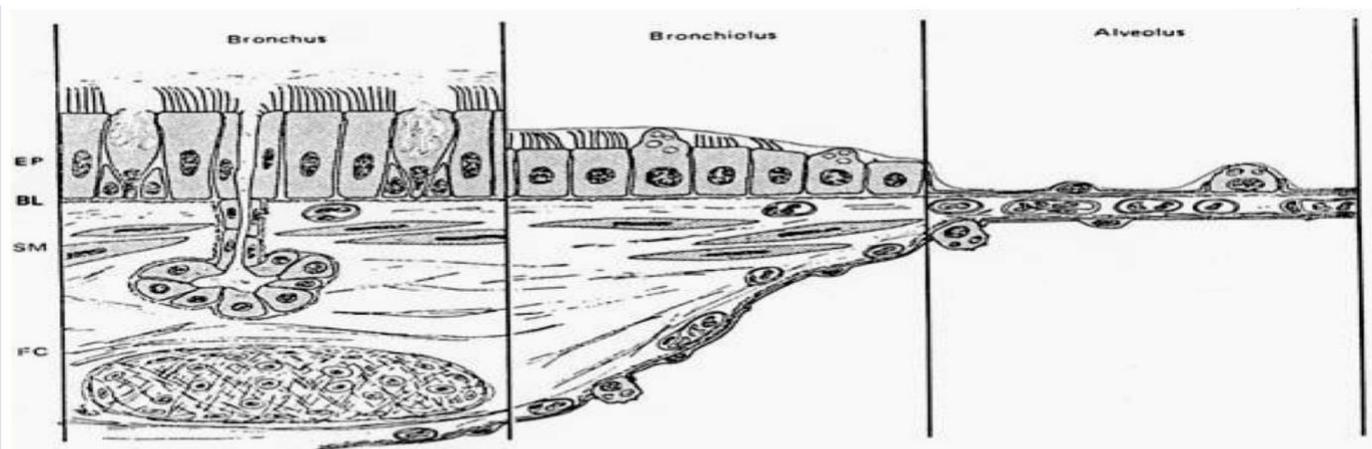
1. Pores
2. Capillary network
3. Elastic & reticular fibers (for support)
No collagen type 1 and if I had it in pathology state we call it lung fibrosis but the collagen type 3 is physiologically found and normal because type 3= reticular collagen
4. Cells (alveolar macrophages- fibroblast = interstitial cells)



Epithelial transitions

The respiratory system provides beautiful examples of epithelial transitions.

- The pseudostratified ciliated columnar epithelium of the trachea and bronchi gives way to a simple columnar ciliated epithelium in the bronchioles and then to the simple squamous epithelium of the alveolar ducts and alveoli.
- The ciliated cells undergo a gradual reduction in height from trachea to terminal and respiratory bronchiole.



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.

بس تحاول تستوعب انه هاد آخر شيت وأنت لسا بالانترو:



دقيقة يا جماعة نفهم

الطب والجراحة لجنة