Respiratory system pathology

By

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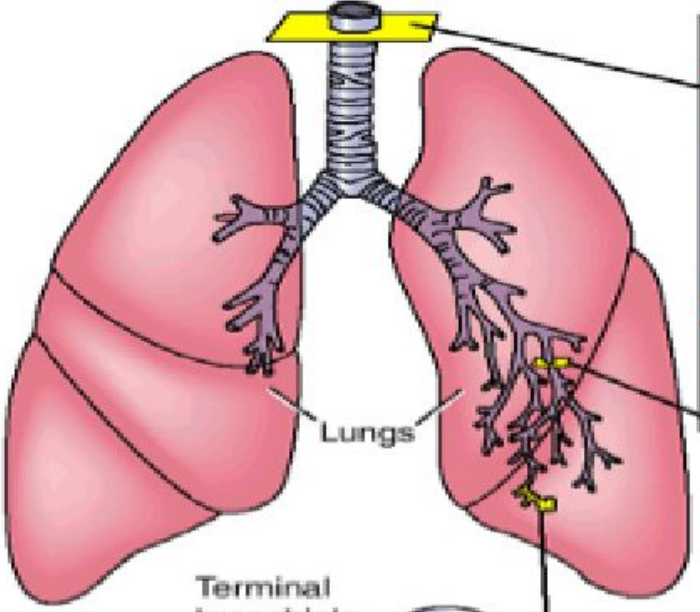
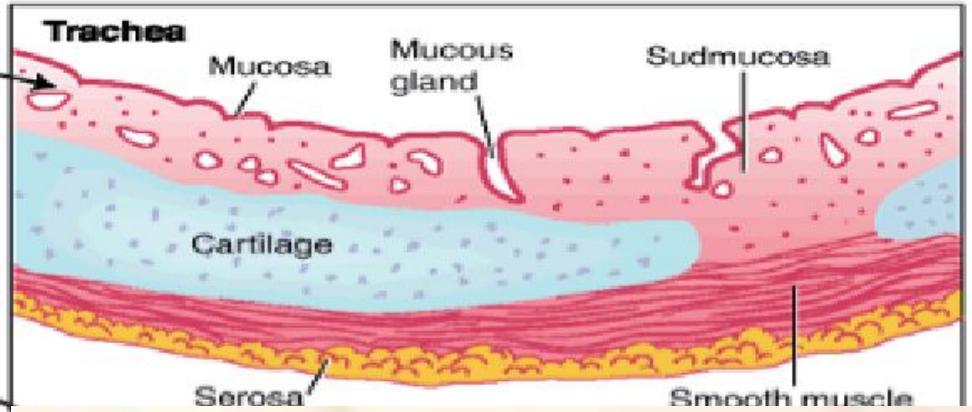
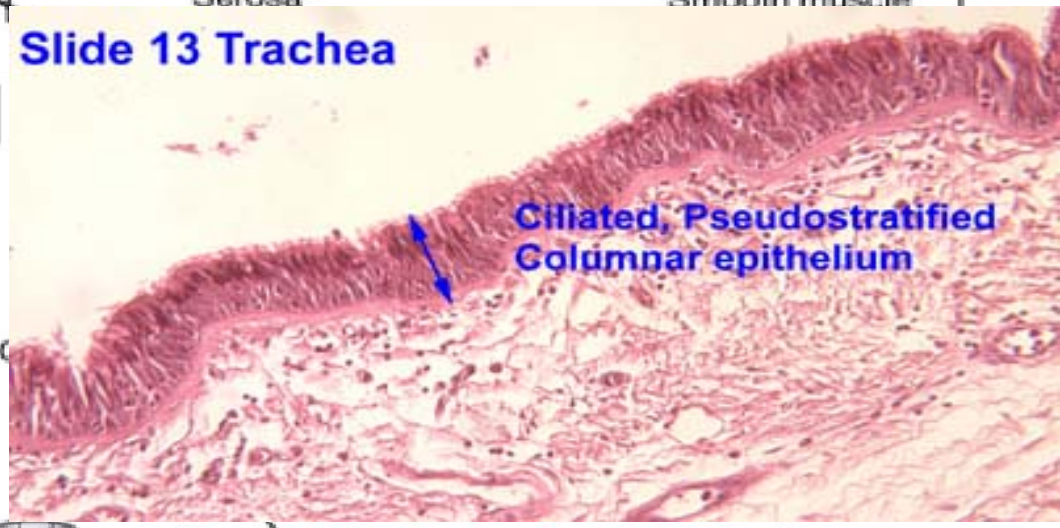
Objective of lecture

Review-1
Congenital Anomalies of lung -2
Atelectasis (collapse):- definition , pathogenesis and-3
. morphology
.Summary-4

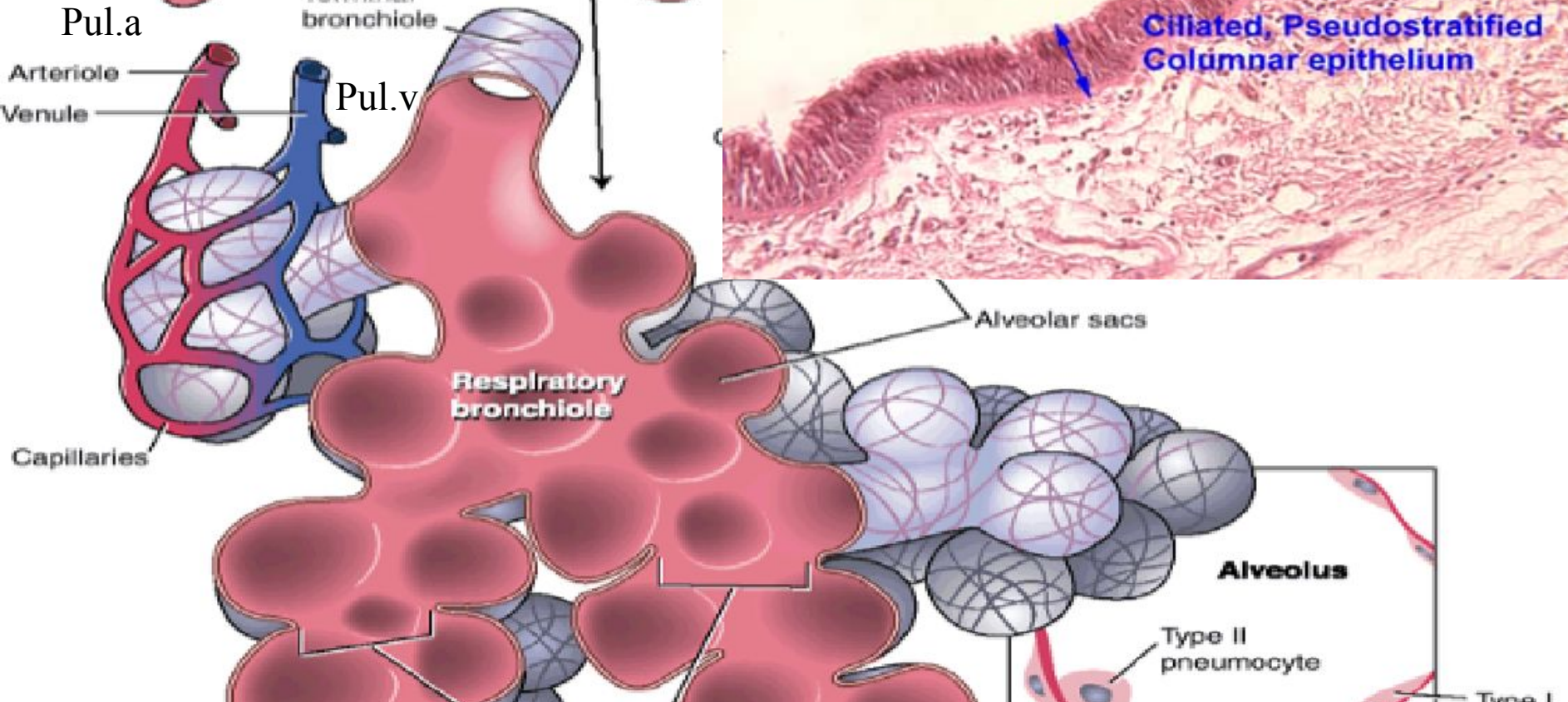

Lungs

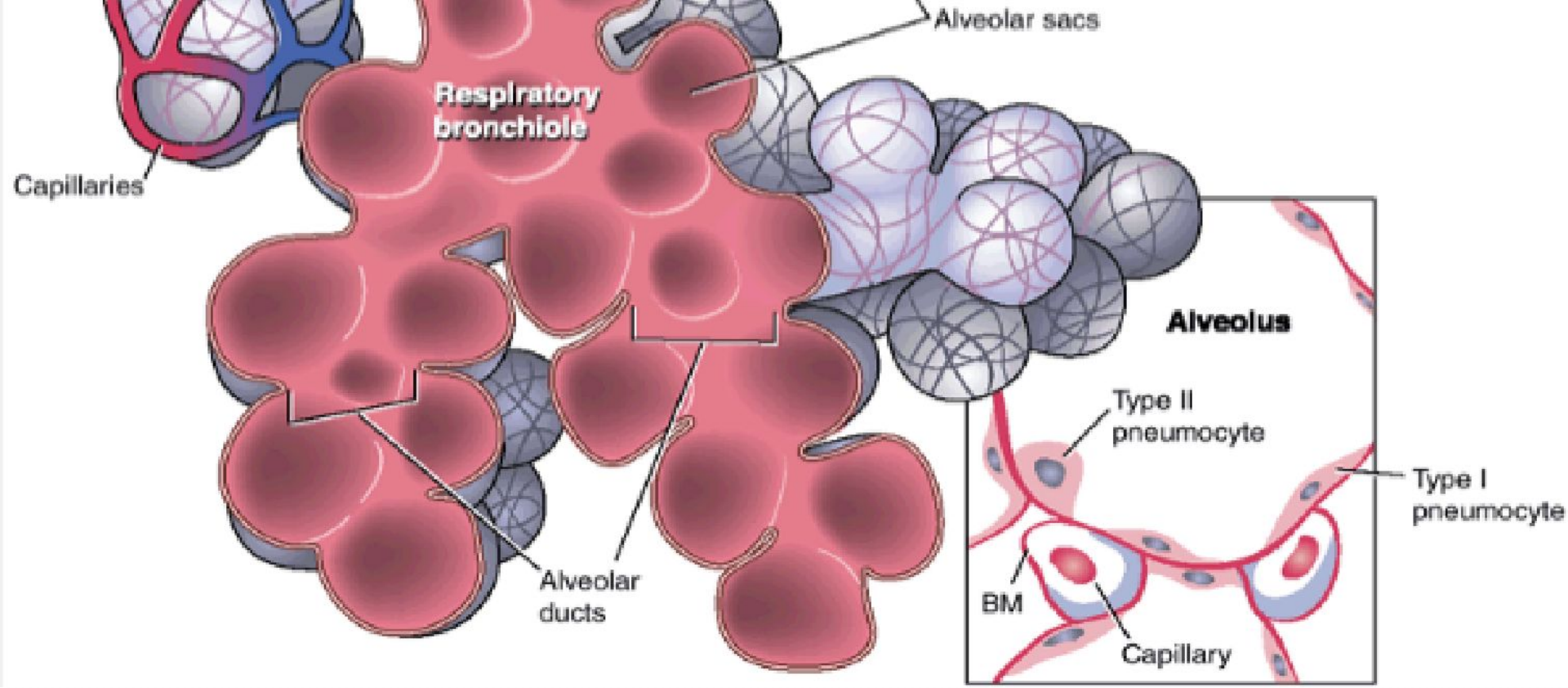

Trachea
Mucosa
Mucous gland
Sudmucosa
Cartilage
Serosa
Smooth muscle


Slide 13 Trachea
Ciliated, Pseudostratified
Columnar epithelium

Pul.a

Pul.v


Terminal bronchiole
Arteriole
Venule
Capillaries
Respiratory bronchiole
Alveolar sacs
Alveolus
Type II pneumocyte



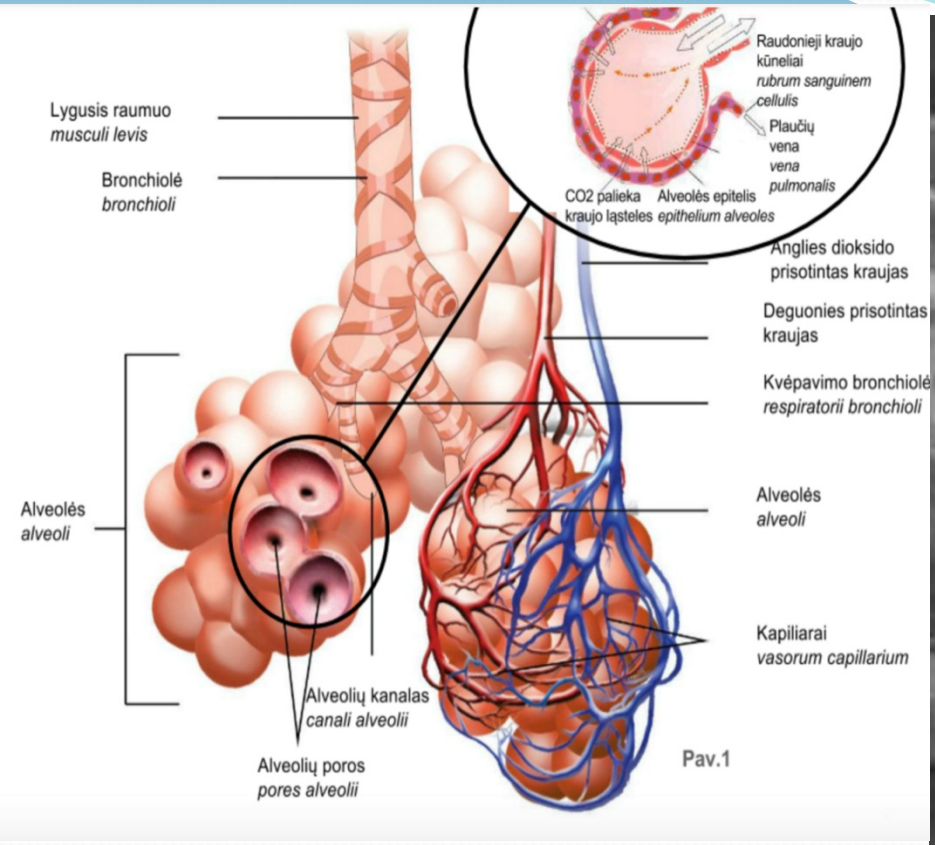
The alveolar epithelium comprises -

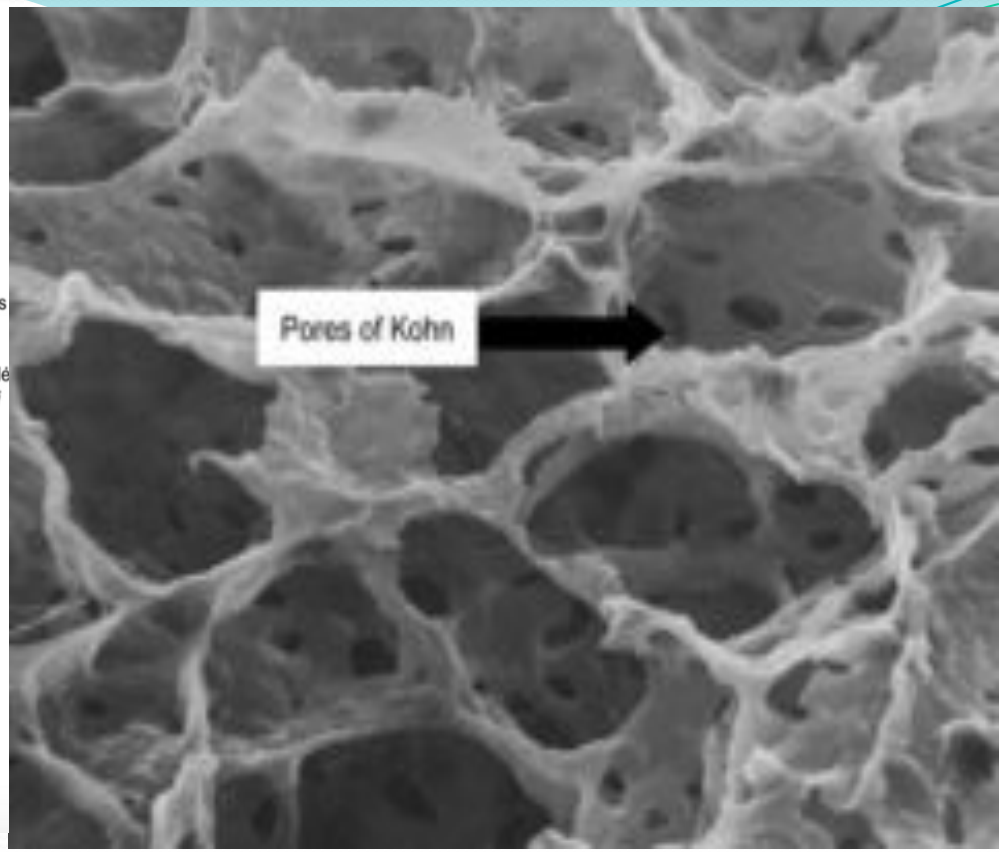
-Type I pneumocyte :-flat cell, and it responsible for the gas (oxygen and carbon dioxide) exchange that takes place in the alveoli.

-Type II :- rounded cells which important for :-pulmonary surfactant production

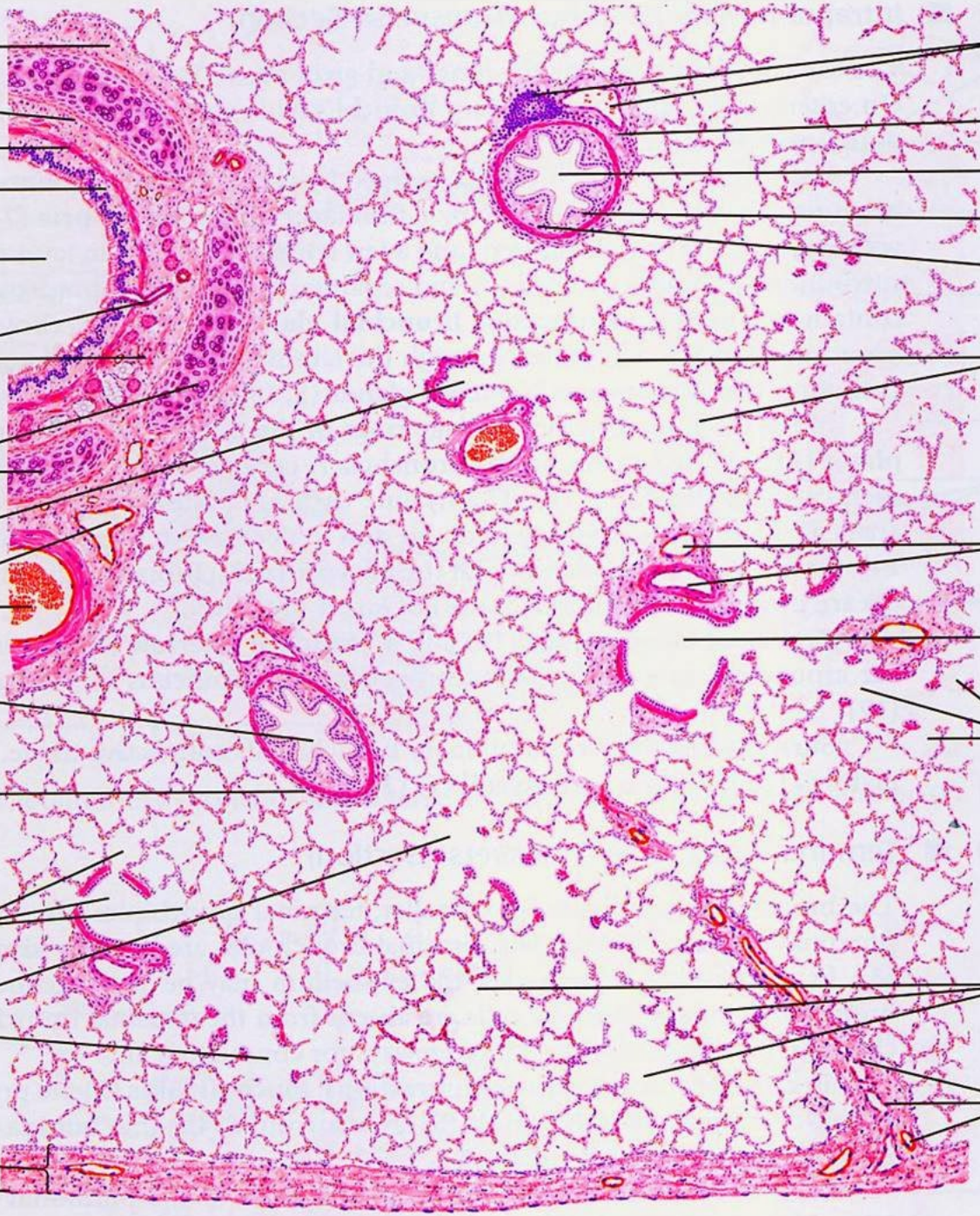
-Bronchiolar stem cells proliferate to replace pneumocytes .

-Alveolar macrophages which derived from blood (often with carbon particles and other phagocytosed materials.





The alveolar wall are not solid but are perforated by numerous pores of kohn ,which permit the passage of bacteria and exudate between adjacent alveoli .


1 Adventitia
2 Submucosa
3 Smooth muscle
4 Lamina propria
5 Intrapulmonary bronchus
6 Bronchial glands with excretory duct
7 Hyaline cartilage plates
8 Terminal bronchiole
9 Pulmonary vein and artery
10 Terminal bronchiole with mucosal folds
11 Smooth muscle
12 Respiratory bronchiole with alveoli
13 Alveolar ducts
14 Serosa:
a. Connective tissue
b. Mesothelium
15 Lymphatic nodule and vein
16 Adventitia
17 Bronchiole
18 Mucosal folds
19 Smooth muscle
20 Alveolar ducts
21 Blood vessels
22 Respiratory bronchiole
23 Alveoli opening into alveolar duct
24 Alveolar sacs
25 Trabecula with blood vessels

Hematoxylin and Eosin

Stains blue => purple

- -Nuclei
- -Bacteria
- -Calcium

Stains Pink => Red

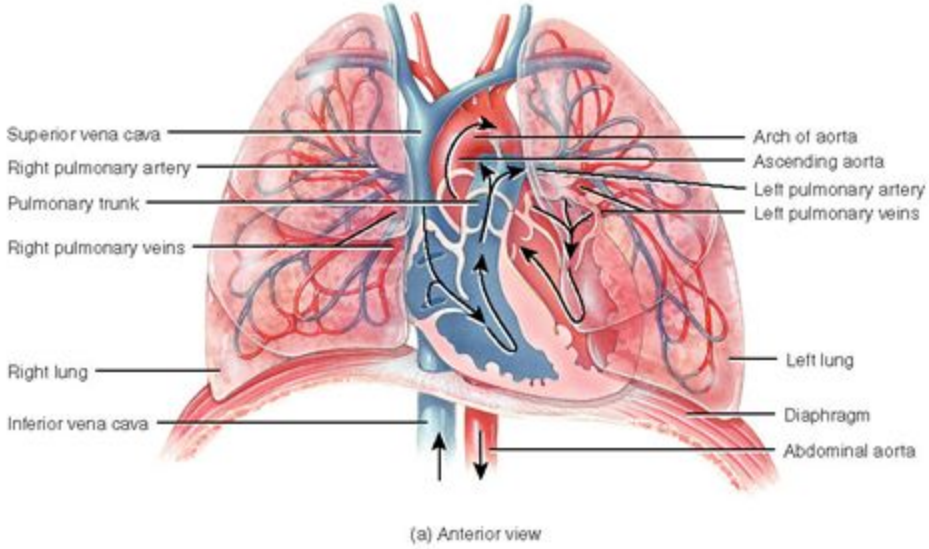
- -Cytoplasm
- -Collagen
- -Fibrin
- -RBC

"Protein is pink"

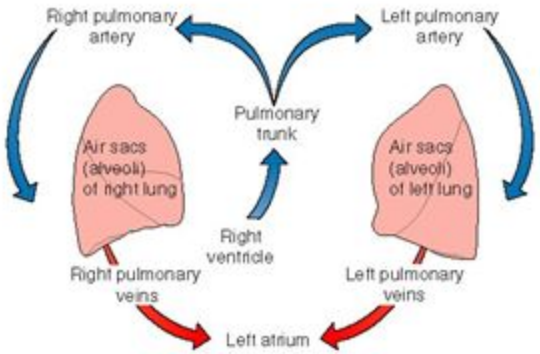
KNOW MED

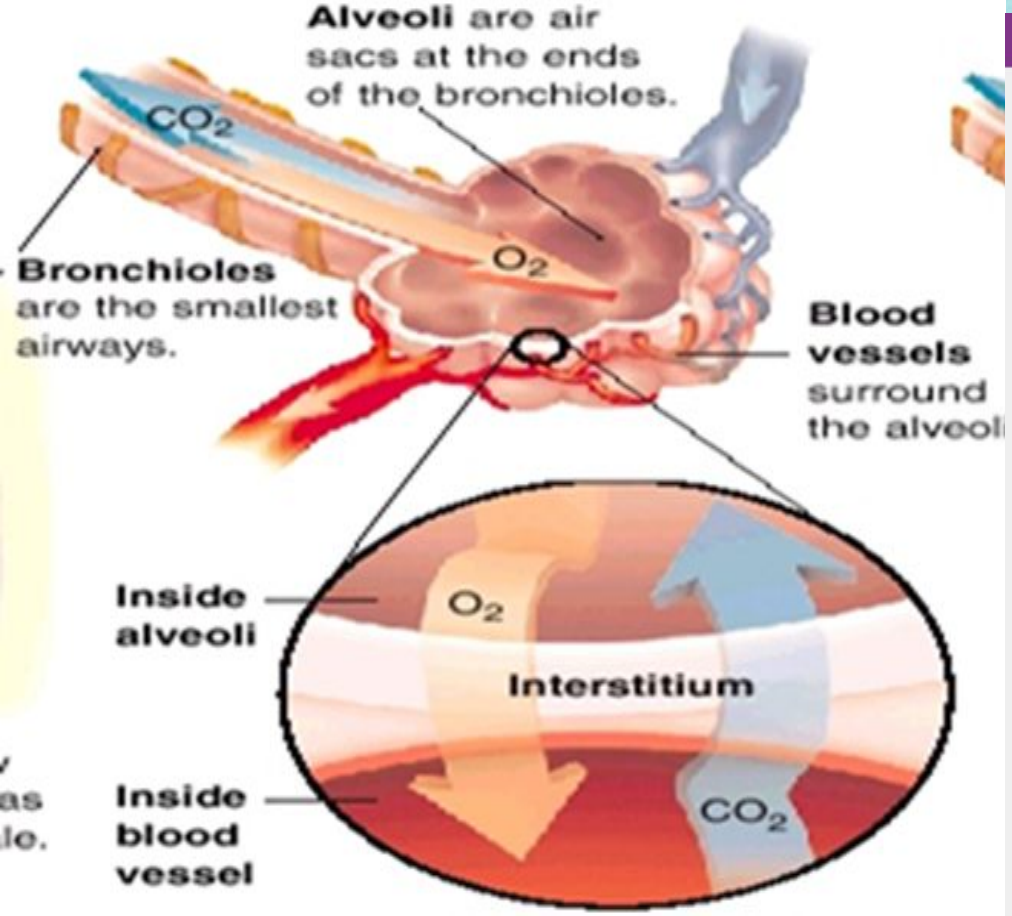
Double Blood Supply to the Lungs

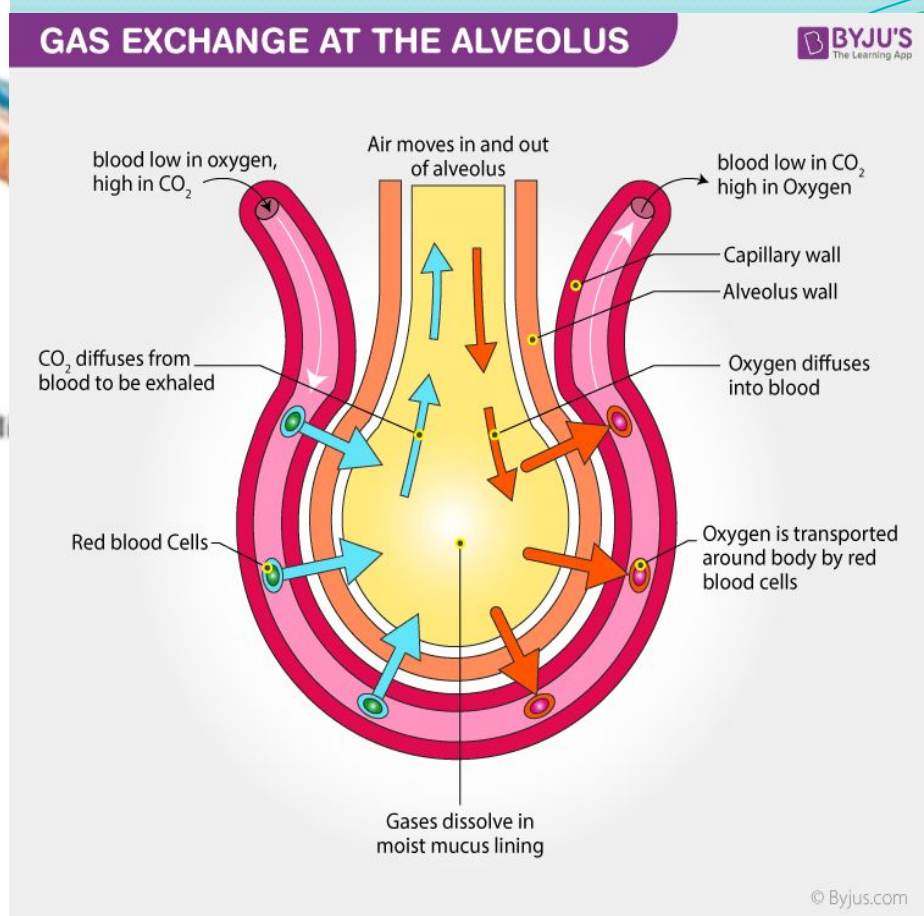
- Deoxygenated blood arrives through pulmonary trunk from the right ventricle
- Bronchial arteries branch off of the aorta to supply oxygenated blood to lung tissue
- Venous drainage returns all blood to heart



(a) Anterior view







Gas exchange

The partial pressure of oxygen in the alveoli must be above that of the blood flowing through the alveolar capillaries. Ventilation must also lower the partial pressure of carbon dioxide in the alveoli below that of the alveolar capillary blood to enable excess carbon dioxide to be removed.

The partial pressure of oxygen (PO2) and carbon dioxide (PCO2) are important measures of the adequacy of oxygenation.

In arterial and mixed venous blood ---------- same principle

Pulmonary function test(PFT)

PFT :- is a valuable tool for evaluating the respiratory system

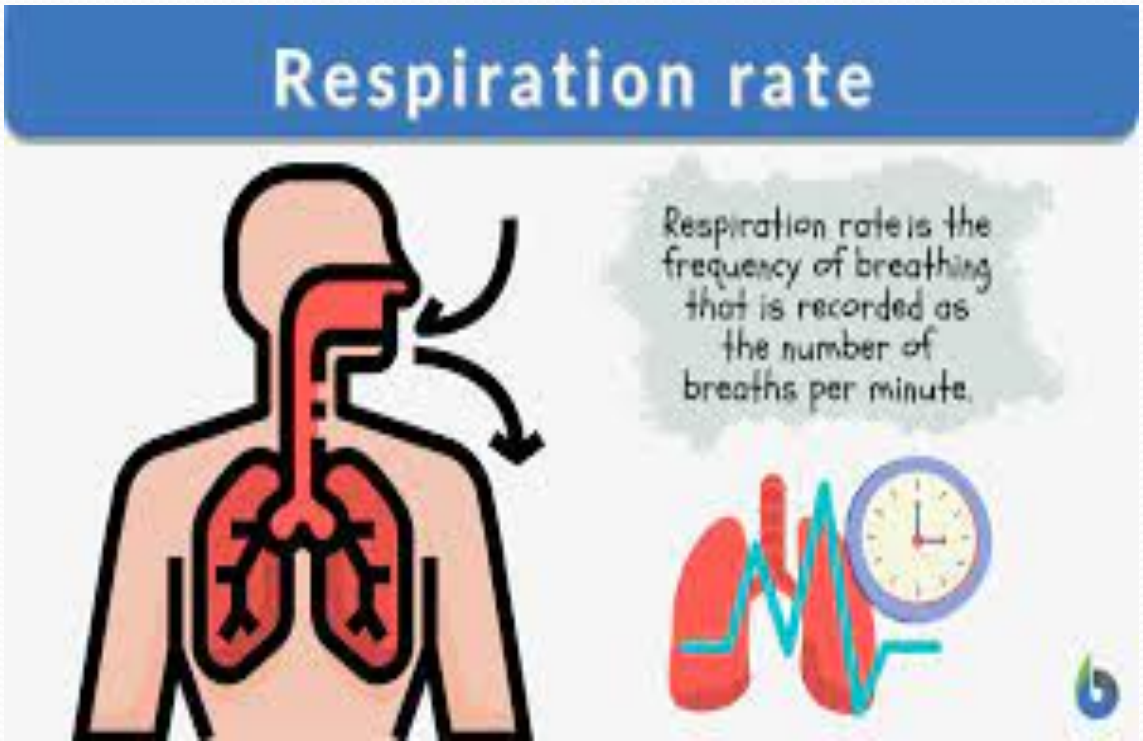
The total amount of air which can be forcibly and maximally exhaled out of the lungs after fully inhaling, is called forced vital capacity (FVC), which depends on lung size, integrity of the respiratory muscles, and skeleton.

Forced expiratory volume in 1 second (FEV1) is the volume of air exhaled out of the lungs during the first second of a forced maximal expiration. It is one of the most widely used lung function tests. It should be 70% or more of the FVC. If the ratio of FEV1 to FVC falls below 70% this is strong evidence of obstructive airway disease, such as asthma (reversible) or chronic obstructive pulmonary disease (irreversible).

If the ratio of FEV1 to FVC remains the same , in the presence of lung disease, the inference is that both FEV and FVC are diminished. This happens in restrictive lung disease, such as .pulmonary fibrosis, where the compliance of the lung is reduced FEV1 and FEV1:FVC ratio are important markers of severity of the .disease, as well as progress during treatment

Spirometry is used to assess lung function work by measuring the .quantity of air inhaled and exhaled and the rate of exhalation

Respiratory rate: A person's respiratory rate is the number of breaths you take per minute. The normal respiration rate for an adult at rest is 12 to 20 breaths per minute. A respiration rate under 12 or over 25 breaths per minute while resting is considered abnormal



Congenital Anomalies of lung

Many congenital abnormalities, such as :-

1-Tracheal agenesis (rare) .

2-Tracheo-oesophageal fistula, which allows food to travel from the oesophagus into the main airways, causes choking.

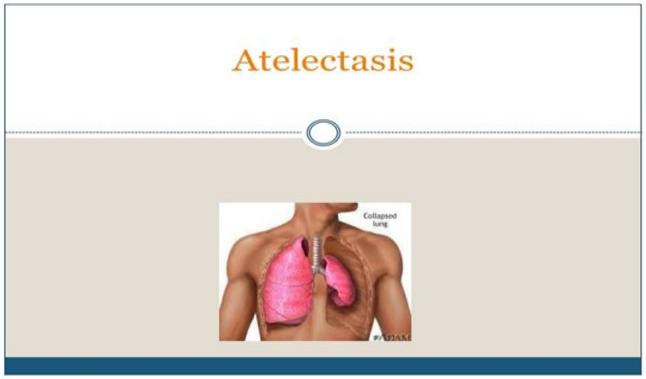
3-Lung cysts may be

A-congenital and persist into adult life. These include bronchogenic cysts, pulmonary sequestration, congenital cystic adenomatoid malformation , congenital lobar emphysema and congenital lung collapse .

B-Acquired cysts are due to previous infection ,especially staphylococcal, and also include hydatid disease or obstruction of distal lung by a foreign body.

4-Primary cilia dyskinesia or immotile cilia syndrome is part of Kartagener's syndrome (situs invertus, bronchiectasis, chronic rhino-sinusitis,). The basic problem lies in the defective movement of cilia, leading to recurrent chest infections, ear/nose/throat symptoms, and male infertility (in female decreased fertility).

THE LUNG



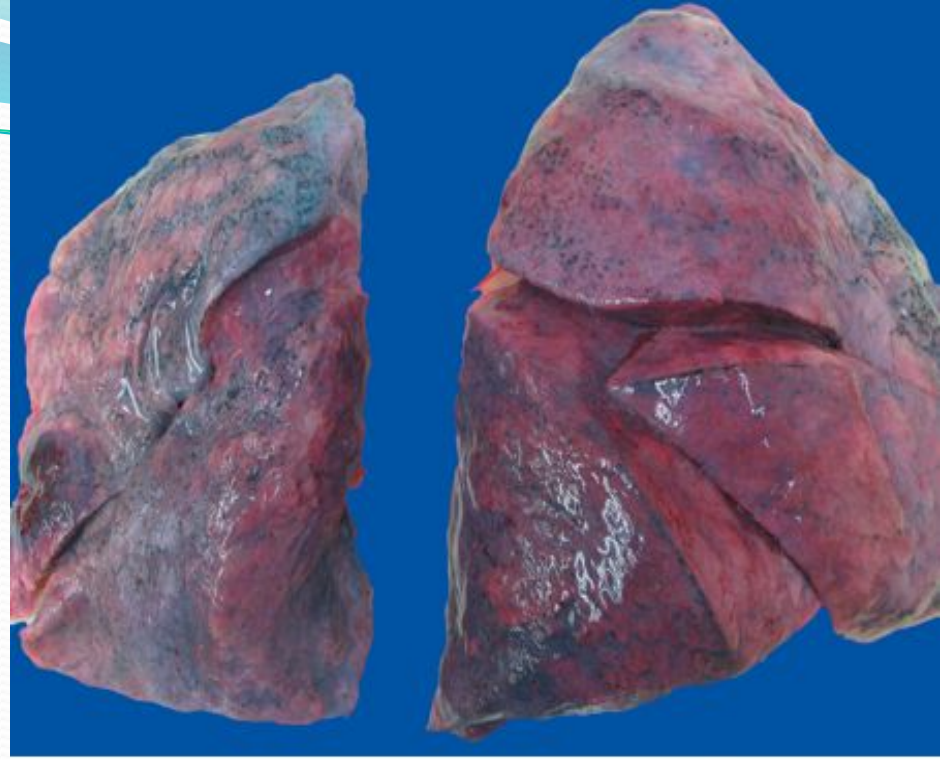
Atelectasis (collapse)

-Incomplete lung expansion , or collapse of previously inflated lung . is a complete or partial collapse of the entire lung or area (lobe) of the lung. Leading airless pulmonary parenchyma . It results in shunting of inadequately oxygenated blood from pulmonary arteries into veins, thus giving rise to a ventilation-perfusion imbalance and hypoxia.

-Atelectasis (collapse) lead to loss of lung volume .

-Significant of atelectasis reduces oxygenation (hypoxemia) and predispose to infection.

Types of atelectasis :- 1-Congenital (in neonatal) and
2-Acquired

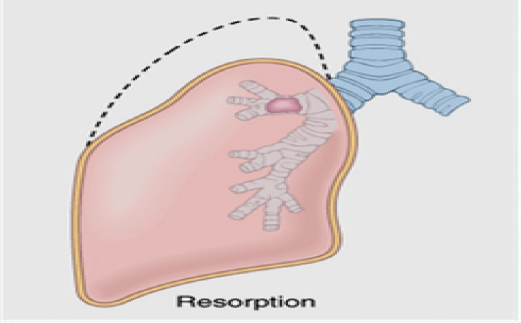


A-Atelectasis (collapse of lung) :- loss of lung volume with bluish discoloration due to hypoxia and its wrinkled pleural surface (due to collapse),
B-Atelectasis of Lt lung (the smaller size of the left lung and its wrinkled pleural surface (due to collapse), compared to the smooth pleural surface of the right normal lung.

Pathogenesis

Acquired atelectasis is classified into three forms

1-Resorption /obstructive atelectasis .

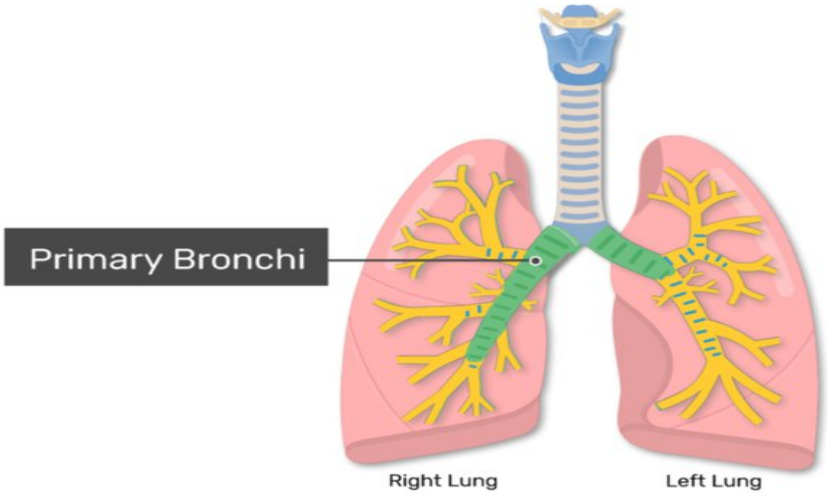


Following complete airway obstruction and this lead to desorption of oxygen in the dependent alveoli .

Causes include

1-Excessive secretions(a mucous or muco-purulent plug) . The most common cause of such obstruction (following surgical operations or bronchial asthma, bronchiectasis, chronic bronchitis) .

Aspiration of foreign bodies, particularly in children-2 (most common site is RT side of lung because the RT bronchi is wider , more vertical , shorter than LT bronchi and the trachea give the RT bronchi before the LT) .The left main bronchus branches off the trachea at a somewhat sharper angle than the right. Drop something down the trachea, add gravity, and most of the time, it's going to end up going straightaway into the right main bronchus rather .than bouncing off at an angle into the left



3- Bronchial tumors .

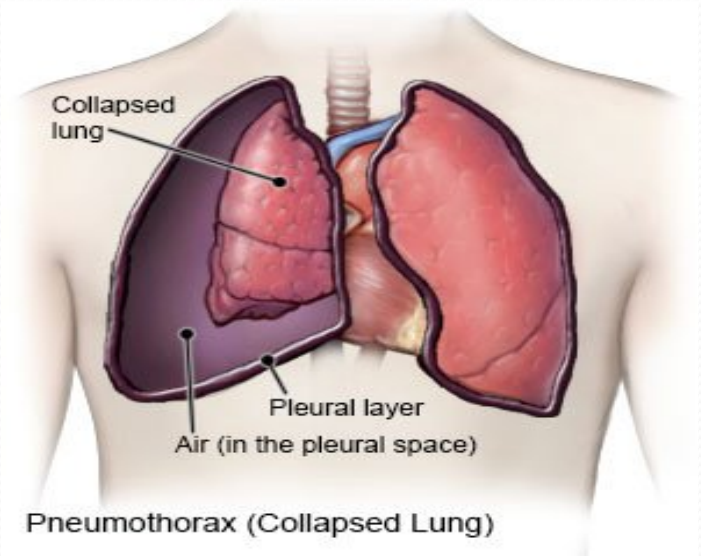
Bronchial tumors lead to Resorption /obstructive atelectasis
loss of lung volume with bluish discoloration due to hypoxia and its wrinkled pleural surface

2. Compression atelectasis

Is usually due to mechanical compression of the lung due to accumulations of fluid, blood (pleural effusion) or air within the pleural cavity (pneumothorax) .

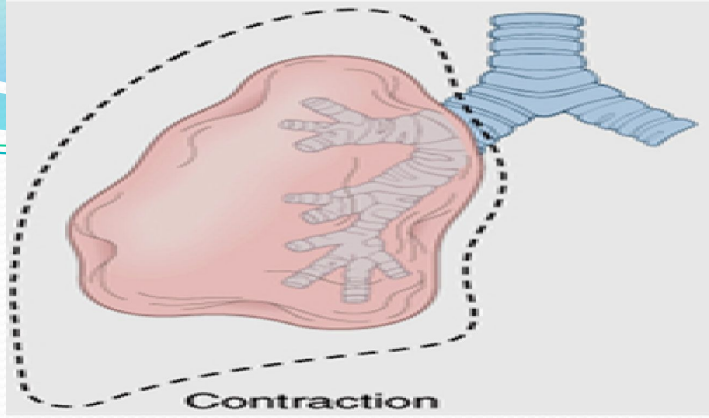
-fluid accumulation within the pleural cavity as in cardiac failure . blood accumulation as in rupture aneurysm , blood stained effusion as in neoplasms of lung or by tumor of pleural space . or by air as in pneumothorax.

Basal atelectasis resulting from the elevated position of the diaphragm commonly occurs in bedridden patients, in patients with ascites, and in patients during and after surgery.



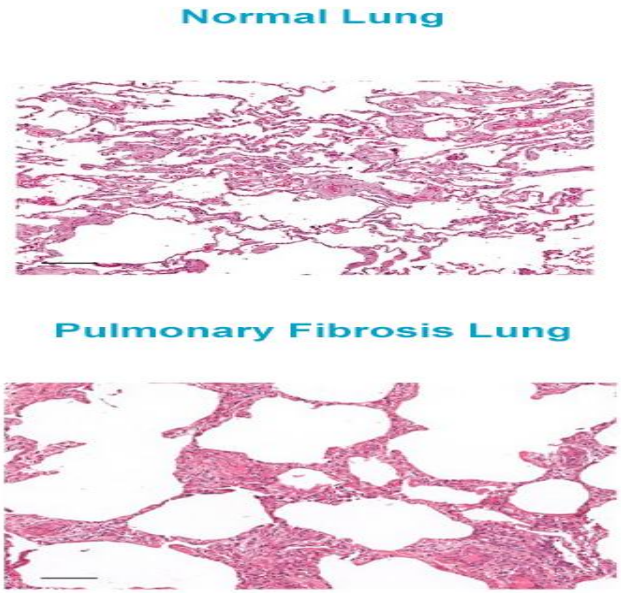
Pneumothorax (Collapsed Lung)

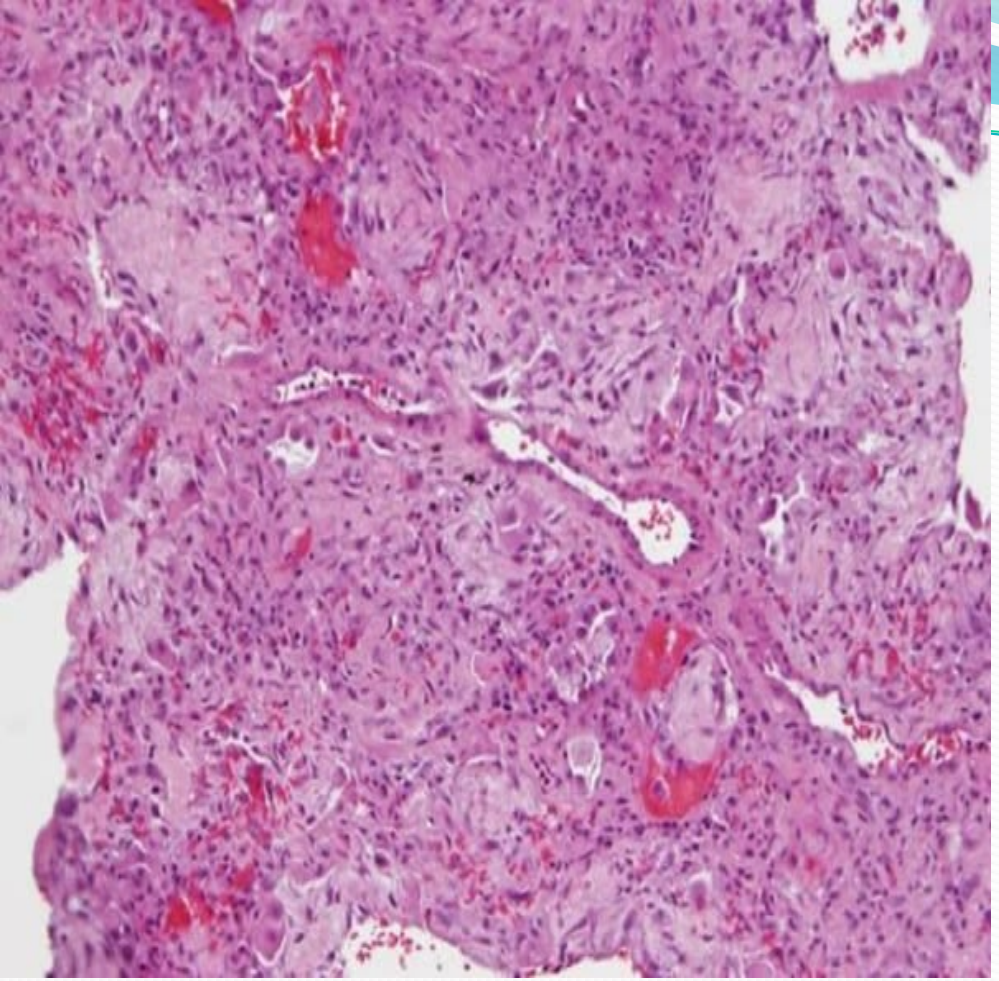
3. Contraction atelectasis



Occurs in the presence of focal or generalized pulmonary fibrosis(scar) or pleural fibrosis prevent full expansion .

-pulmonary fibrosis is the most common complication of patient with covid -19 non treated





Contraction atelectasis

A:- destruction of alveolar walls and fibrosis

B: lung fibrosis and collapse , loss of lung volume with bluish discoloration due to hypoxia and its wrinkled pleural surface

Atelectasis (except contraction type) is reversible and-should be treated quickly to prevent hypoxemia and .infection of the collapsed lung

Atelectasis is one of the most common breathing-. (respiratory) complications after surgery

The most common type of collapse is resorption-/obstructive atelectasis

Thank you for taking my lecture . I hope you learned something new.