

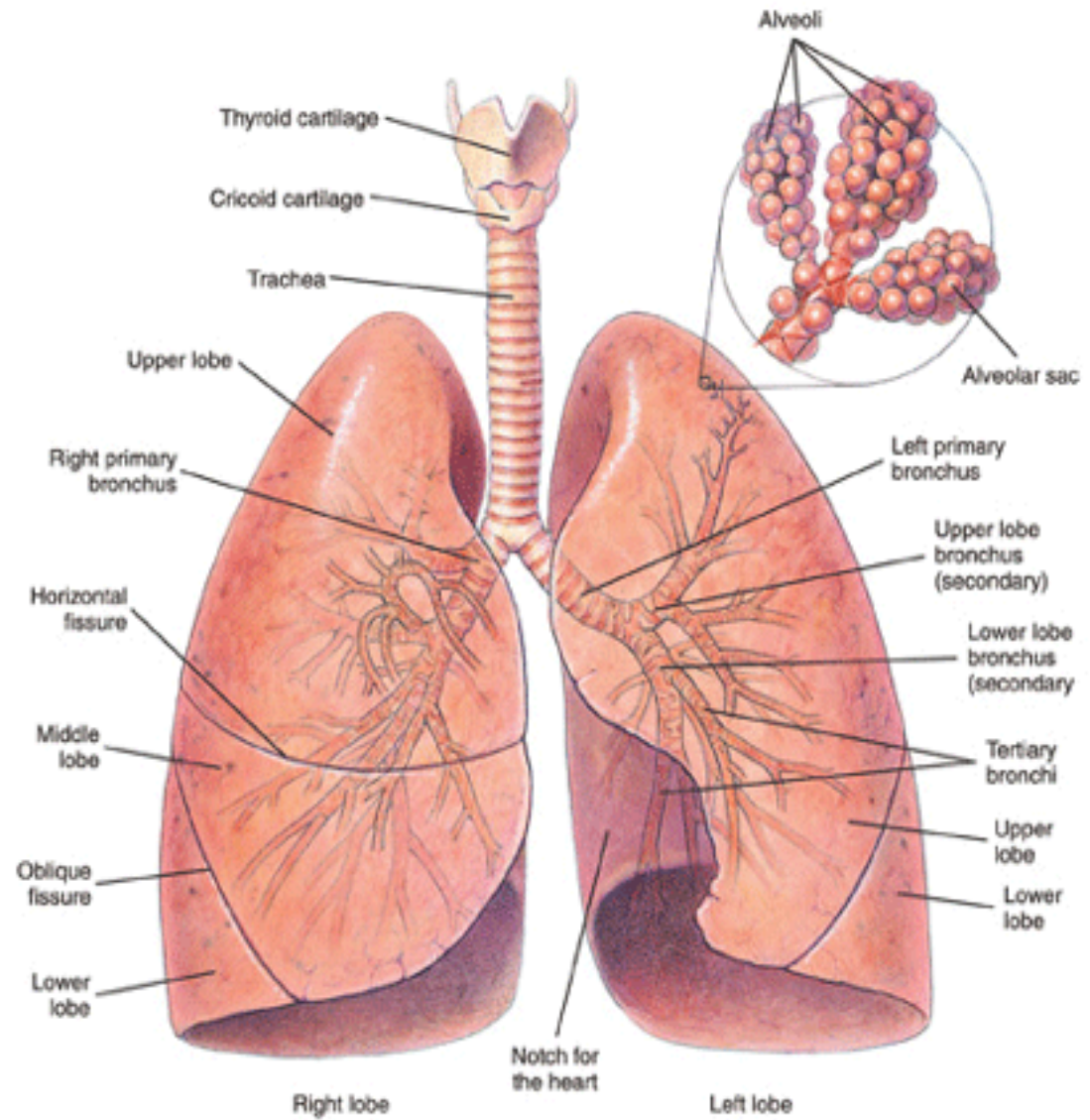
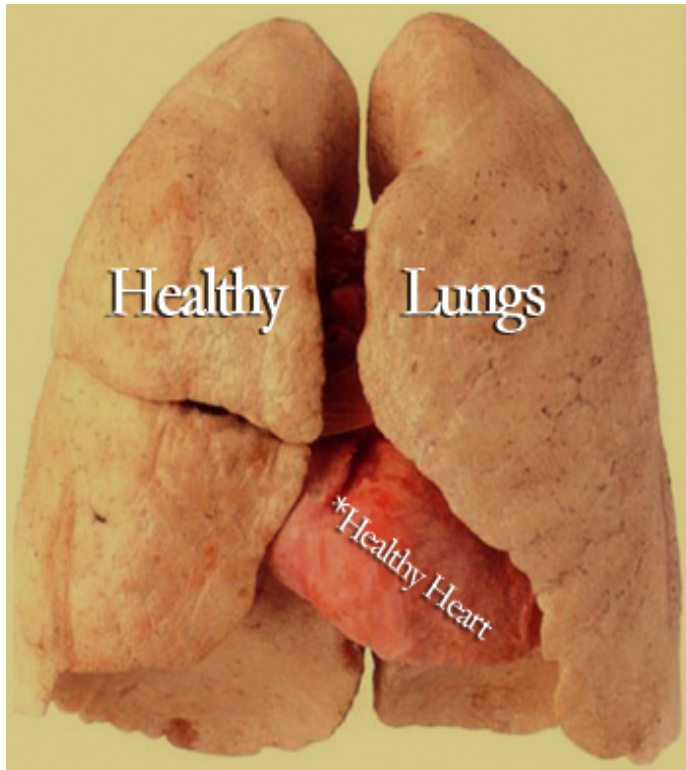
RESPIRATORY SYSTEM BLOCK

Pathology Practical 1

First Practical Session

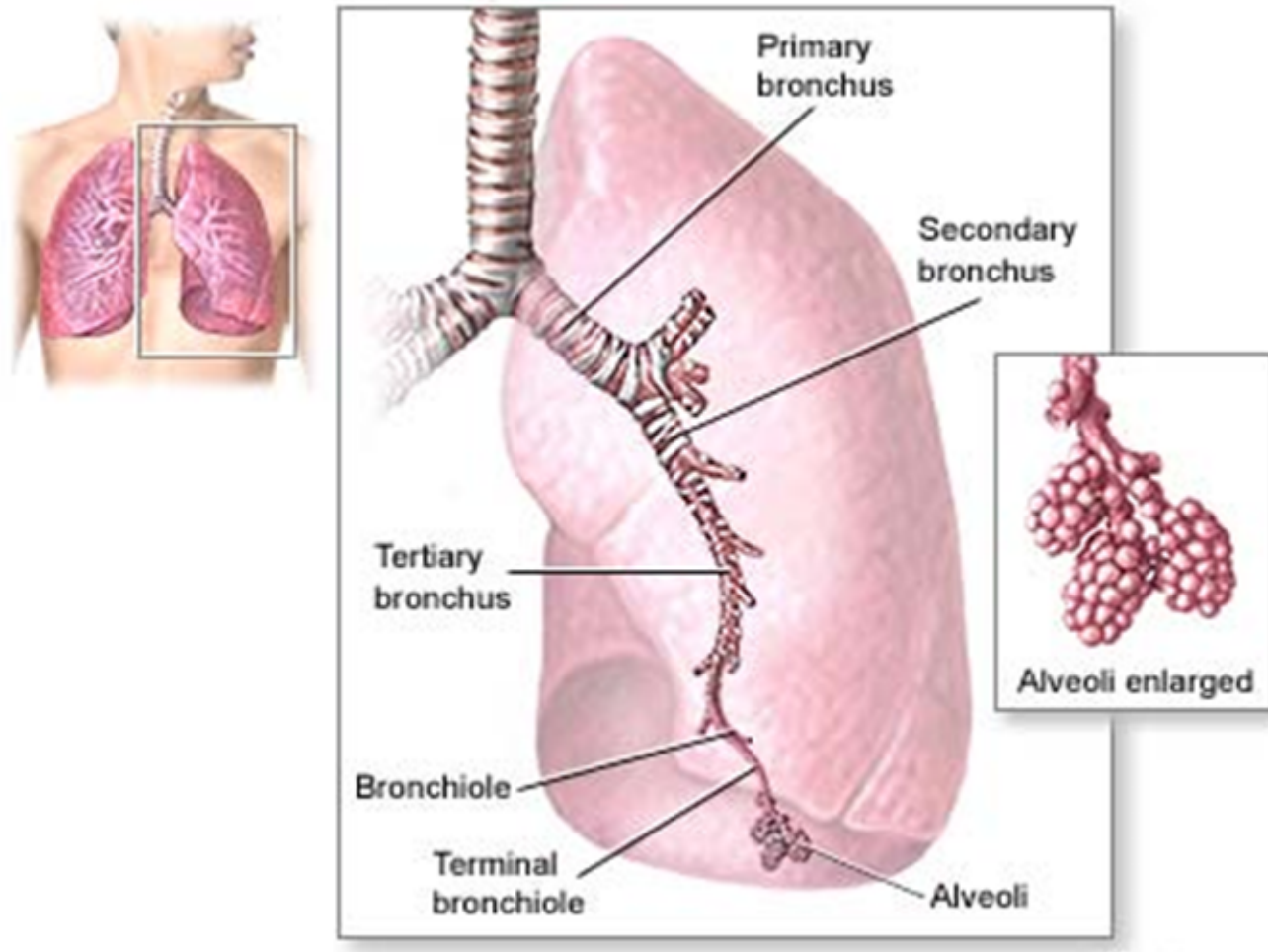
- **Allergic Alveolitis**
- **Bronchial asthma**
- **Bronchiectasis**
- **Chronic Bronchitis**
- **Emphysema**
- **Lobar Pneumonia**
- **Bronchopneumonia**
- **Pulmonary Embolus & Infarction**

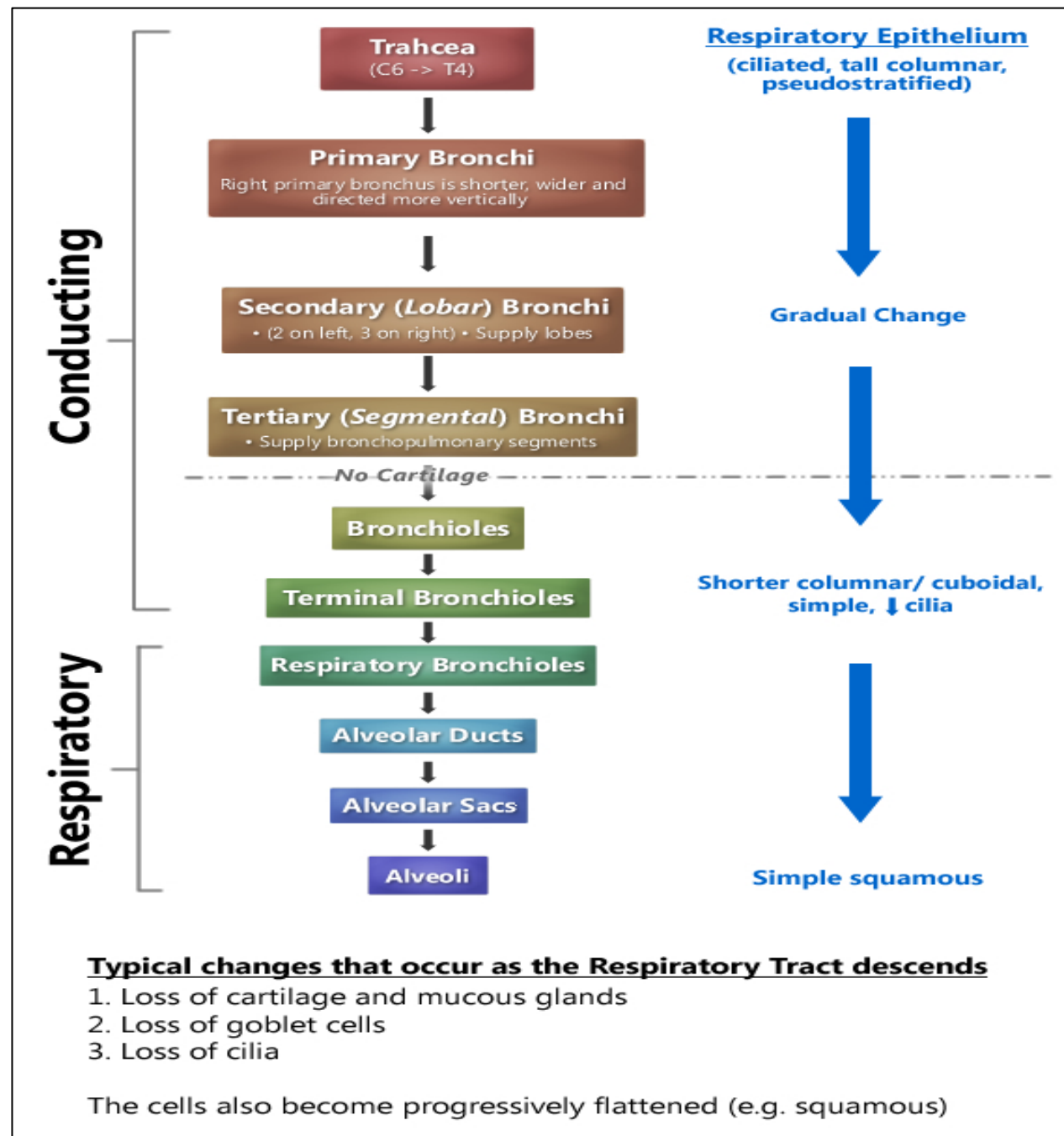
Anatomy of the Respiratory System



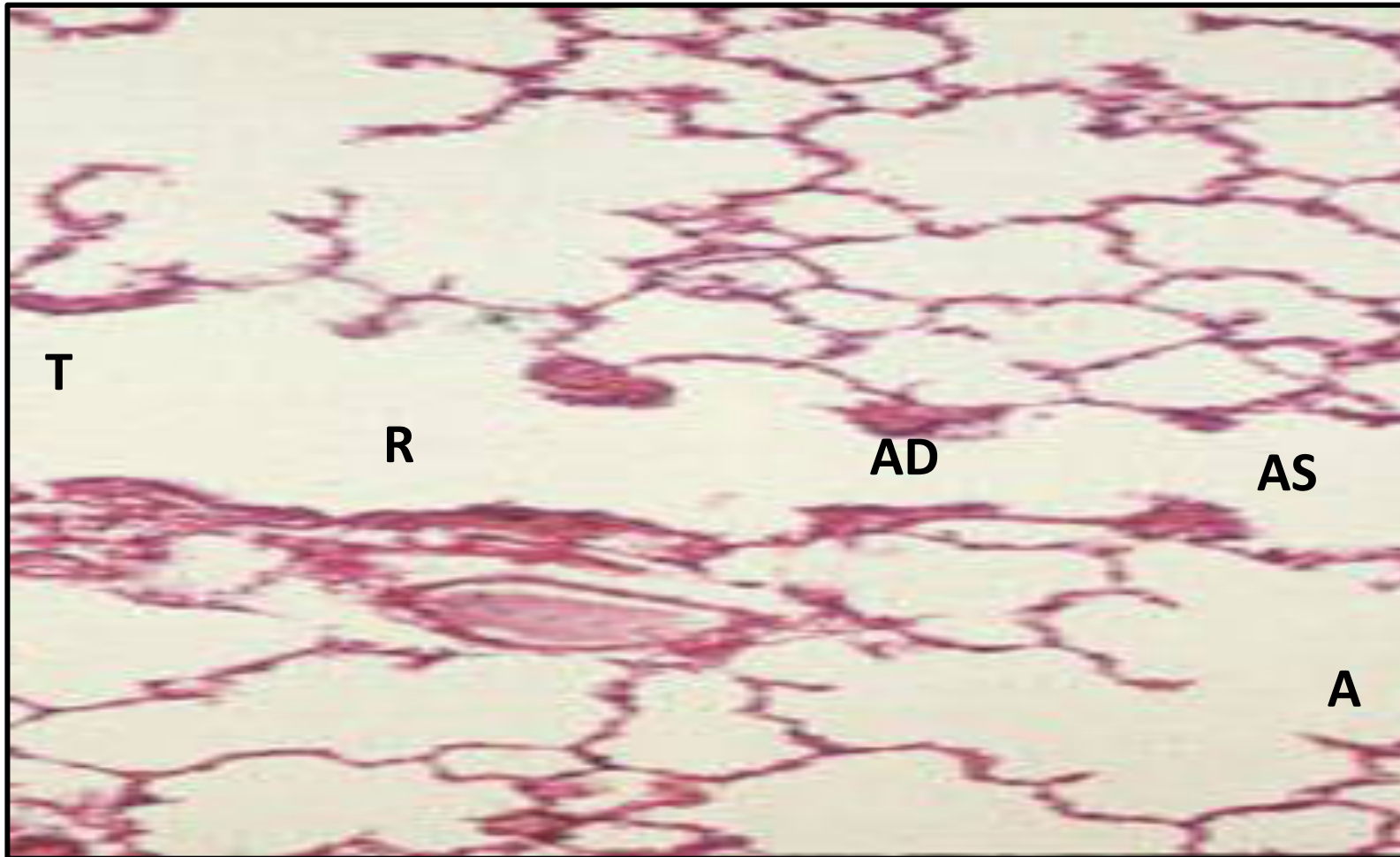
Lung Anatomy

- Cartilage is present to the level of proximal bronchioles.
- Beyond terminal bronchiole gas exchange occurs.
- The distal airspaces are kept open by elastic tension in alveolar walls.



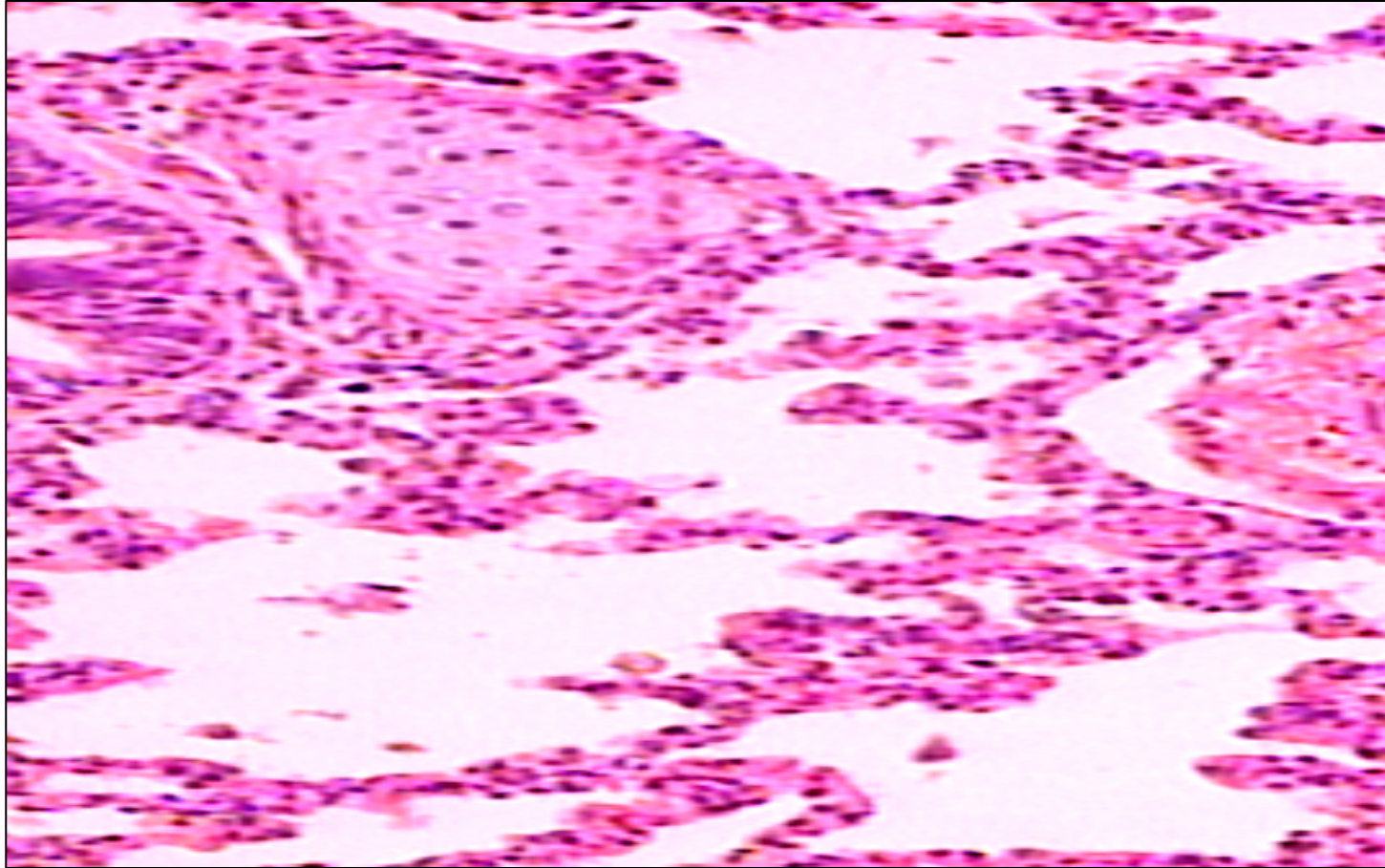


Normal Histology of the Lungs



Microscopic section of normal lung showing terminal bronchiole (T) , respiratory bronchiole (R), alveolar duct (AD), alveolar sac (AS), and alveoli (A).

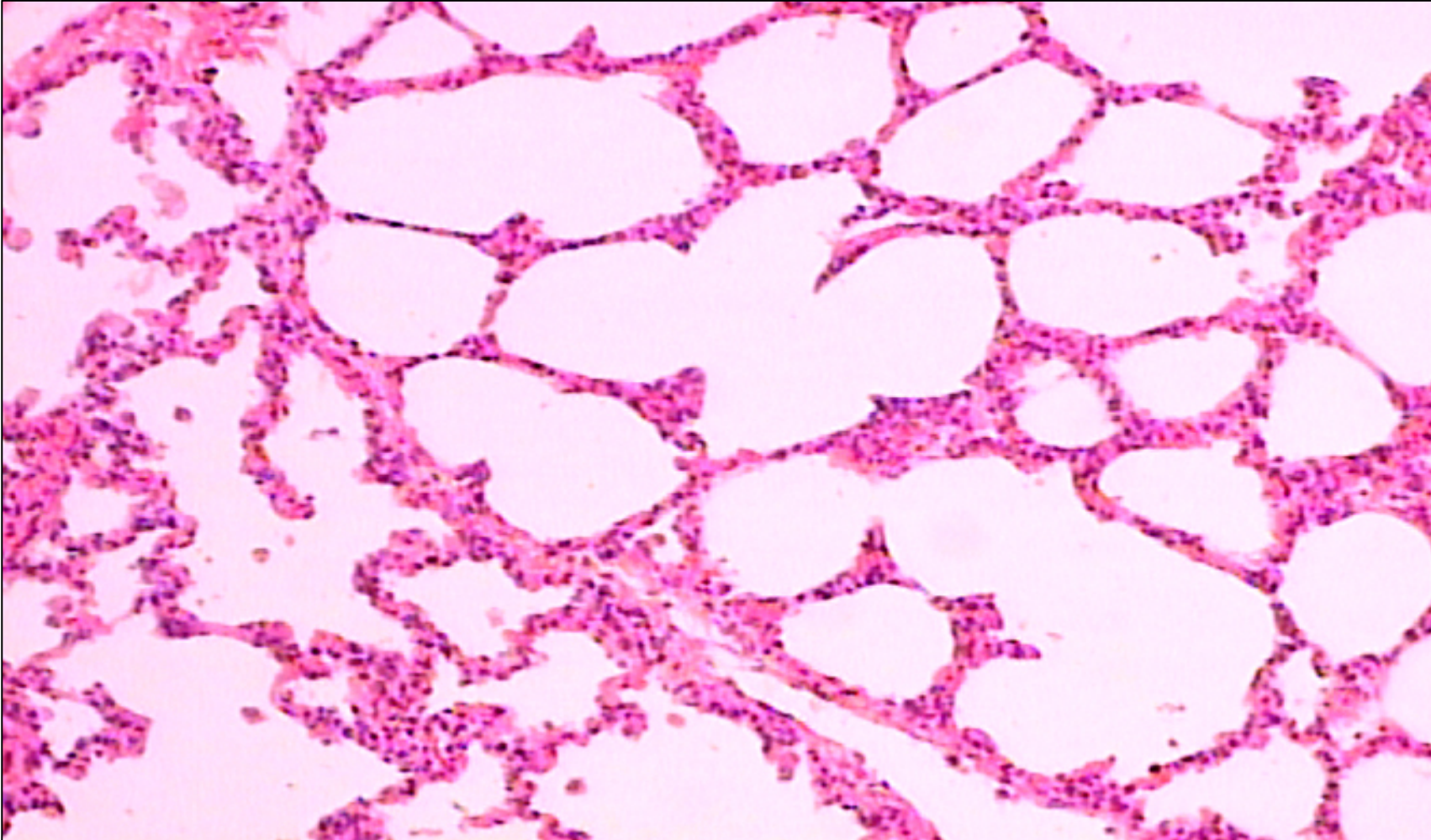
Normal Histology of the Lungs - Bronchiole



*This view shows a **BRONCHIOLE** (right) and **Blood Vessel** (left) in cross-section as well as numerous **ALVEOLI** in normal lung at 100X magnification.*

The bronchiole inner membrane is composed of pseudostratified columnar epithelial tissue. Portions of hyaline cartilage rings can also be seen outside of the bronchiole.

Normal Histology of the Lungs - Alveoli



***Normal Alveoli:** These oval-shaped alveoli expand with air during inspiration, have very thin epithelial walls and are surrounded by capillaries creating the respiratory membrane where gas exchange occurs between air and blood*

Classification of Respiratory Diseases

1. Inflammatory lung diseases:

(Asthma, cystic fibrosis, & COPD)

2. Restrictive lung diseases:

(Allergic Alveolitis)

3. Obstructive lung diseases :

(Bronchial Asthma, Bronchiectasis, & (COPD- Ch. Bronchitis & Emphysema))

4. Respiratory tract infections:

-Upper resp. tract infection (sinusitis, tonsillitis, otitis media, pharyngitis & laryngitis)

-Lower resp. tract infection (Pneumonia & Bronchopneumonia , T.B.)

5. Malignant tumors (Squamous CC, adenocarcinoma, Large CC & Small CC)

6. Benign tumors (Pulmonary hamartoma, pulmonary sequestration)

7. Pleural cavity diseases (eg. Mesothelioma, effusion)

8. Pulmonary vascular diseases (Embolism, edema & hypertension)

9. Neonatal diseases (pulmonary hyperplasia.)

RESTRICTIVE LUNG DISEASES

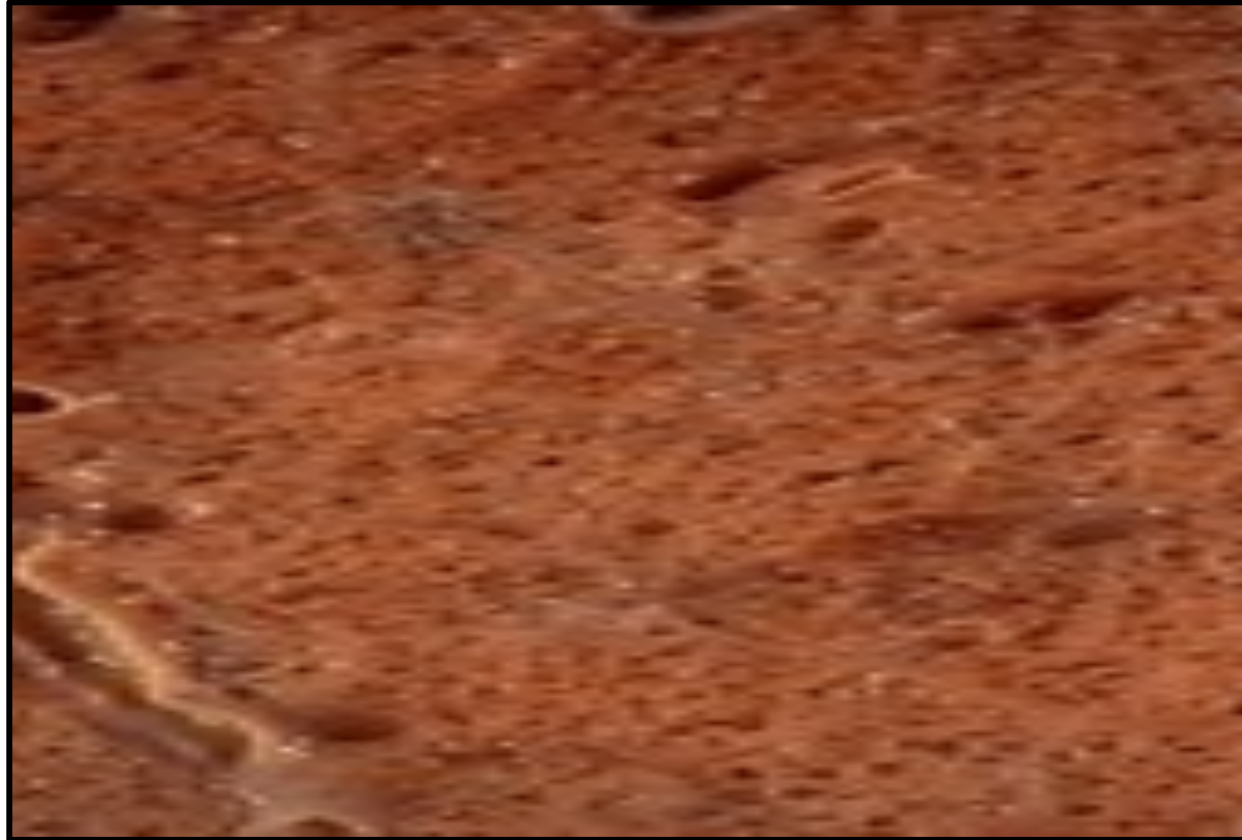
ALLERGIC ALVEOLITIS

Restrictive Lung Disease (Honeycomb lung) – Gross

- ***Represent 15% of non-infectious diseases of lungs.***
- ***End-stage: diffuse interstitial pulmonary fibrosis (Honeycomb lung).***
- ***Acute: Acute Respiratory Distress Syndrome***
- ***Chronic :***
 - ***Occupational: Asbestosis, silicosis, coal worker pneumoconiosis.***
 - ***Interstitial lung disease (interstitial pneumonia), Idiopathic pulmonary fibrosis.***



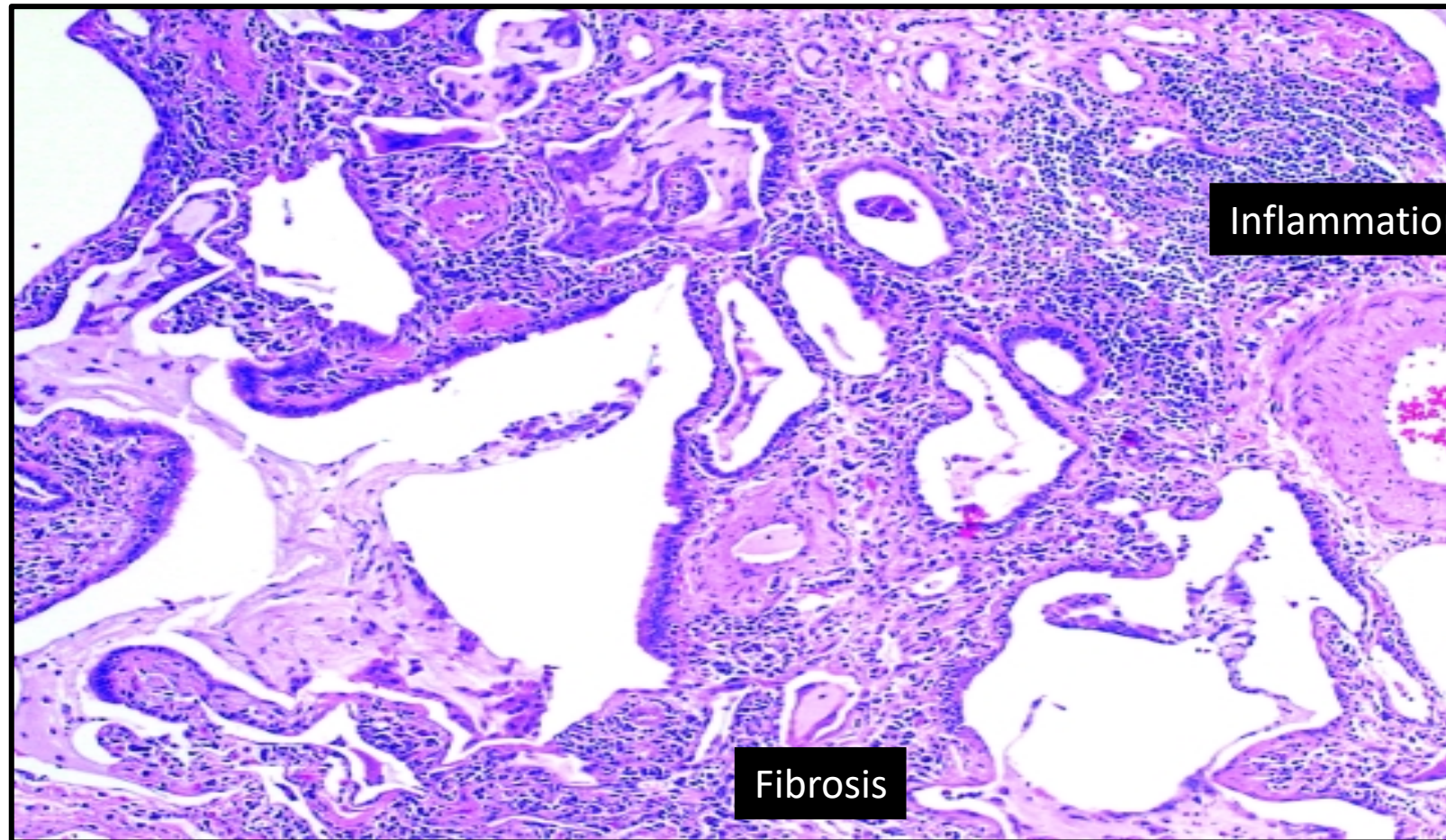
Restrictive Lung Disease (Honeycomb lung) – Cut section



“Honeycomb” lung. (extensive fibrosis from restrictive lung disease)

The gross appearance, as seen here in a patient with organizing diffuse alveolar damage

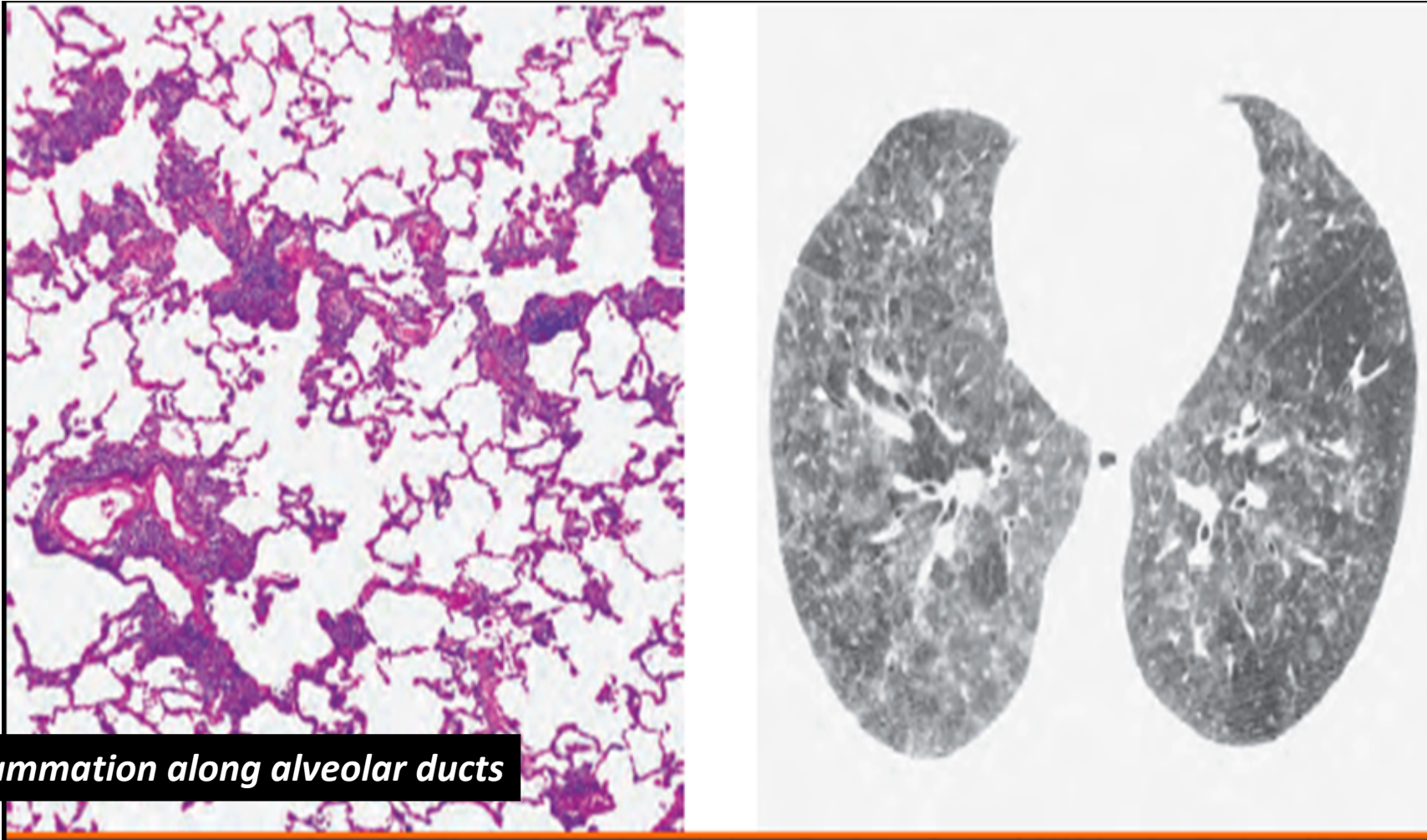
Restrictive Lung Disease (Honeycomb lung) – LPF



Restrictive Lung Disease

Pulmonary fibrosis with extensive interstitial collagen deposition, minimal lymphocytic inflammatory infiltrates, and residual airspace dilation.

Hypersensitivity Pneumonitis– Histopathology & Radiogram



interstitial inflammation along alveolar ducts

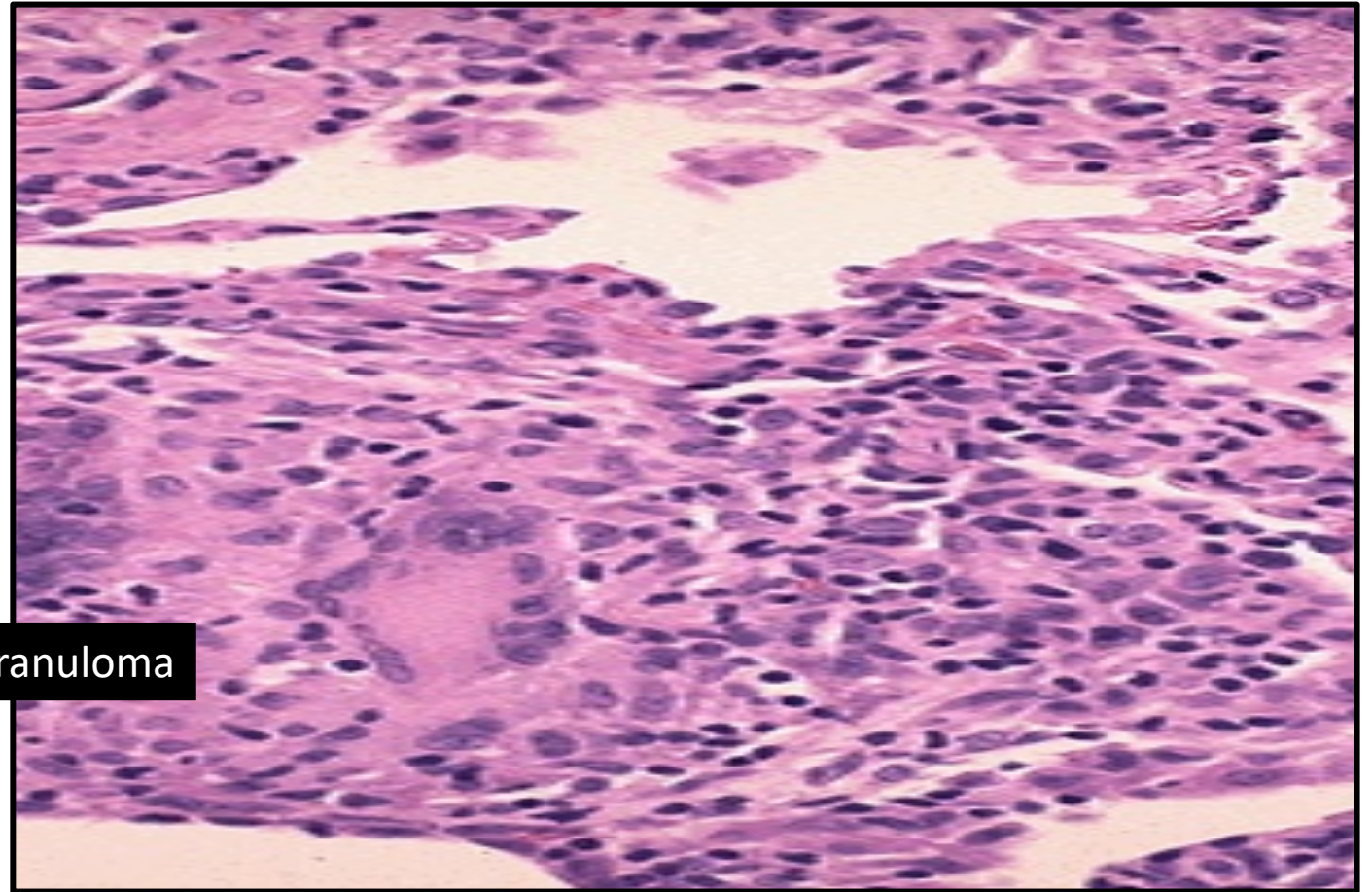
*This case of **extrinsic allergic alveolitis** shows interstitial inflammation along alveolar ducts (bronchiolocentric distribution). The inflammation is diffuse, lacks nodularity, and manifests radiologically as a ground-glass pattern*

Hypersensitivity Pneumonitis (HP)

***Interstitial bronchiolocentric pneumonitis
(Extrinsic allergic alveolitis)***

***Infiltration by lymphocytes, plasma cells and
foamy macrophages in alveolar space and
terminal airways .***

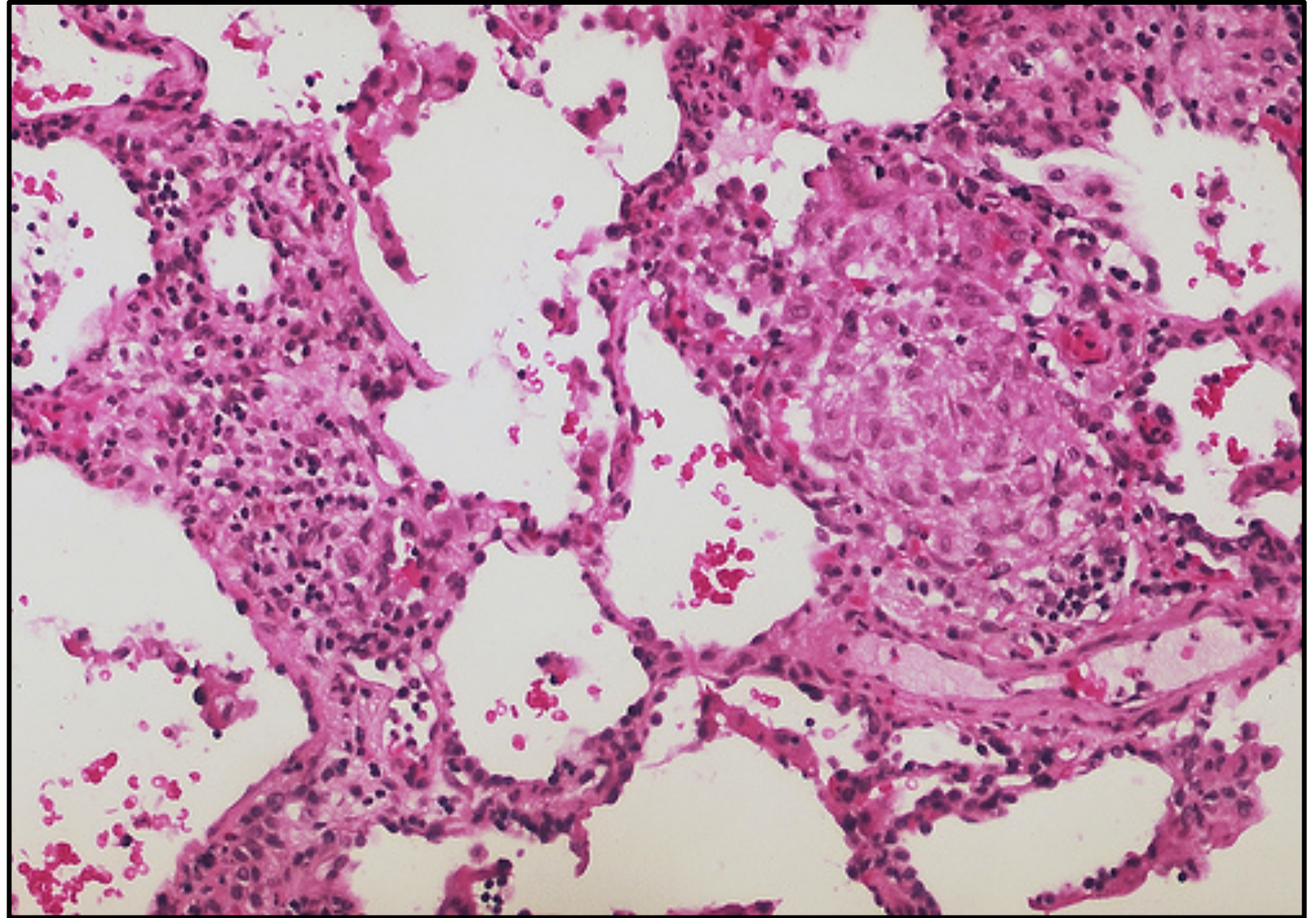
***Interstitial fibrosis, obliterative bronchiolitis
and intra-alveolar exudate (Nodules of
organizing fibroblasts, histiocytes and other
inflammatory cells)***



Granuloma

Hypersensitivity Pneumonitis (HP)

Interstitial fibrosis, lymphocyte infiltration in the alveolar wall, mainly collagen fibers hyperplasia, especially in the bronchioles due to their respective muscle fibers and endothelial cell proliferation and thickening



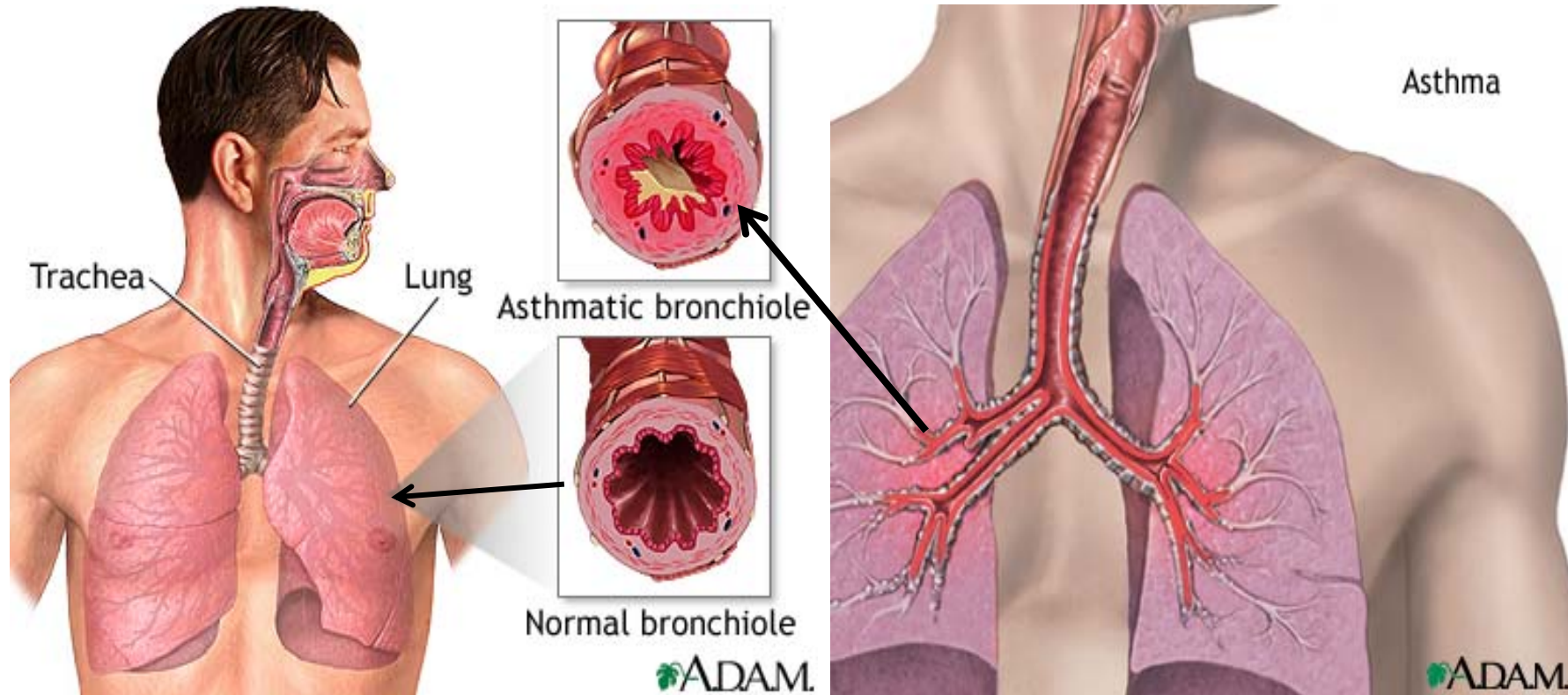
OBSTRUCTIVE LUNG DISEASES



- 1. Bronchial Asthma**
- 2. Bronchiectasis**
- 3. COPD :**
***(Chronic Bronchitis &
Emphysema)***

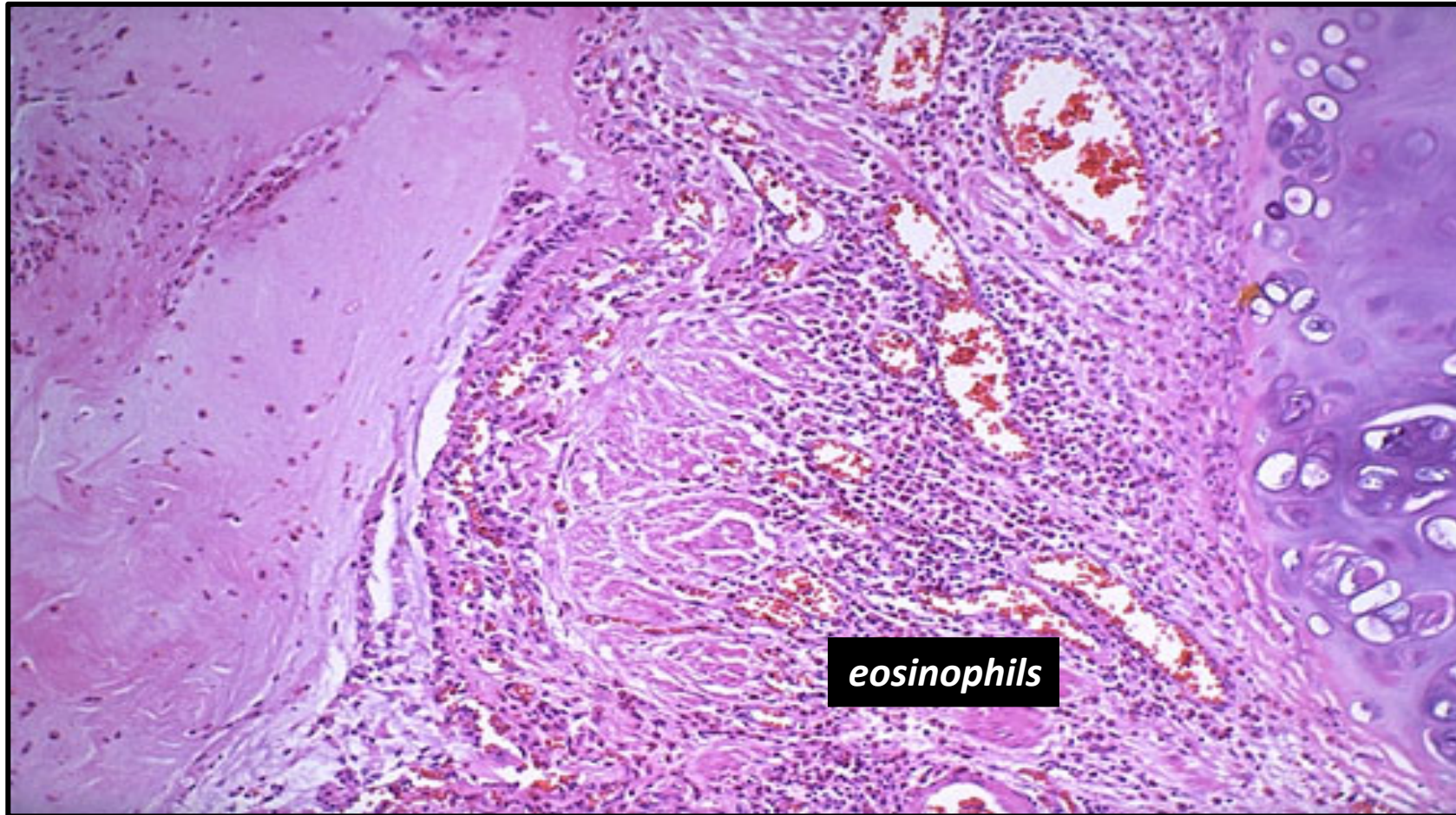
1. BRONCHIAL ASTHMA

BRONCHIAL ASTHMA - Anatomy



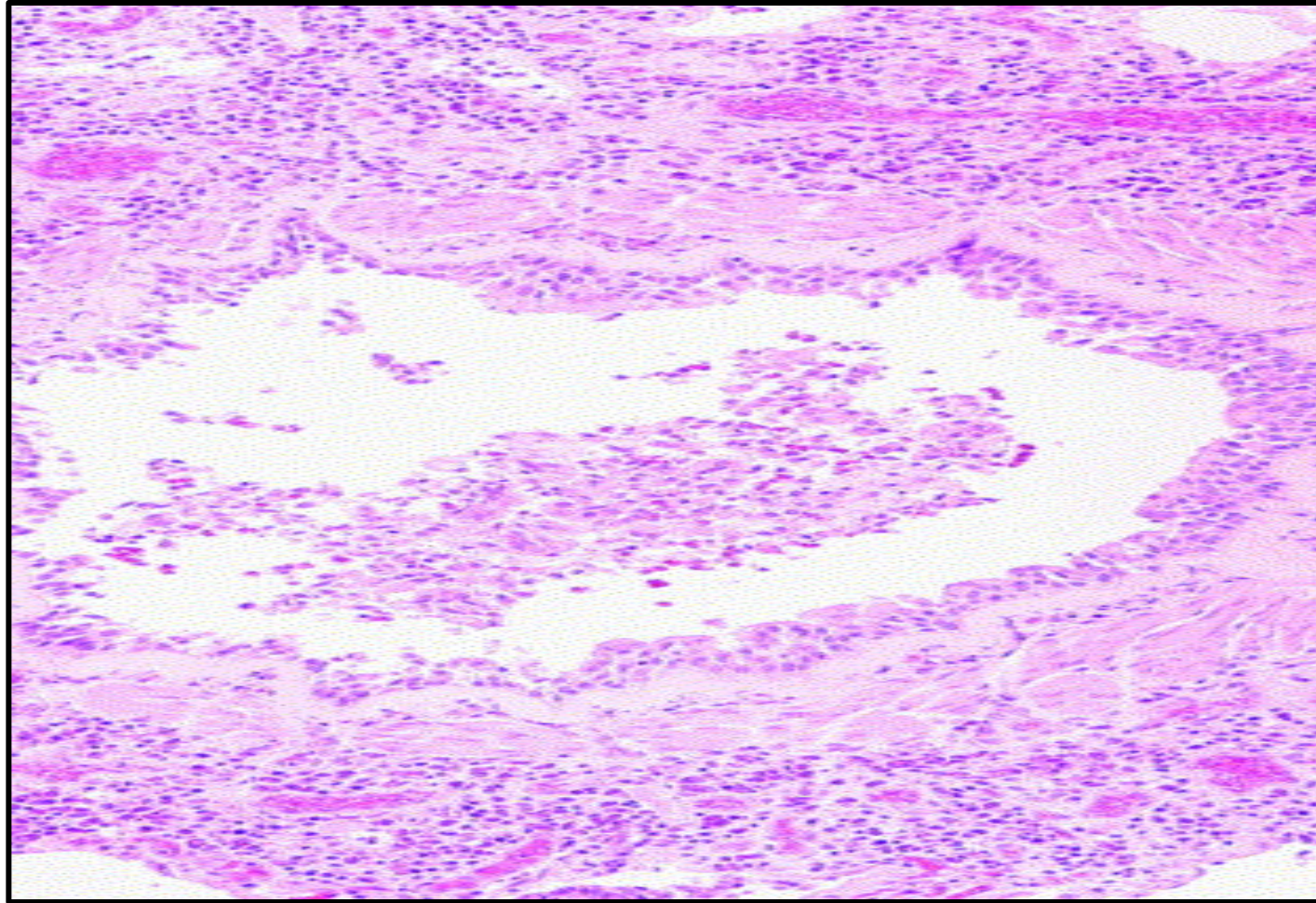
Bronchial Asthma: Inflammation of the airways causes airflow into and out of the lungs to be restricted. The muscles of the bronchial tree become tight and the lining of the air passages swells, reducing airflow and producing the characteristic wheezing sound

BRONCHIAL ASTHMA - LPF



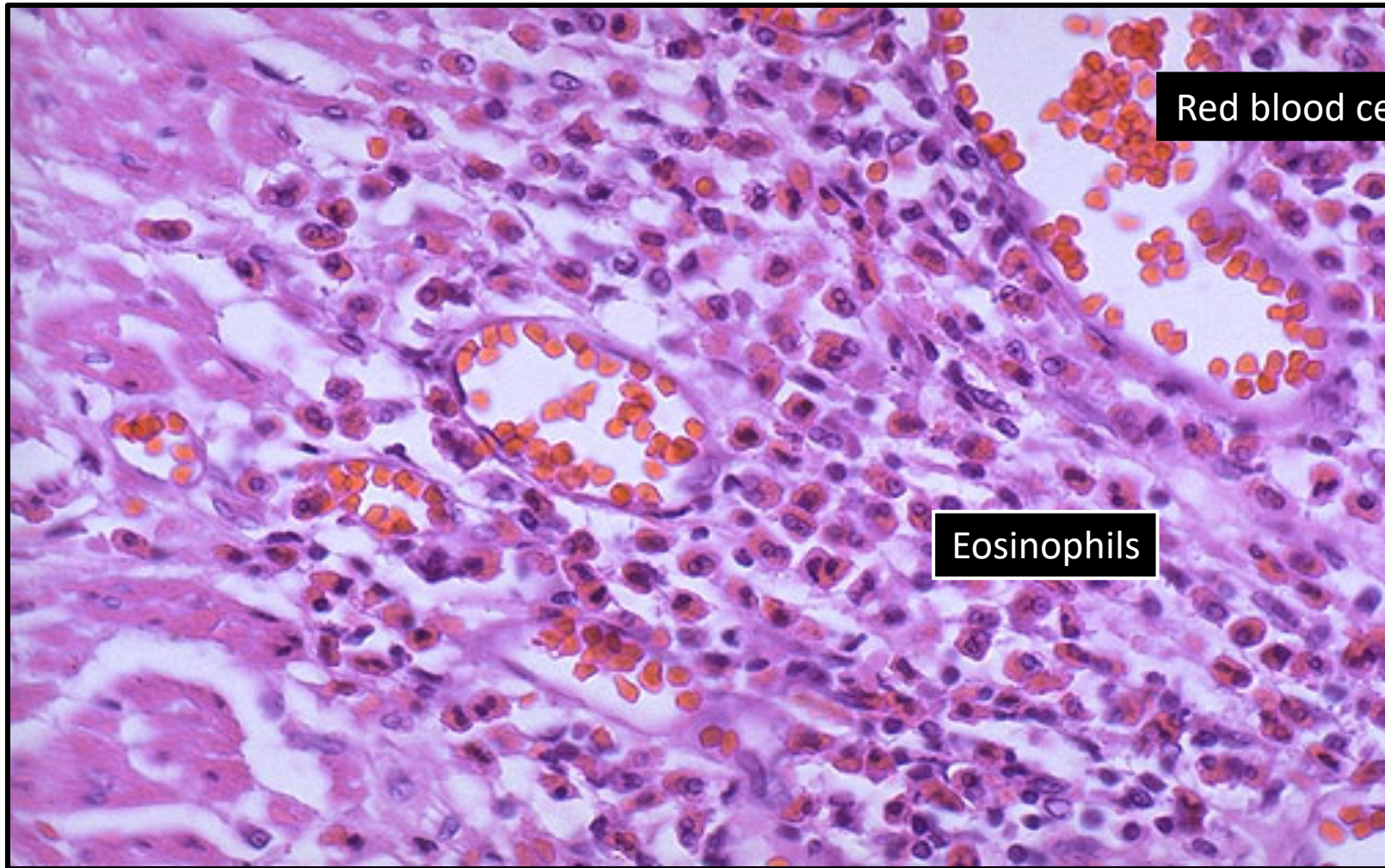
Between the bronchial cartilage at the right and the bronchial lumen filled with mucus at the left is a submucosa widened by smooth muscle hypertrophy, edema, and inflammation (mainly eosinophils). These are changes of bronchial asthma. The peripheral eosinophil count or the sputum eosinophils can be increased during an asthmatic attack.

BRONCHIAL ASTHMA - LPF



Bronchus from a fatal case of bronchial asthma in a 4-year-old child. There is partial plugging of the lumen, an intense inflammatory infiltrate and vascular congestion.

BRONCHIAL ASTHMA - HPF



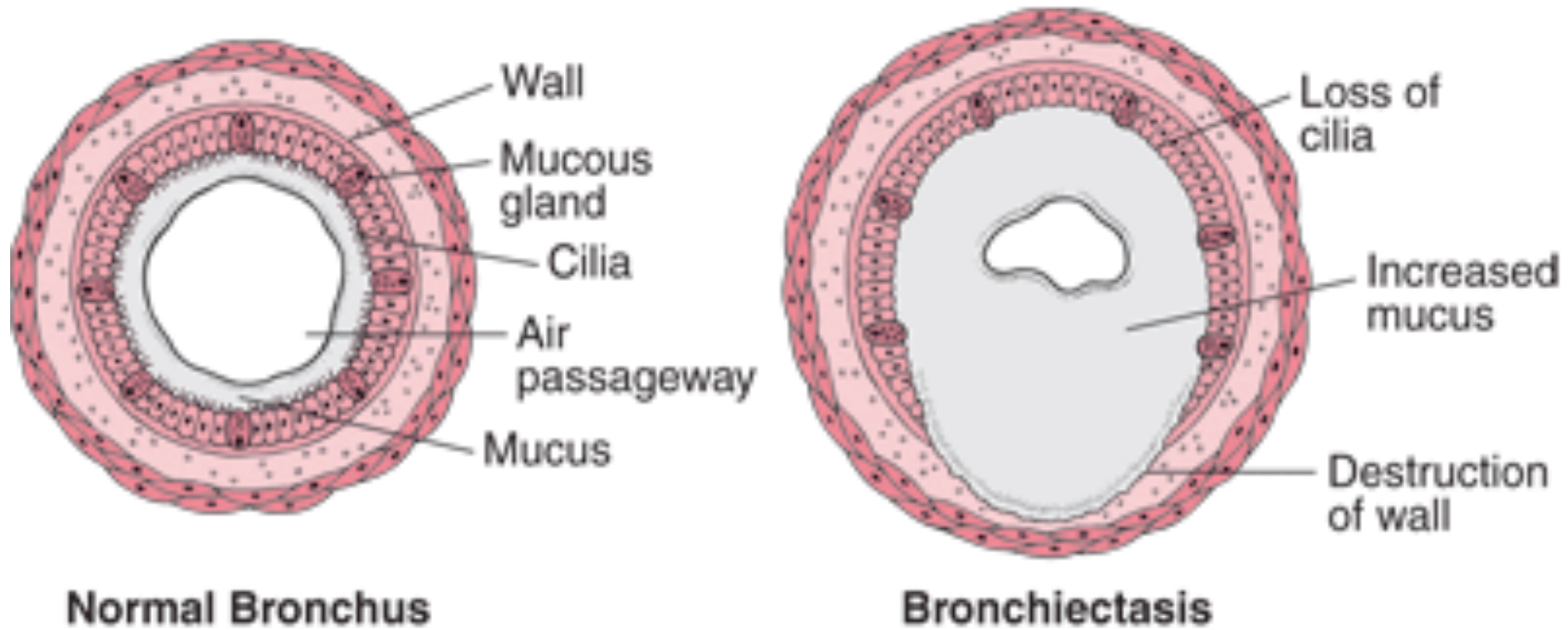
Red blood cells

Eosinophils

Changes of bronchial asthma: the numerous eosinophils are prominent from their bright red cytoplasmic granules in this case of bronchial asthma

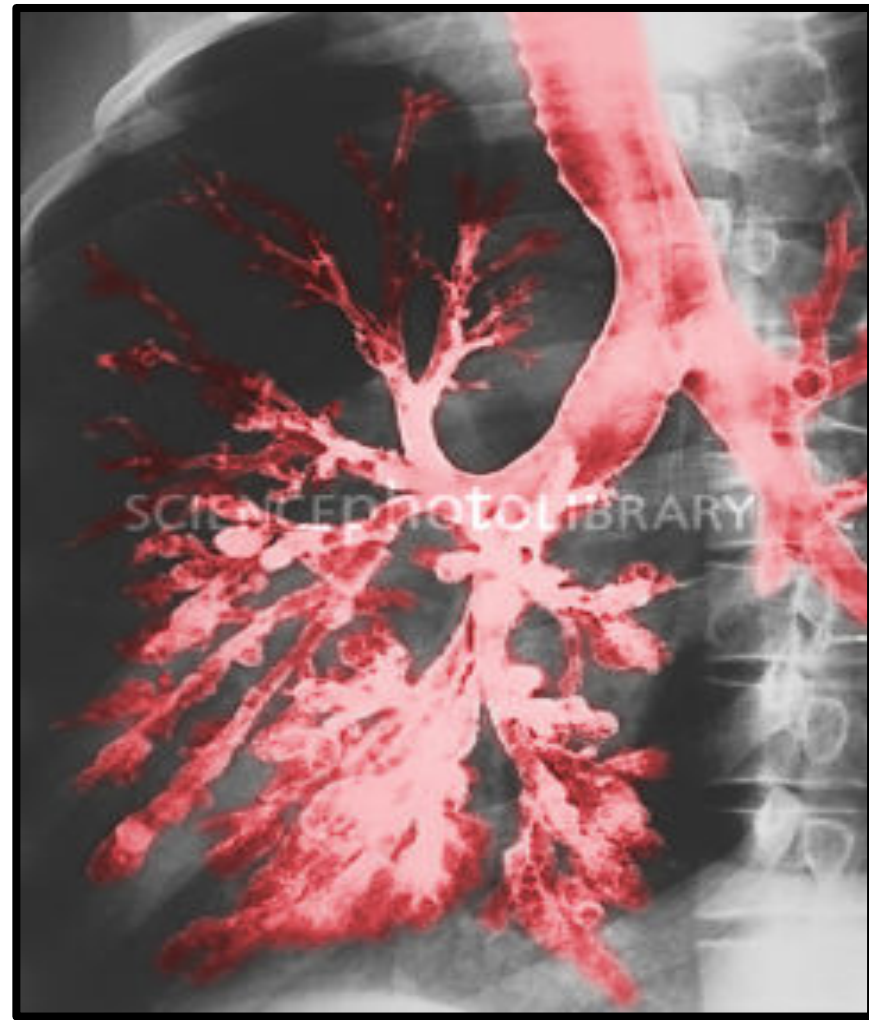
2. BRONCHIECTASIS

Diagram of Normal & Bronchiectatic Bronchus



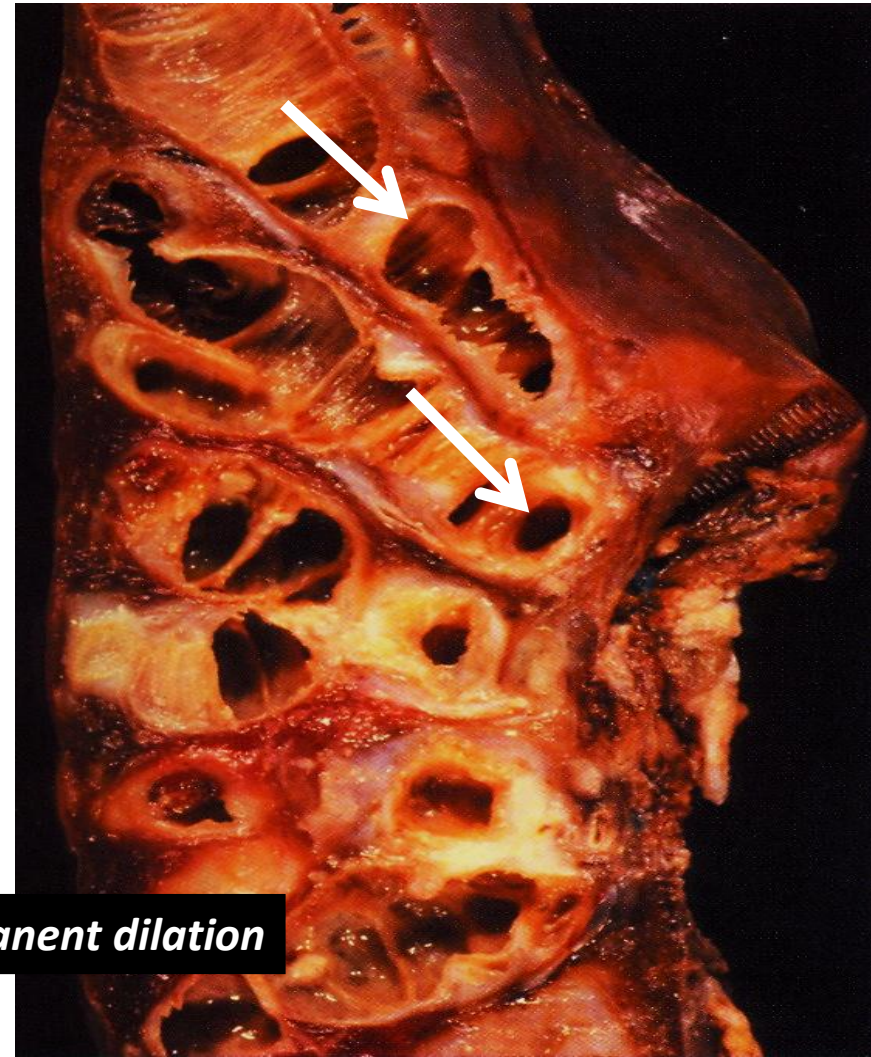
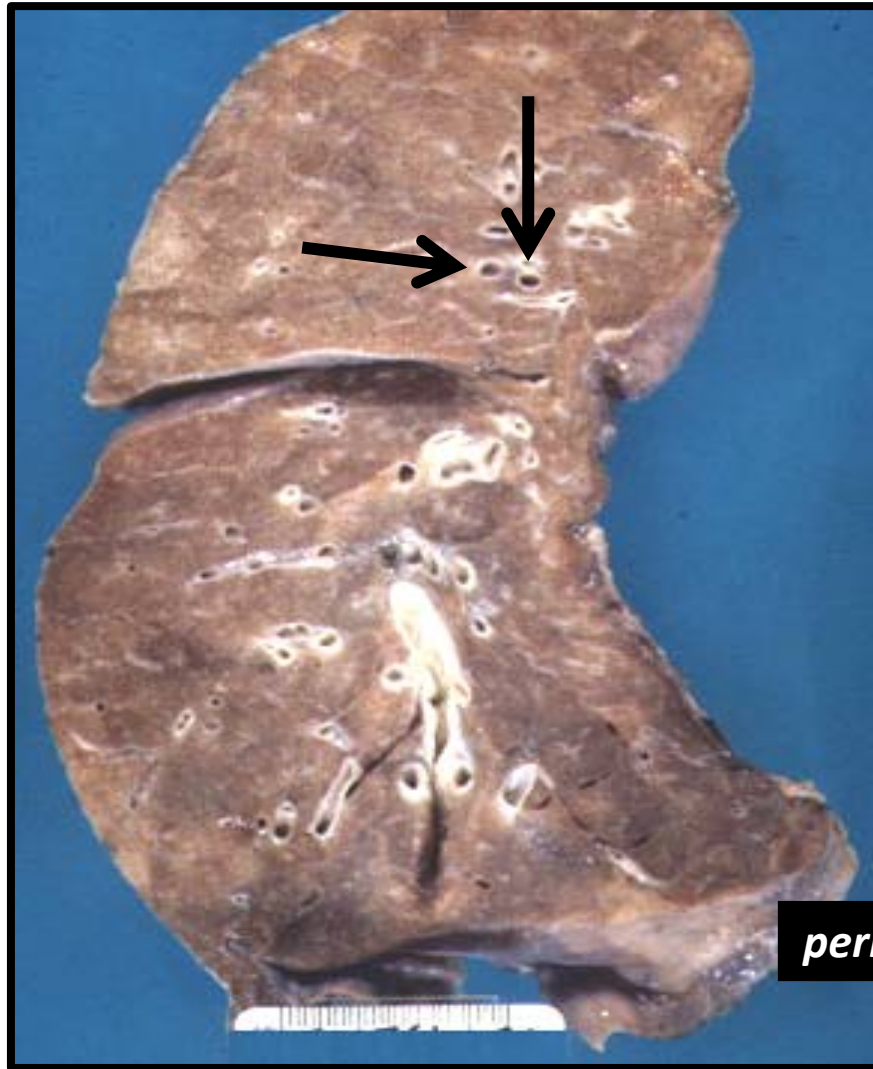
In Bronchiectasis, mucus production increases, the cilia are destroyed or damaged, and areas of the bronchial wall become chronically inflamed and are destroyed .

Bronchiectasis – Gross pathology & Colored X-ray



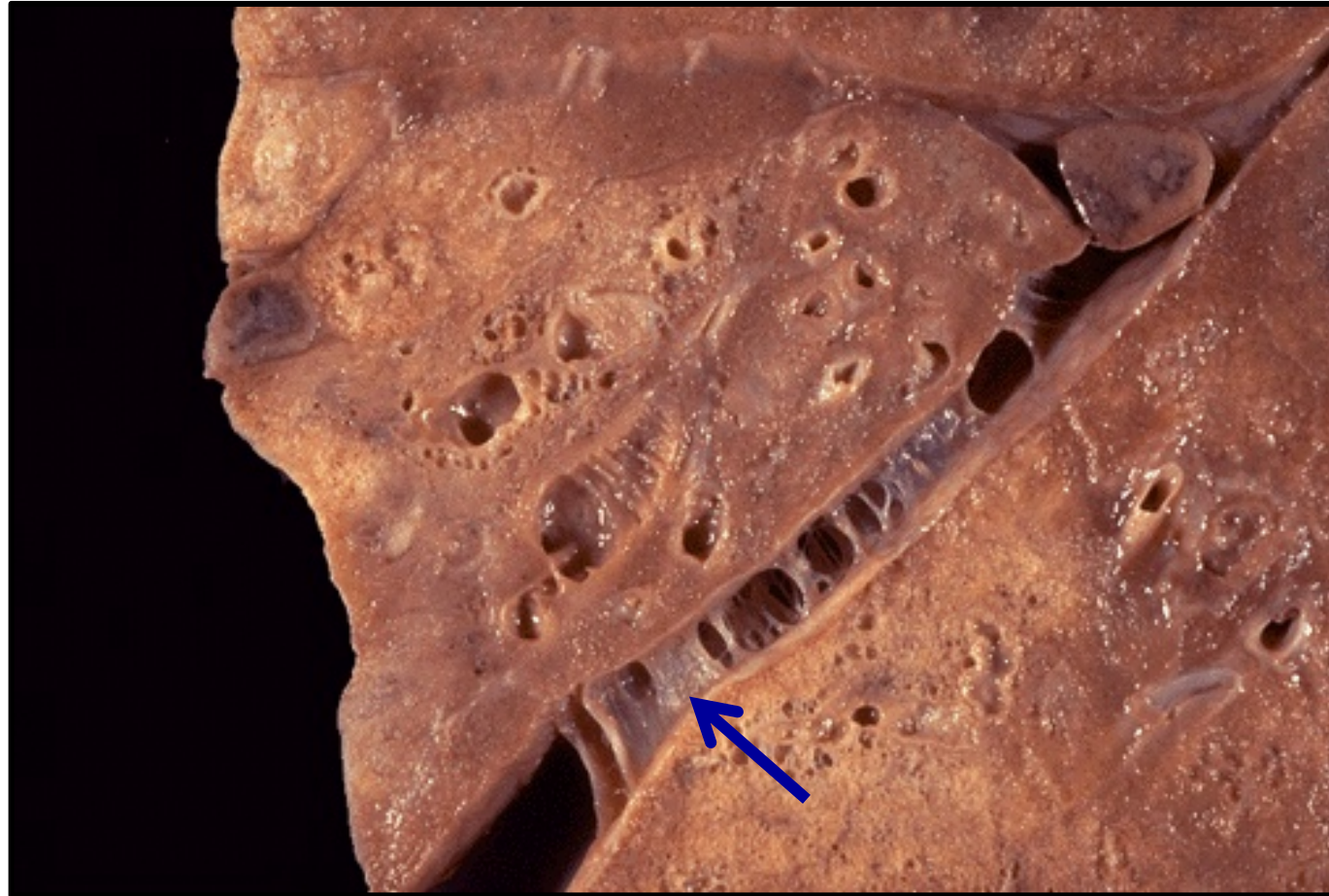
Permanent dilatation of bronchi and bronchioles caused by destruction of muscle and elastic tissue resulting from or associated with chronic necrotizing infection -Markedly distended peripheral bronchi.

Bronchiectasis – Gross pathology



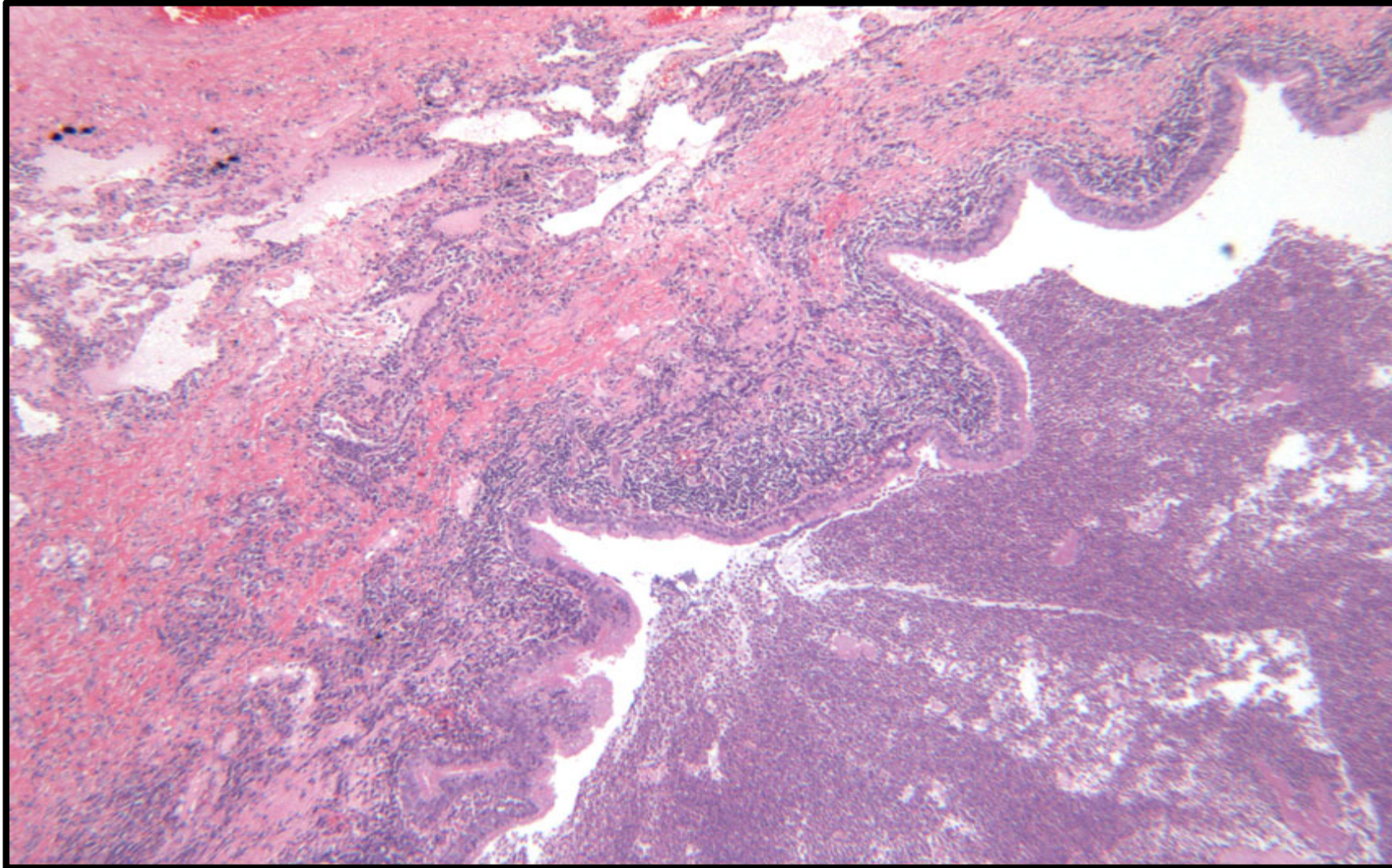
Bronchiectasis occurs when there is obstruction or infection with inflammation and destruction of bronchi so that there is permanent dilation.

Bronchiectasis – Gross pathology



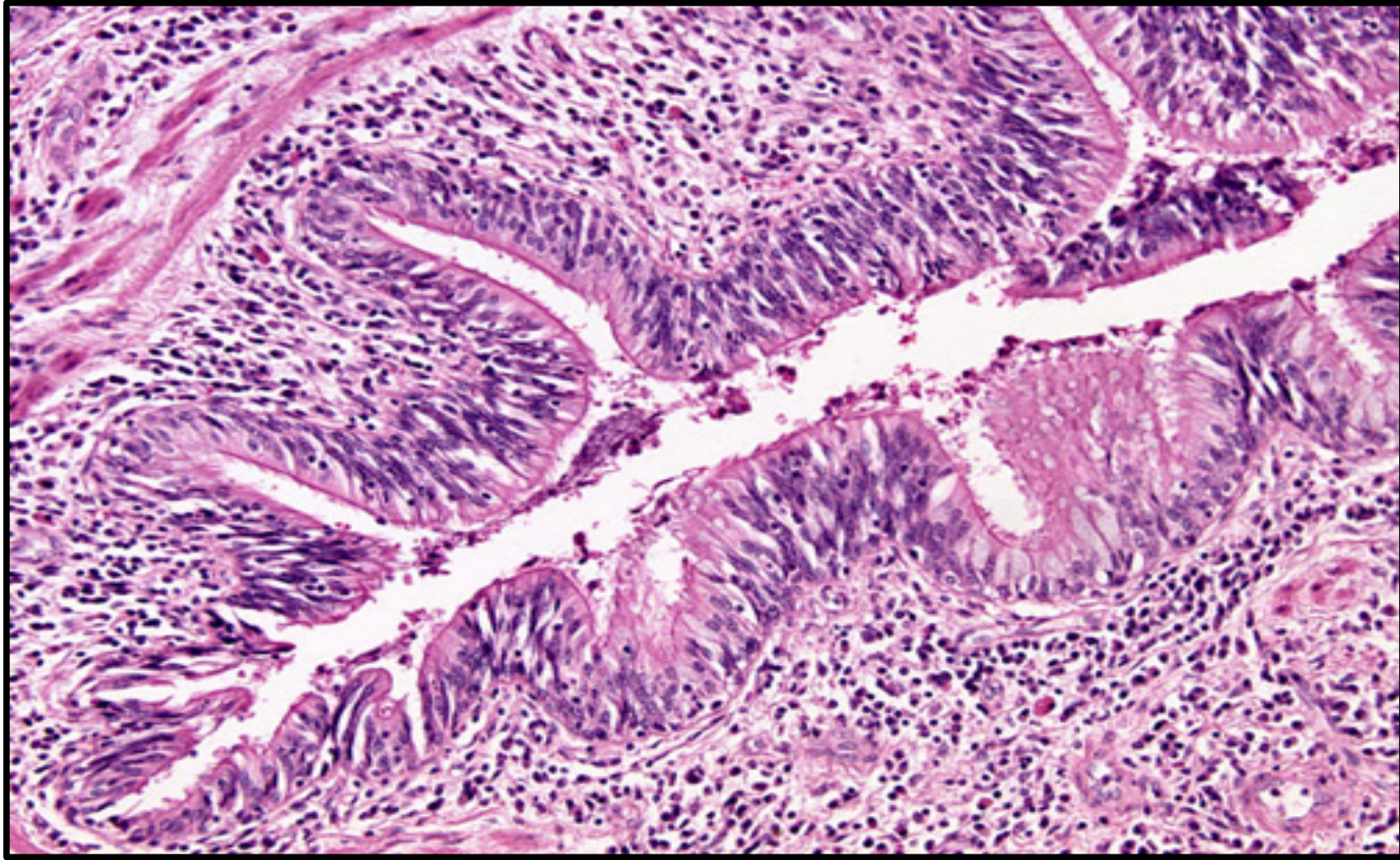
Bronchiectasis is seen here. The repeated episodes of inflammation can result in scarring, which has resulted in fibrous adhesions between the lobes. Fibrous pleural adhesions are common in persons who have had past episodes of inflammation of the lung that involve the pleura.

Bronchiectasis – LPF



Section of a dilated bronchus with florid acute on chronic inflammation of the bronchial wall and surrounding interstitial fibrosis.

Bronchiectasis – HPF



Chronic inflammation, ulceration of bronchial wall, ossification of bronchial cartilage, thickened pleura . Variable inflammation and fibrosis of alveoli

Chronic Obstructive Pulmonary Diseases (COPD)

also known as

**Chronic Obstructive Lung Disease (COLD),
Chronic Obstructive Airway Disease (COAD),
Chronic Obstructive Respiratory Disease (CORD)**

Include:

3. Chronic Bronchitis

4. Emphysema,

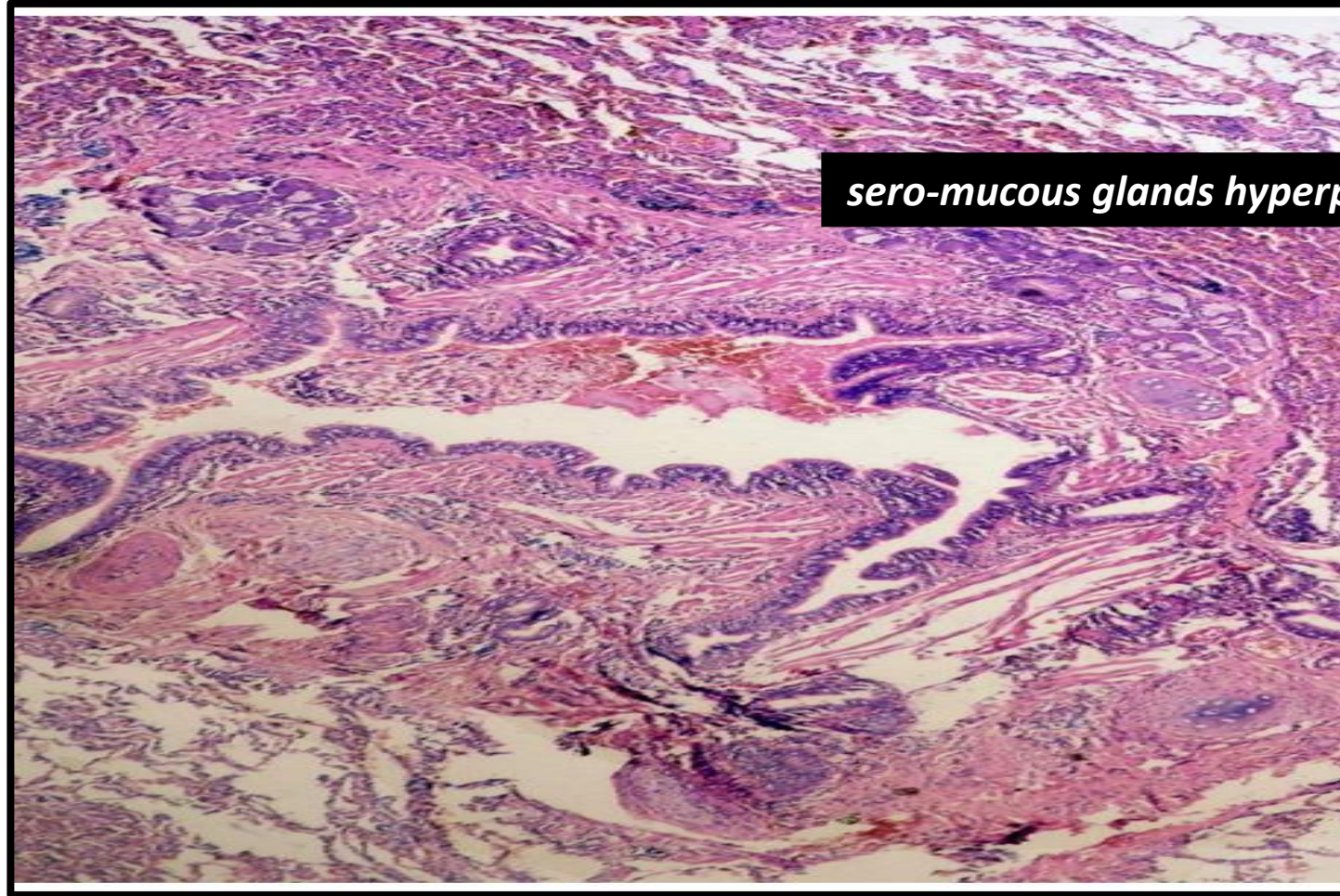
a pair of commonly co-existing diseases of the lungs in which the airways narrow over time.

3. CHRONIC BRONCHITIS

Normal vs Chronic bronchitis



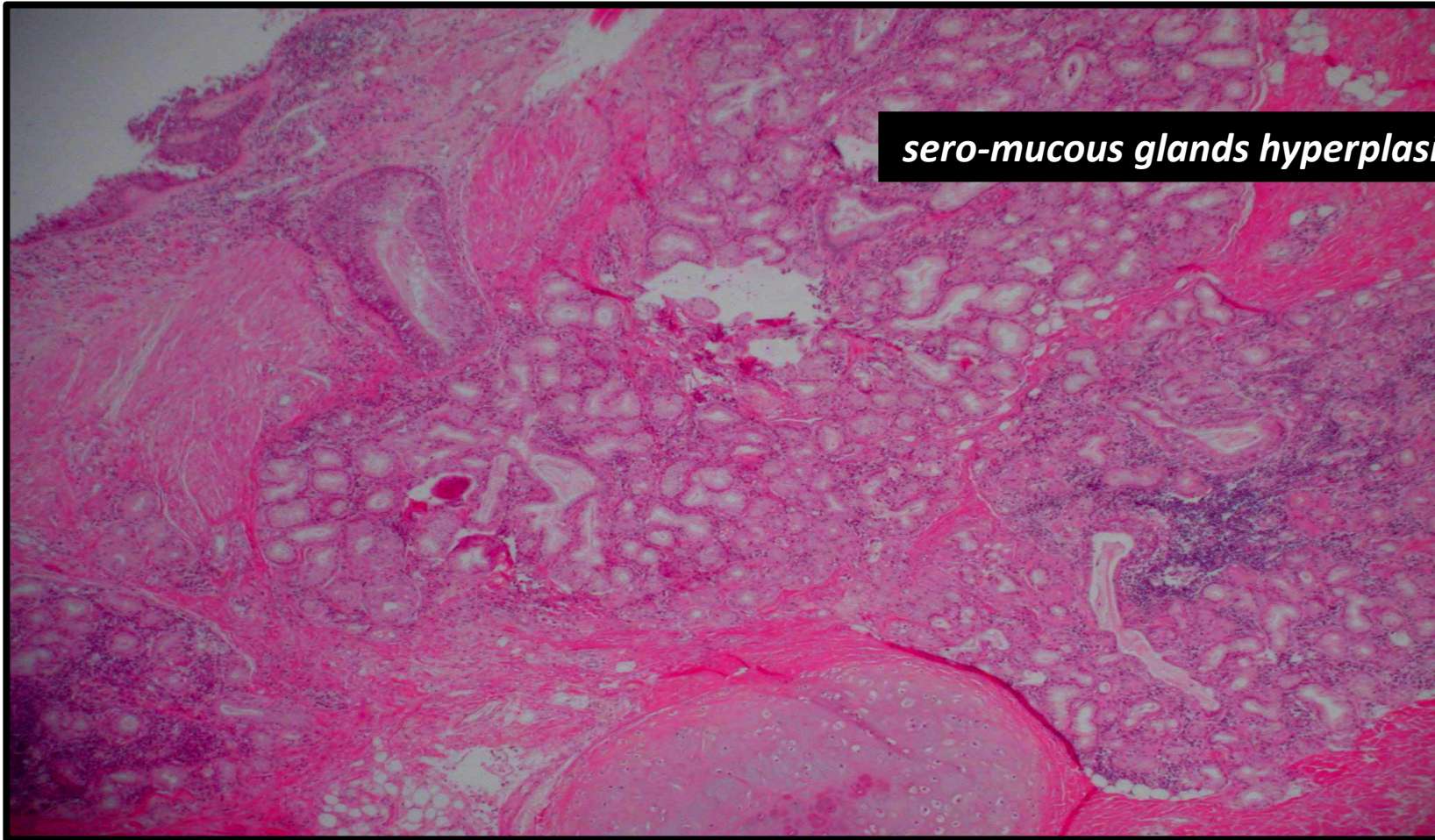
Chronic Bronchitis - LPF



sero-mucous glands hyperplasia

Inflammatory infiltrate in bronchial walls is composed of lymphocytes and plasma cells. In the lumen desquamated epithelial cells (catarrhal inflammation) .In mucosa often occurs mataplasia of cylindric ciliated epithelium into multilayered squamous epithelium. Goblet cells are hyperplastic, hyperplastic are also the sero-mucous glands in the submucosal layer. Muscularis mucosae is hypertrophic

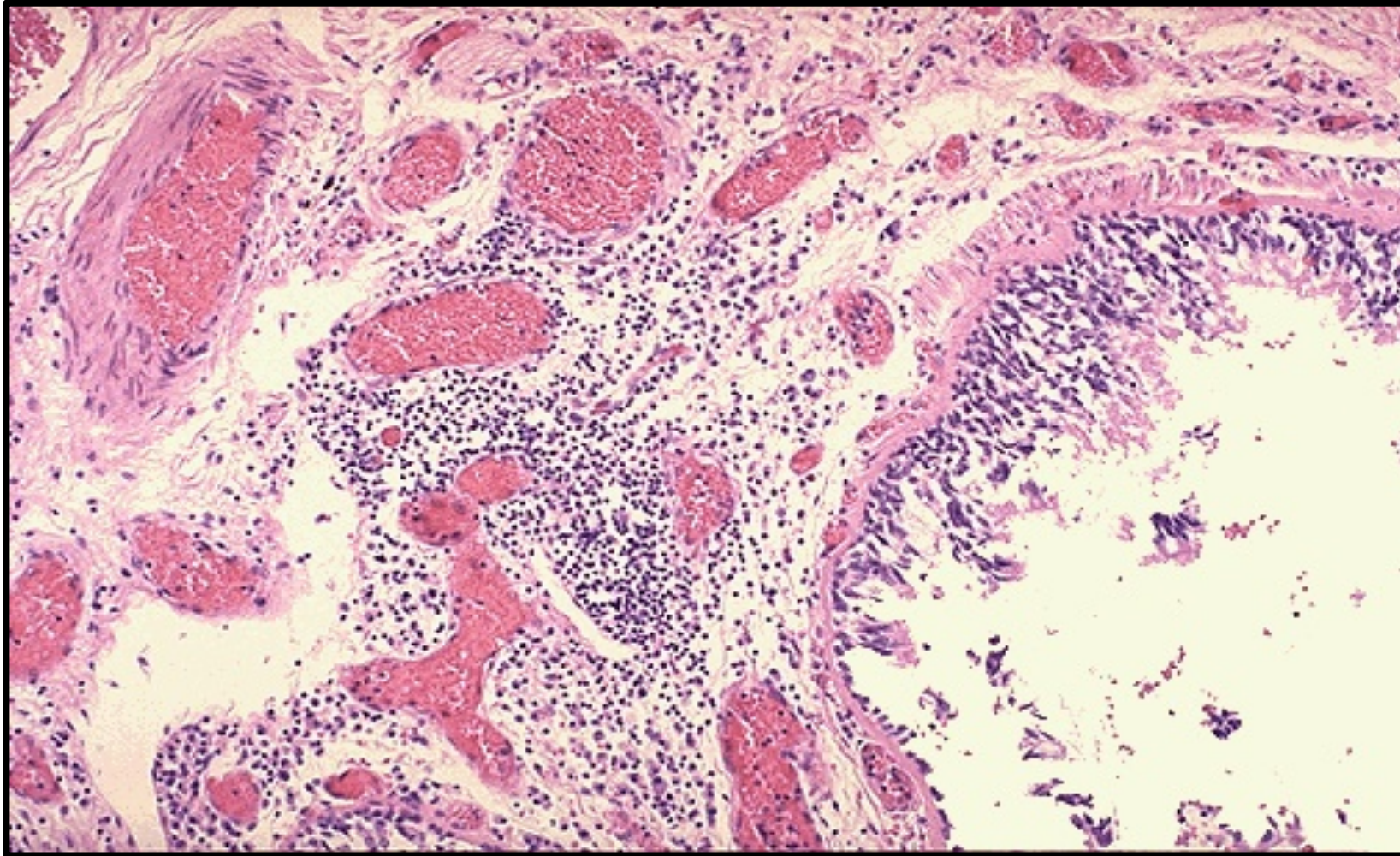
Chronic Bronchitis - LPF



sero-mucous glands hyperplasia

Early - hypersecretion of mucus in large airways with hypertrophy of submucosal glands in tracheobronchial tree . Later - increase in goblet cells in small airways contributes to excessive mucus production and airway obstruction .

Chronic Bronchitis - HPF



- ***Chronic inflammatory infiltrates range from absent to prominent***
Increased percentage of bronchial wall is occupied by submucosal mucous glands, as measured by Reid index; this directly correlates with sputum production, variable dysplasia, squamous metaplasia, bronchiolitis obliterans

4. EMPHYSEMA

Emphysema – Clinical Features

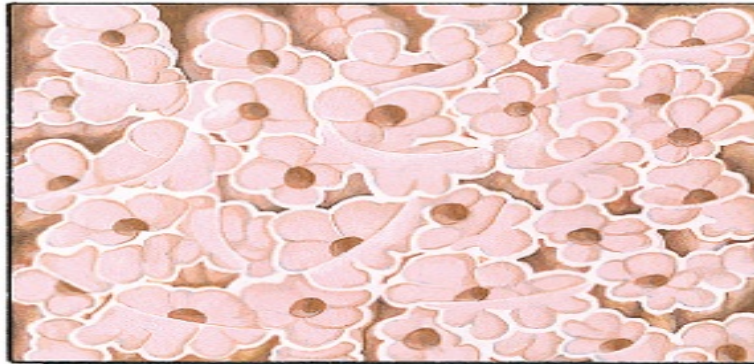


Emphysema patient (so-called pink puffers) exhibit dyspnea without significant hypoxemia and tend to be thin, to have hyperinflated lung fields at total lung capacity, and to be free of signs of right heart failure

Normal Lung

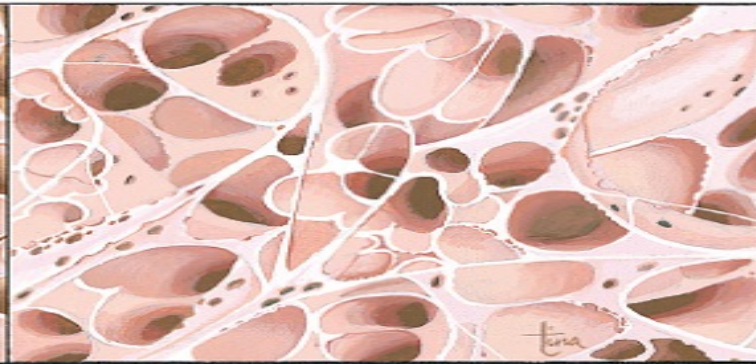


Emphysema



A

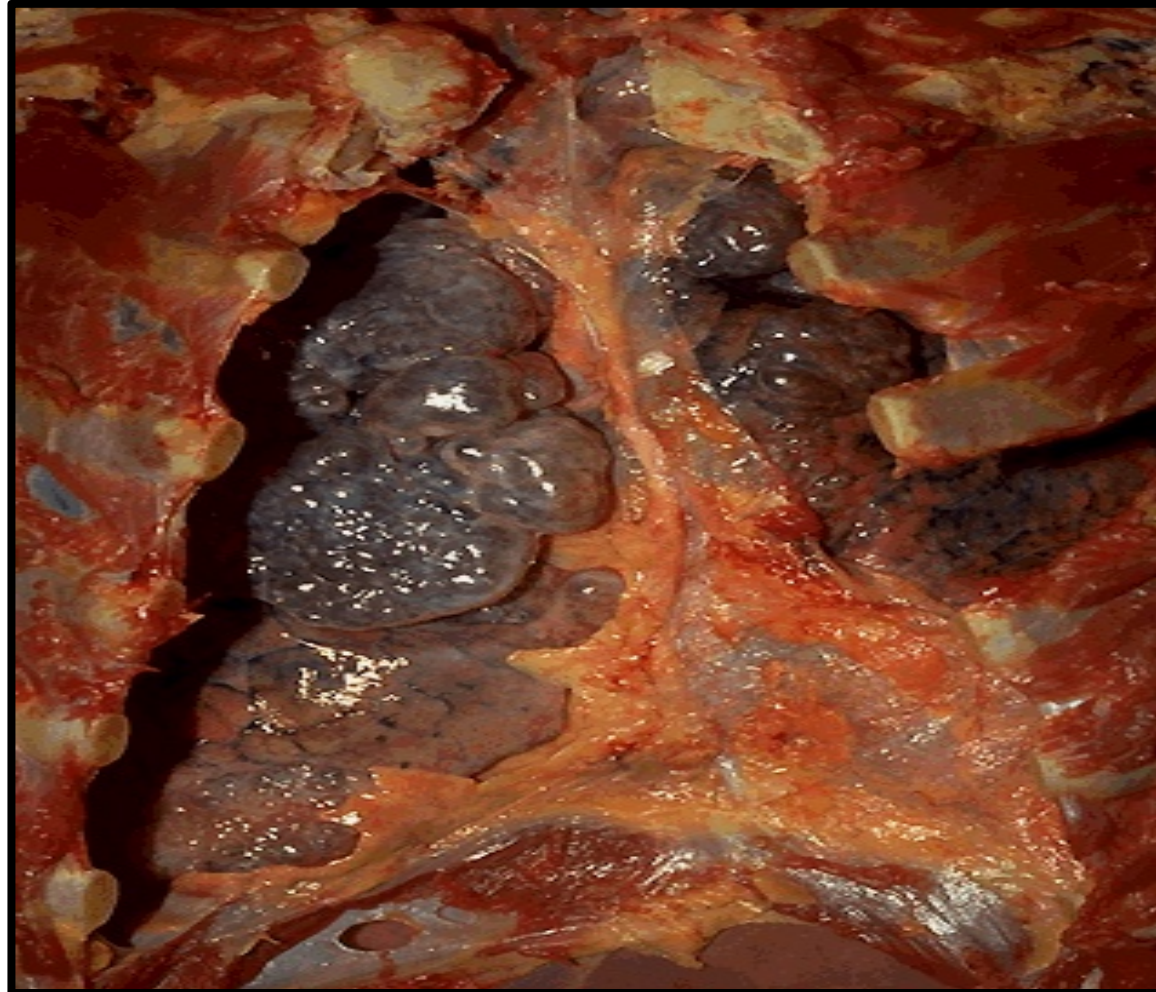
Normal Lung



B

Emphysema

Emphysema – Gross Anatomy



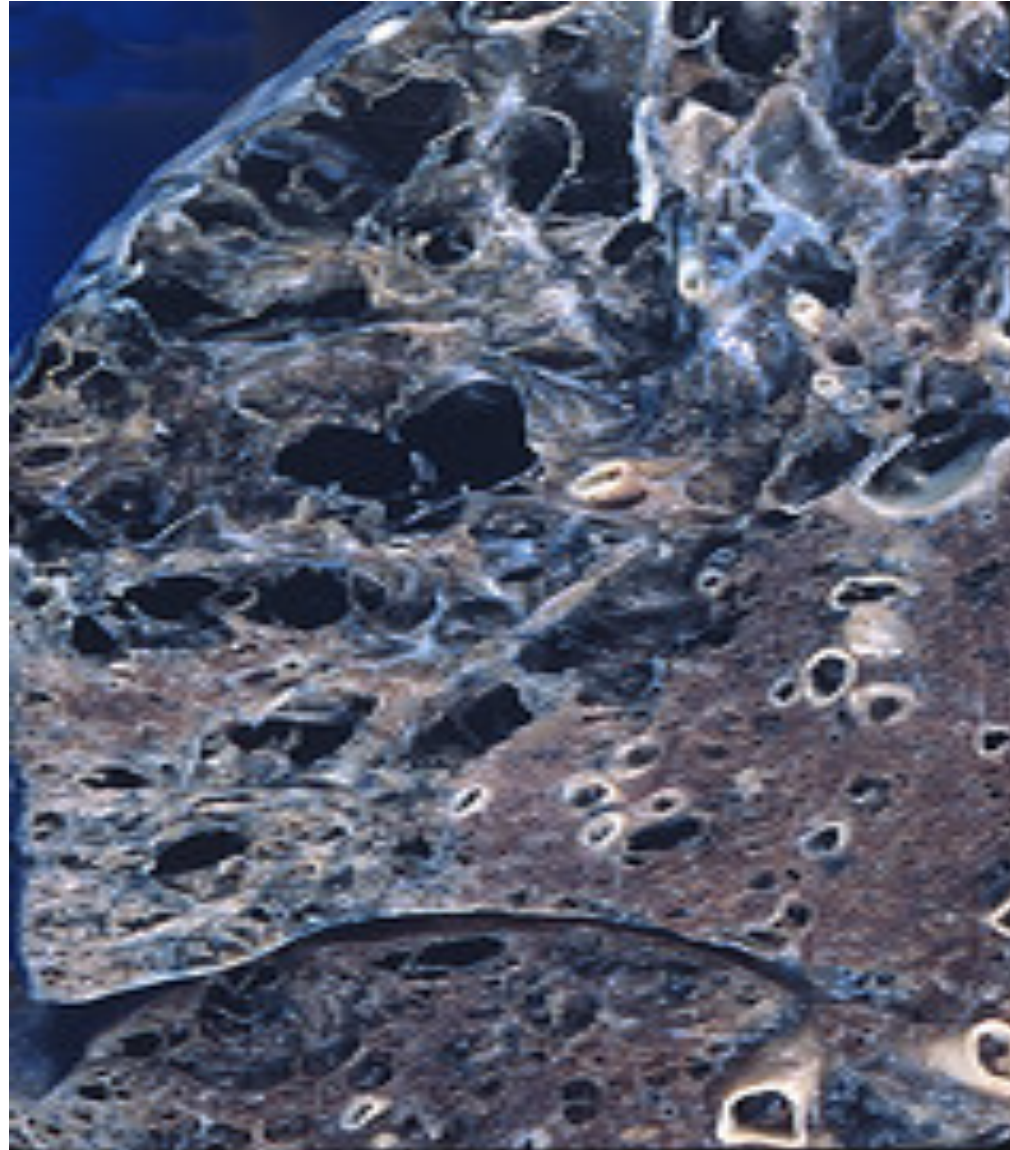
The chest cavity is opened at autopsy to reveal numerous large bullae apparent on the surface of the lungs in a patient dying with emphysema. Bullae are large dilated airspaces that bulge out from beneath the pleura.

Emphysema – Gross pathology



Dilated airspaces in emphysematous lung. Although there tends to be some scarring with time because of superimposed infections, the emphysematous process is one of loss of lung parenchyma, not fibrosis

Bullous Emphysema – Gross pathology



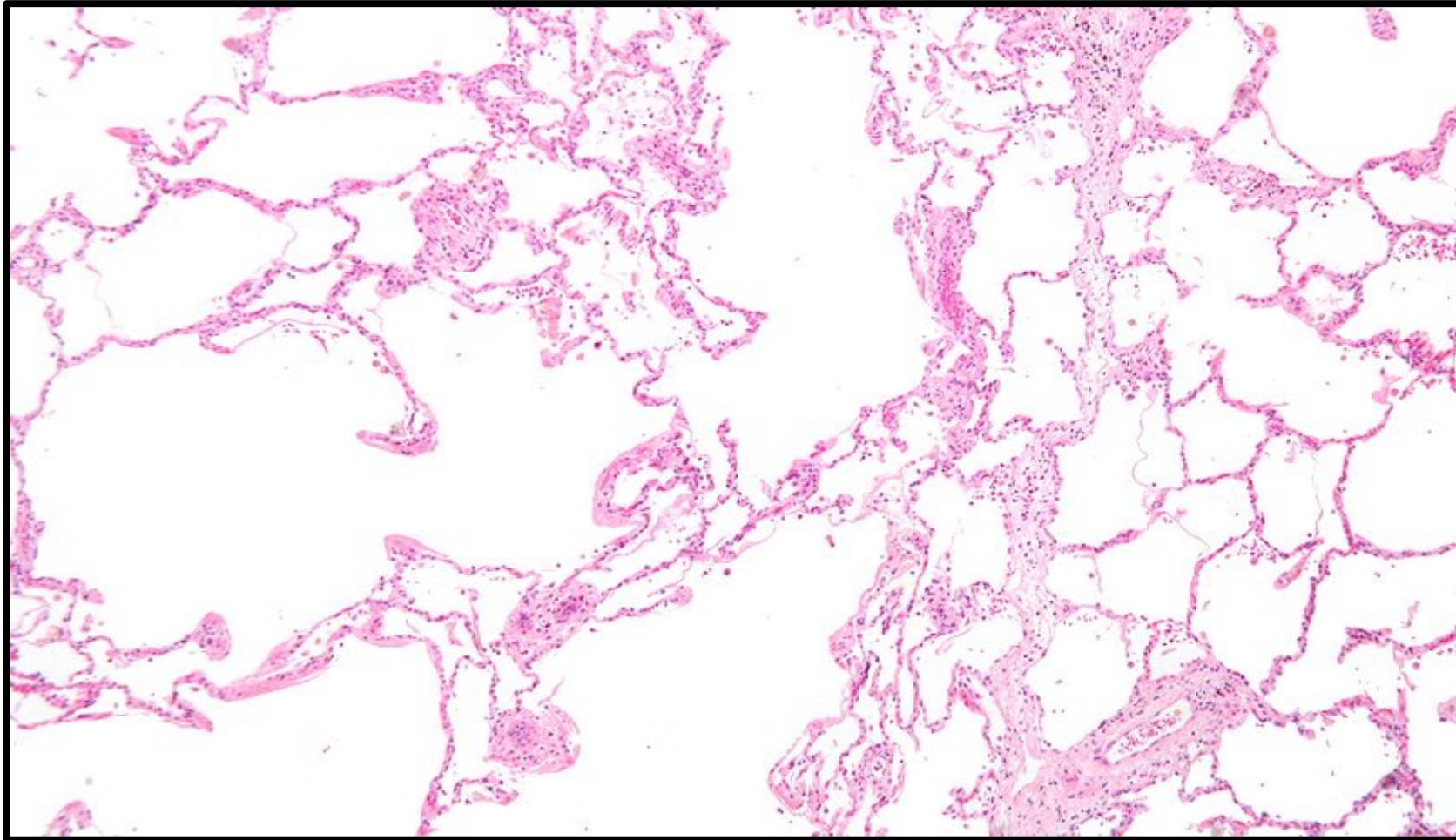
A bulla is defined as an emphysematous space larger than 1 cm.

Centrilobular Emphysema – Gross pathology



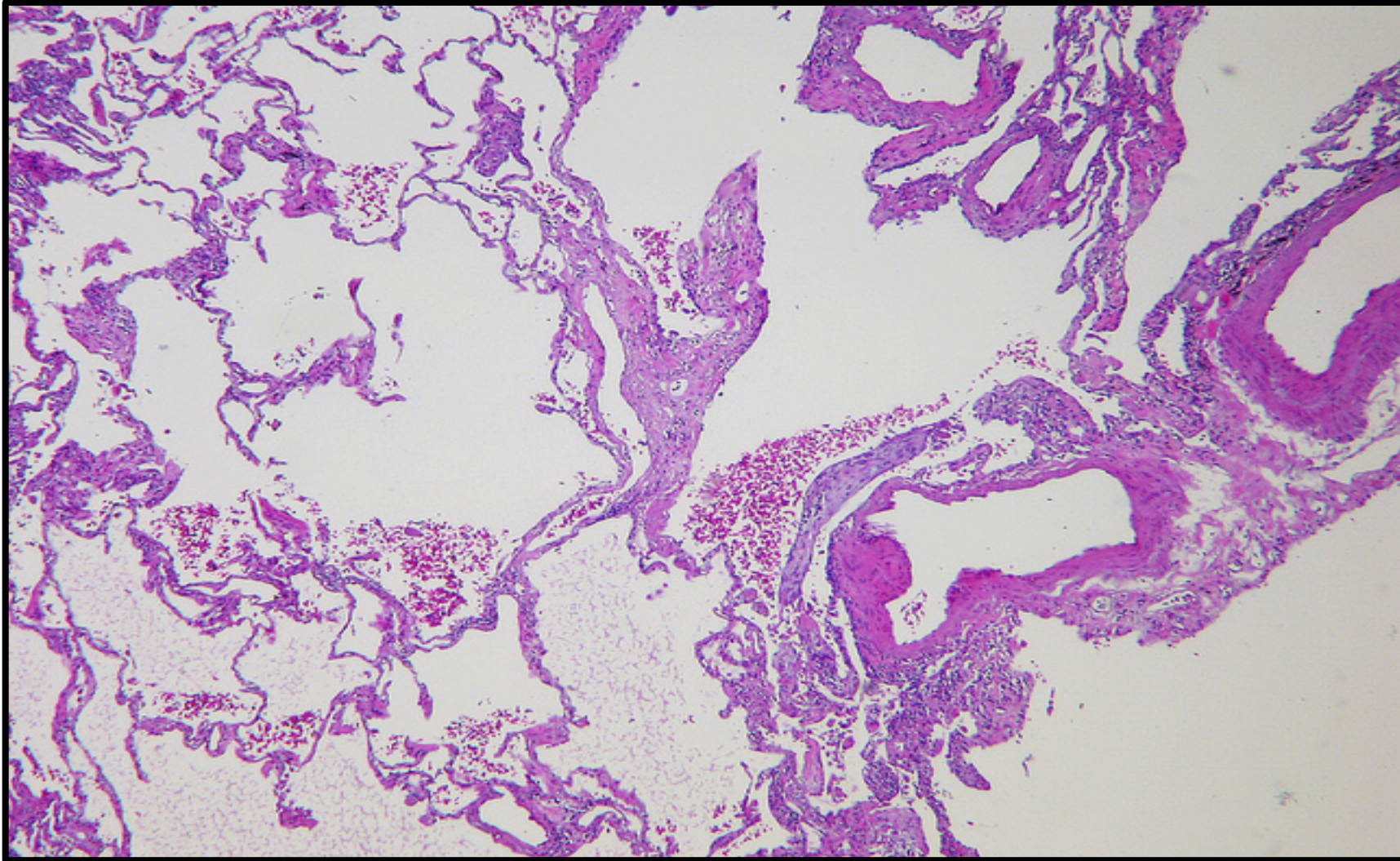
Centrilobular emphysema : Fixed, cut surface of a lung shows multiple cavities lined by heavy black carbon deposits characteristic of smoking.

Panacinar Emphysema – LPF



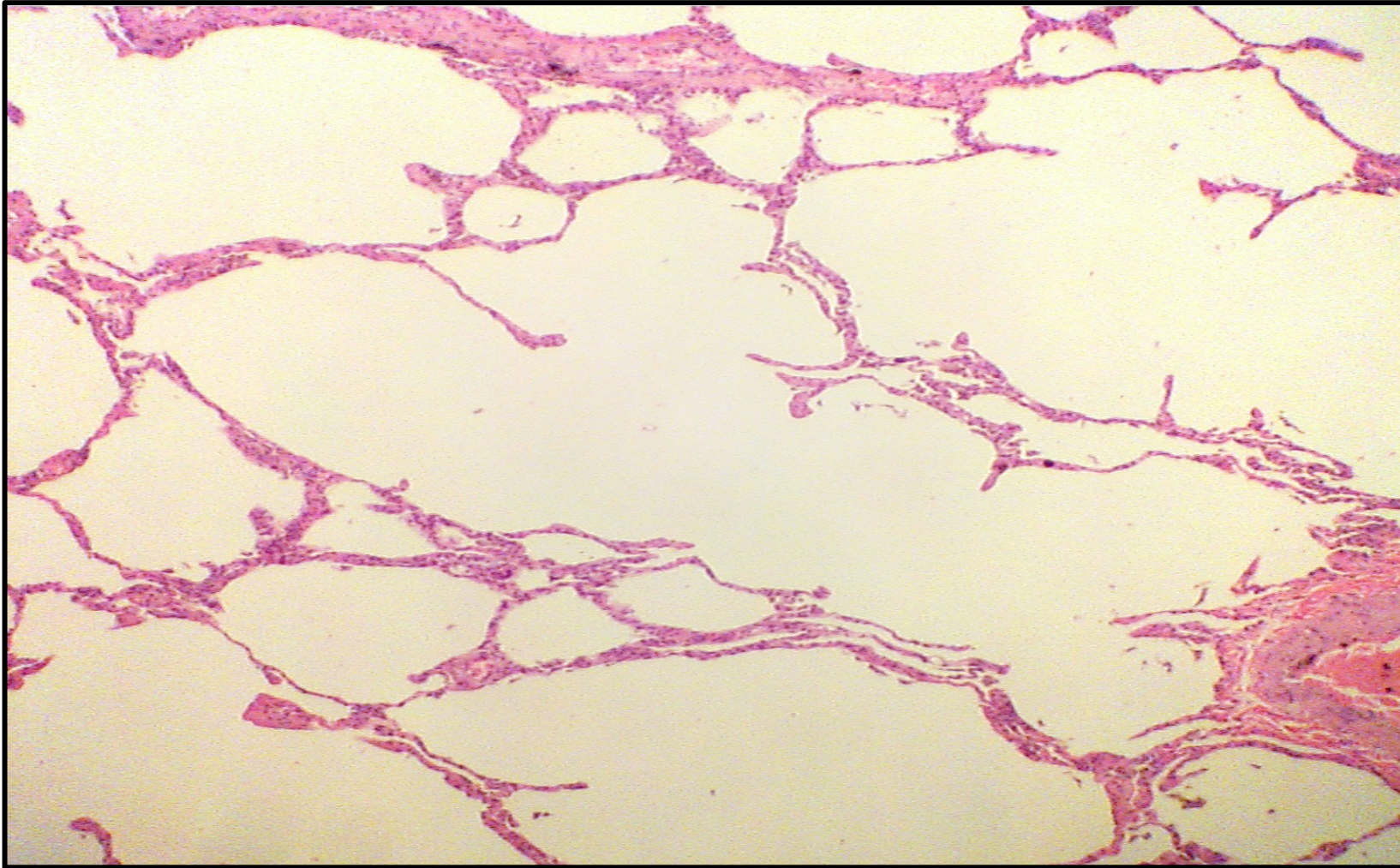
Some of the alveolar septae are ruptured and the ruptured septa project with in air spaces on the form of spurs.

Panacinar Emphysema – LPF



Some of the alveolar septae are ruptured and the ruptured septa project within air spaces on the form of spurs.

Panacinar Emphysema - HPF

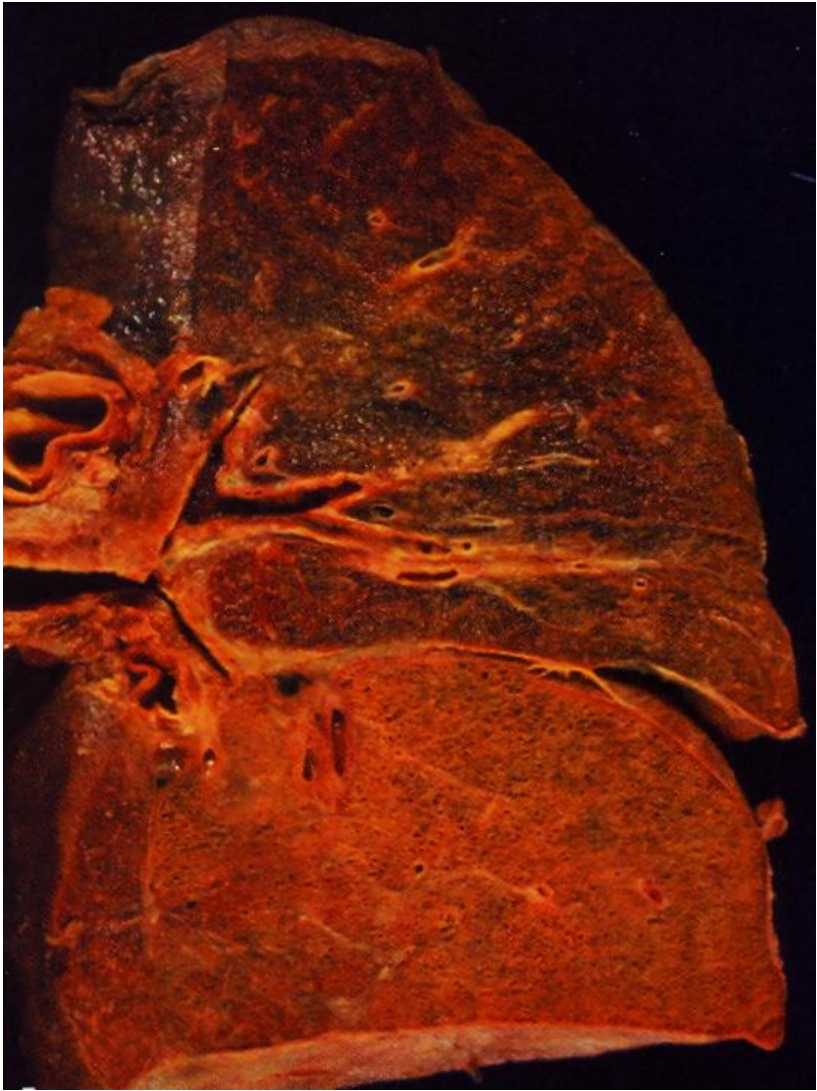
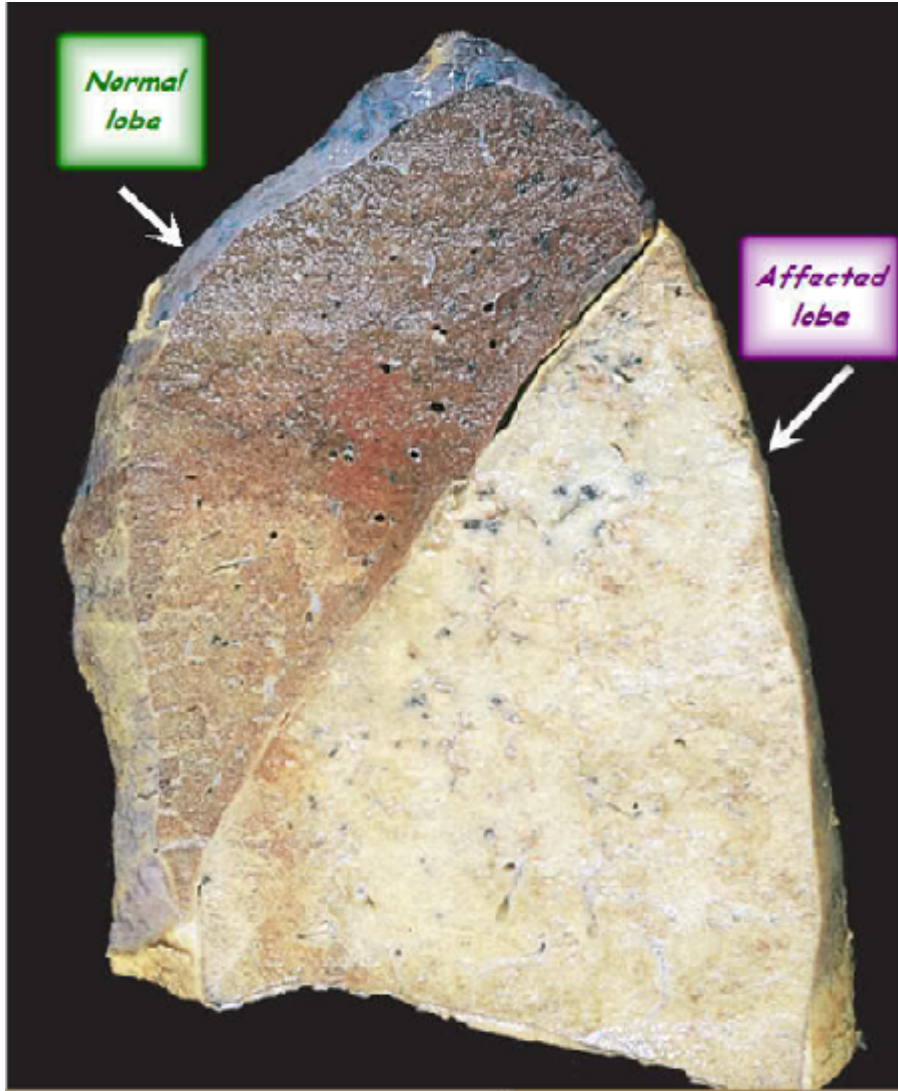


Destruction of tissue leaves emphysematous spaces with little surface area, few capillaries, and large air spaces. Large vessel at lower left

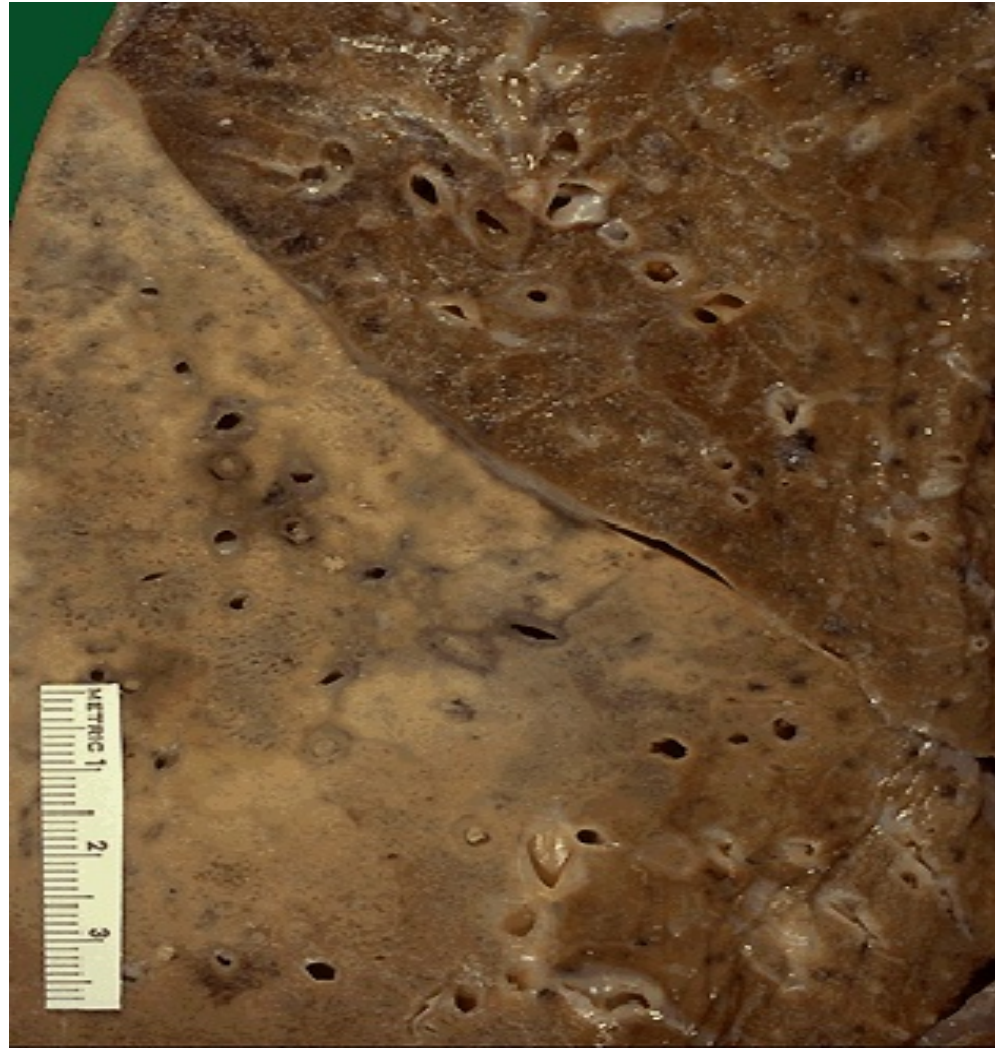
LOWER RESPIRATORY TRACT INFECTIONS

1. Lobar Pneumonia

Lobar Pneumonia - Gross pathology

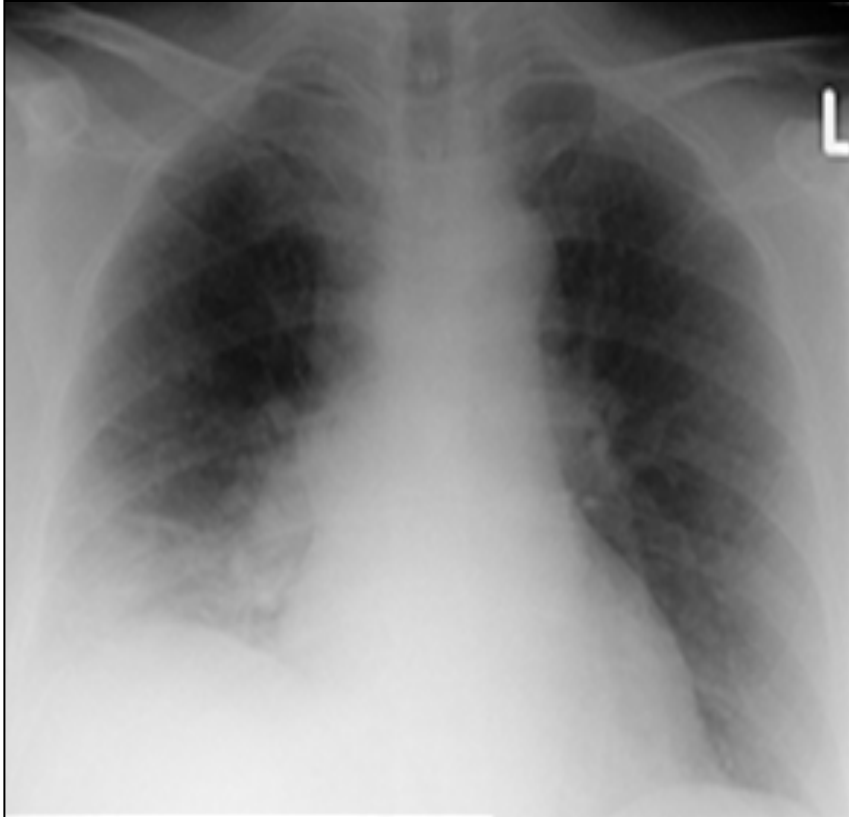


Lobar Pneumonia - Gross pathology

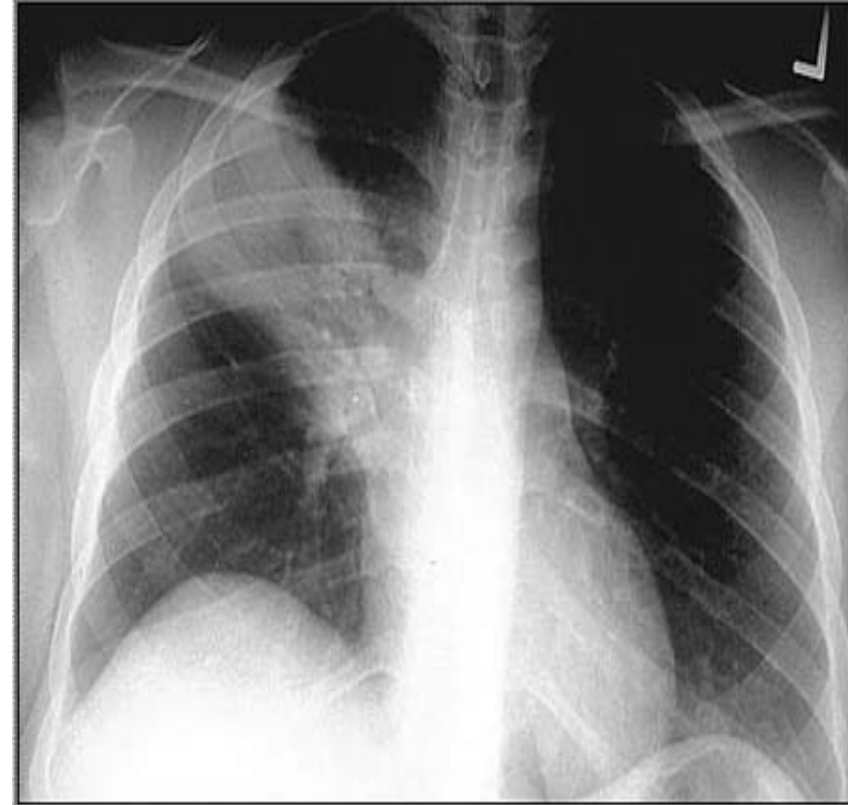


A closer view of the lobar pneumonia demonstrates the distinct difference between the upper lobe and the consolidated lower lobe.

Lobar Pneumonia : X - Ray



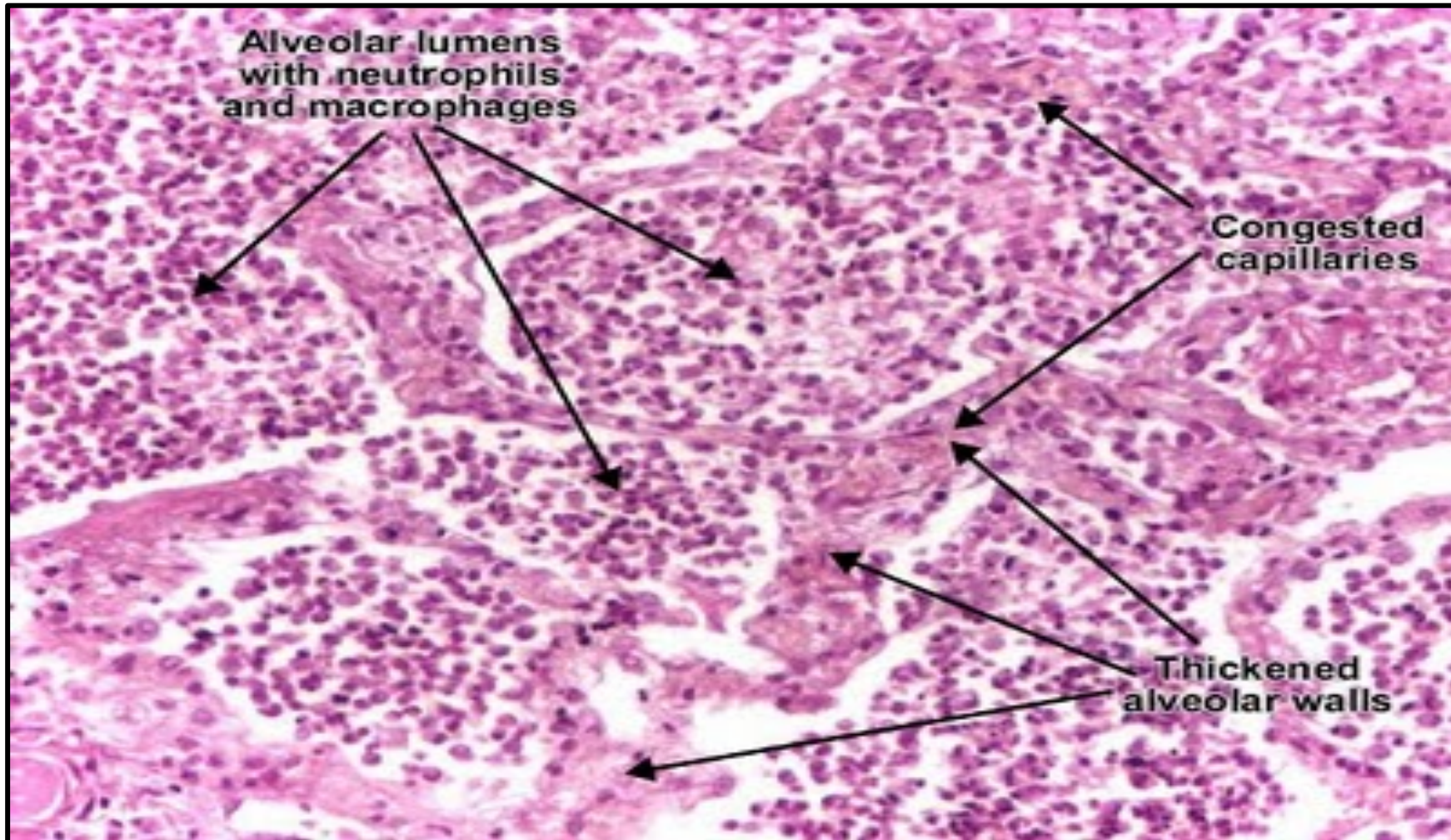
Lobar Pneumonia of the right Lower lobe



Lobar Pneumonia of the right middle lobe

A localised focus of consolidation caused by lobar pneumonia can be seen in both X-ray films taken from 2 different patients .

Lobar Pneumonia - Histopathology



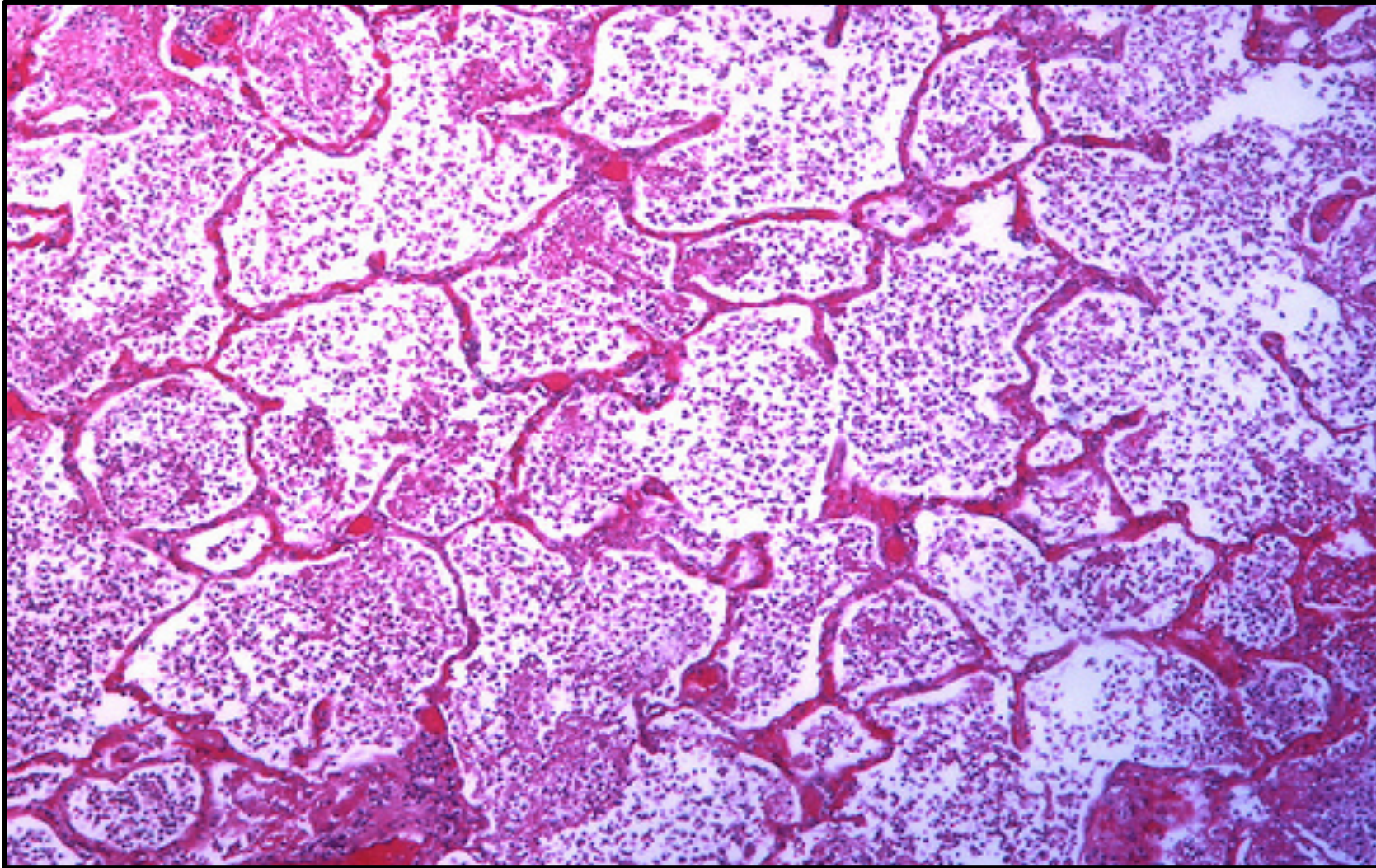
- * Congestion (first 2 days)*
- * Red hepatisation (fibrinous alveolitis) (2nd to 4th day)*
- * Grey hepatisation (leukocytic alveolitis) (4th to 8th day)*
- * Resolution (after 8th day)*

Lobar Pneumonia - LPF



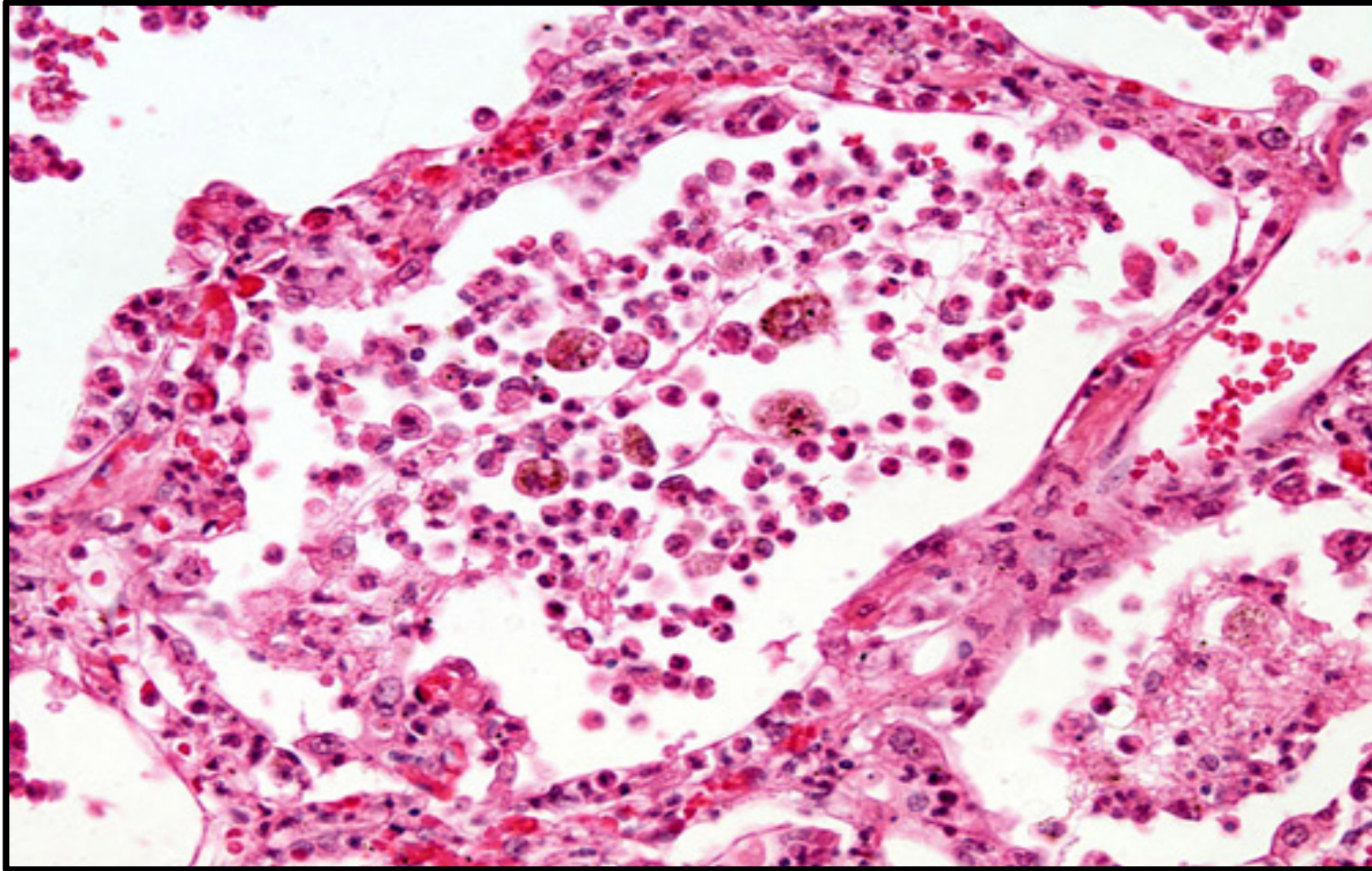
All the alveoli are filled with fibrinous exudate containing fibrin threads, polymorphs, macrophages and red cells. Alveolar walls are congested. Pleura is covered by fibrinous exudate.

Lobar Pneumonia - LPF



the alveoli are filled with fibrinous exudate containing fibrin threads, polymorphs, macrophages and red cells

Lobar Pneumonia - HPF



High power field of alveolar exudate and thickened alveolar wall

2. Bronchopneumonia

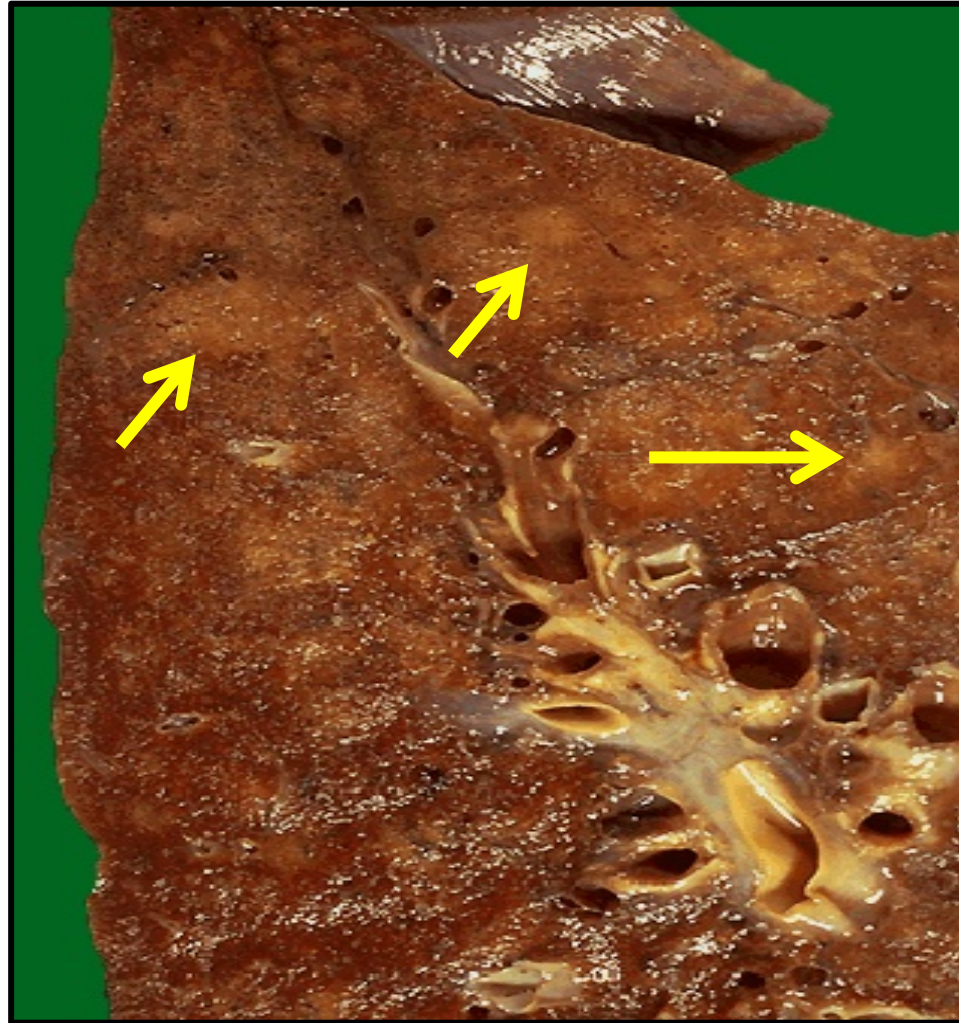
Bronchopneumonia – Gross pathology



The consolidated areas here very closely match the pattern of lung lobules (hence the term "lobular" pneumonia).

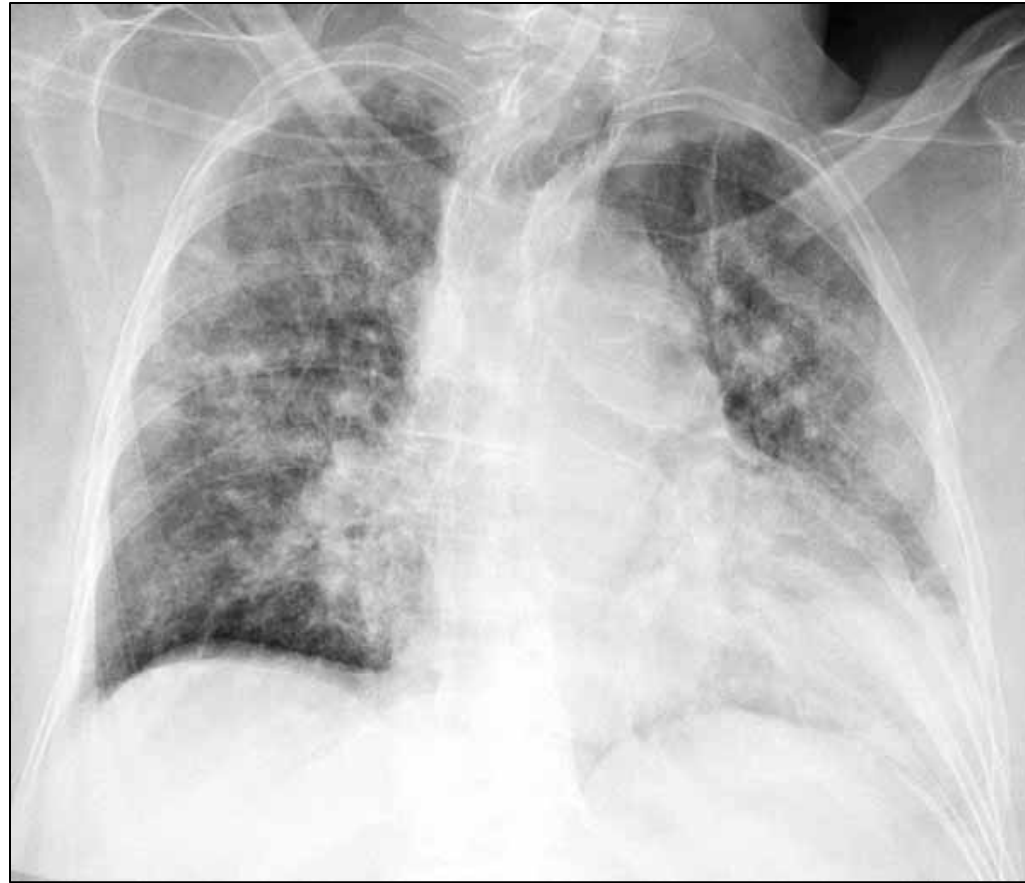
Bronchopneumonia is classically a "hospital acquired" pneumonia seen in persons already ill from another diseases e.g. DM , old age , immune deficiency process.

Bronchopneumonia – Cut section



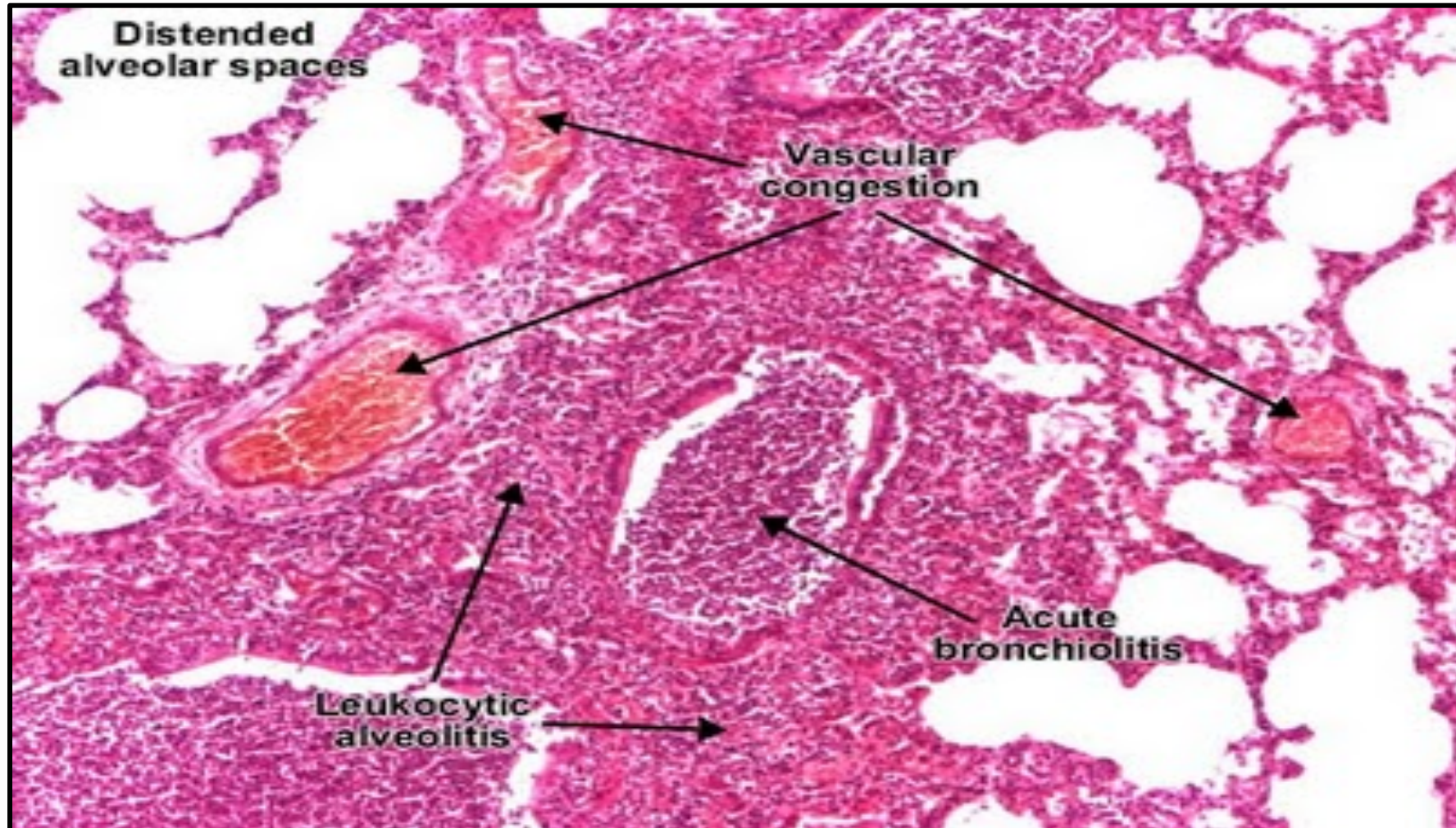
This bronchopneumonia is more subtle, but there are areas of lighter tan consolidation. The hilum is seen at the lower left with radiating pulmonary arteries and bronchi

Bronchopneumonia – X-Ray



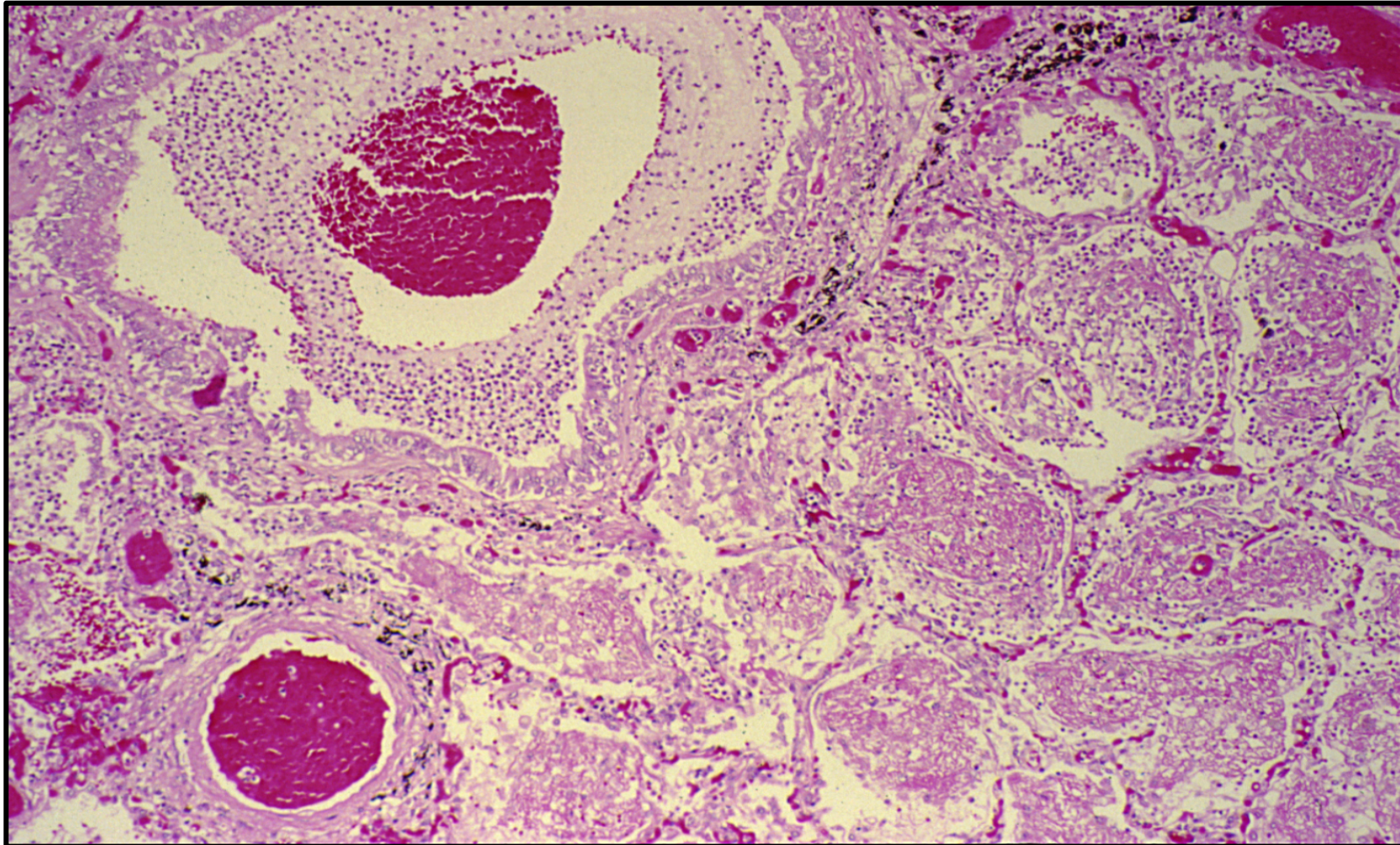
This radiograph demonstrates patchy infiltrates consistent with a bronchopneumonia from a bacterial infection.

Bronchopneumonia – Histopathology



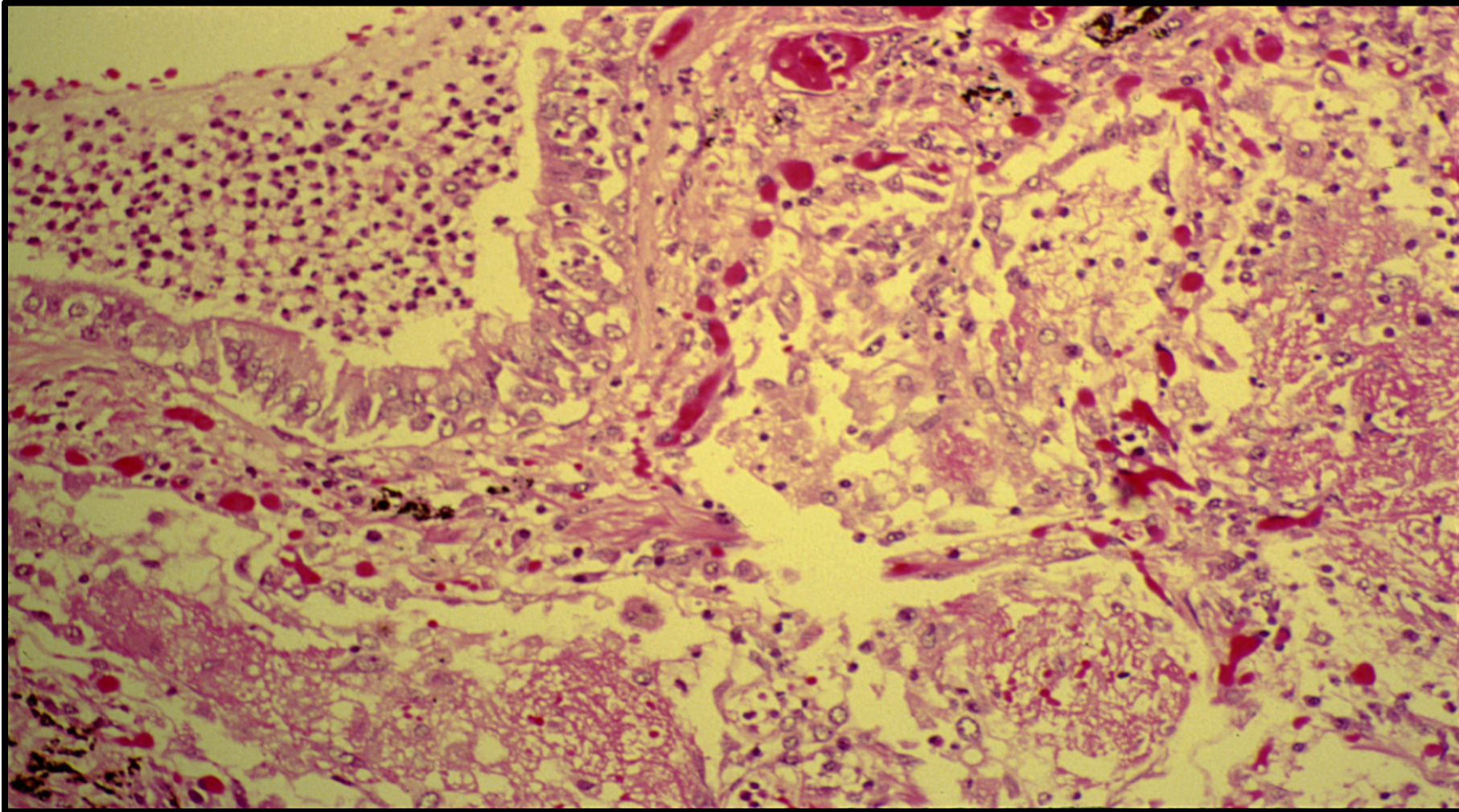
Bronchopneumonia (Lobular pneumonia) is an acute exudative inflammation of the lungs characterised by foci of consolidation surrounded by normal parenchyma. Usually, bronchopneumonia affects one or more lobes and is bilateral.

Bronchopneumonia – LPF



Section of the lung shows foci of inflammatory consolidation surrounding bronchioles: Bronchioles are filled with an inflammatory purulent exudate and show ulceration of mucosa, focal inflammation and necrosis of walls . Surrounding lung parenchyma shows congestion and edema

Bronchopneumonia – MPF



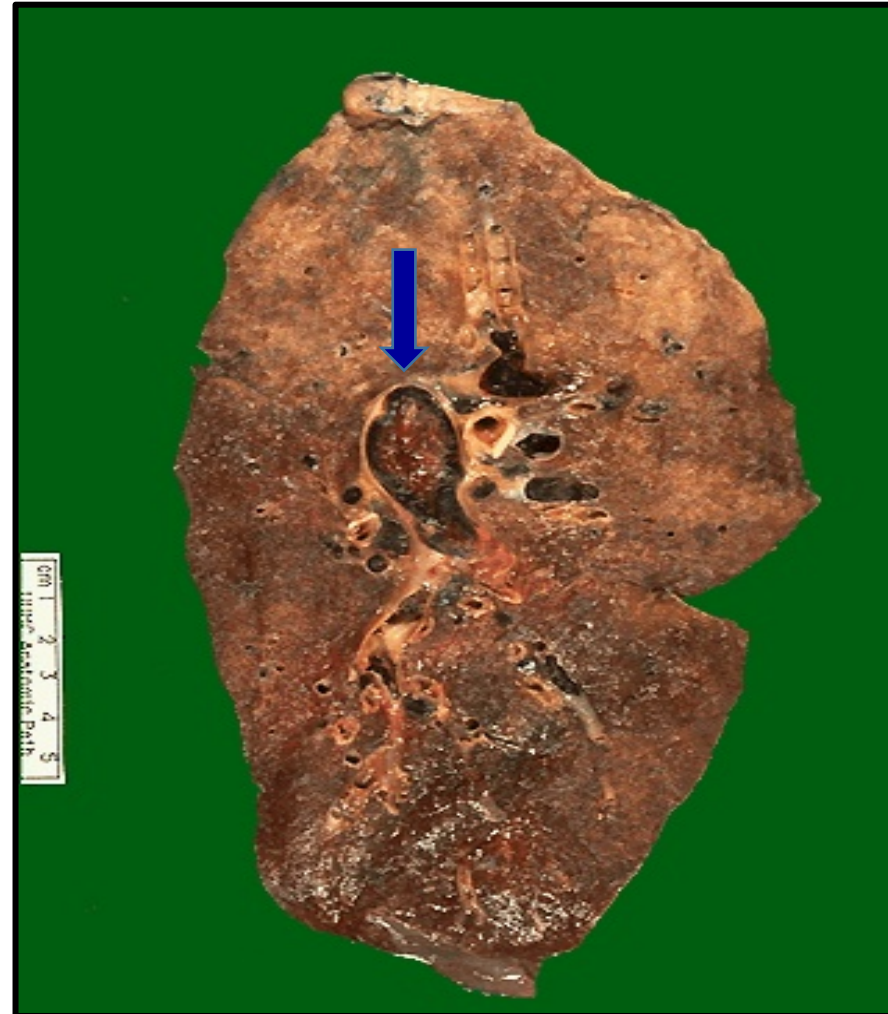
At high magnification, the alveolar exudate of mainly neutrophils is seen. The surrounding alveolar walls have capillaries that are dilated and filled with RBC's. Such an exudative process is typical for bacterial infection. This exudate gives rise to the productive cough of purulent yellow sputum seen with bacterial pneumonias

PULMONARY EMBOLUS AND INFARCTION

Thromboembolism in the Lung – Gross

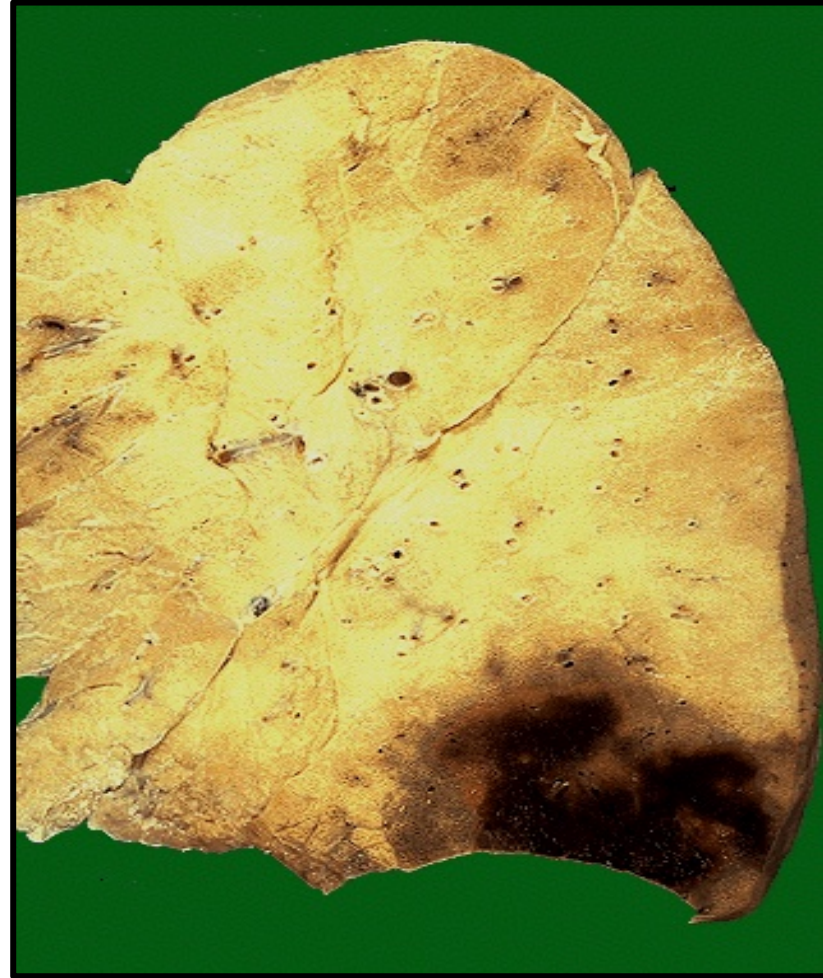
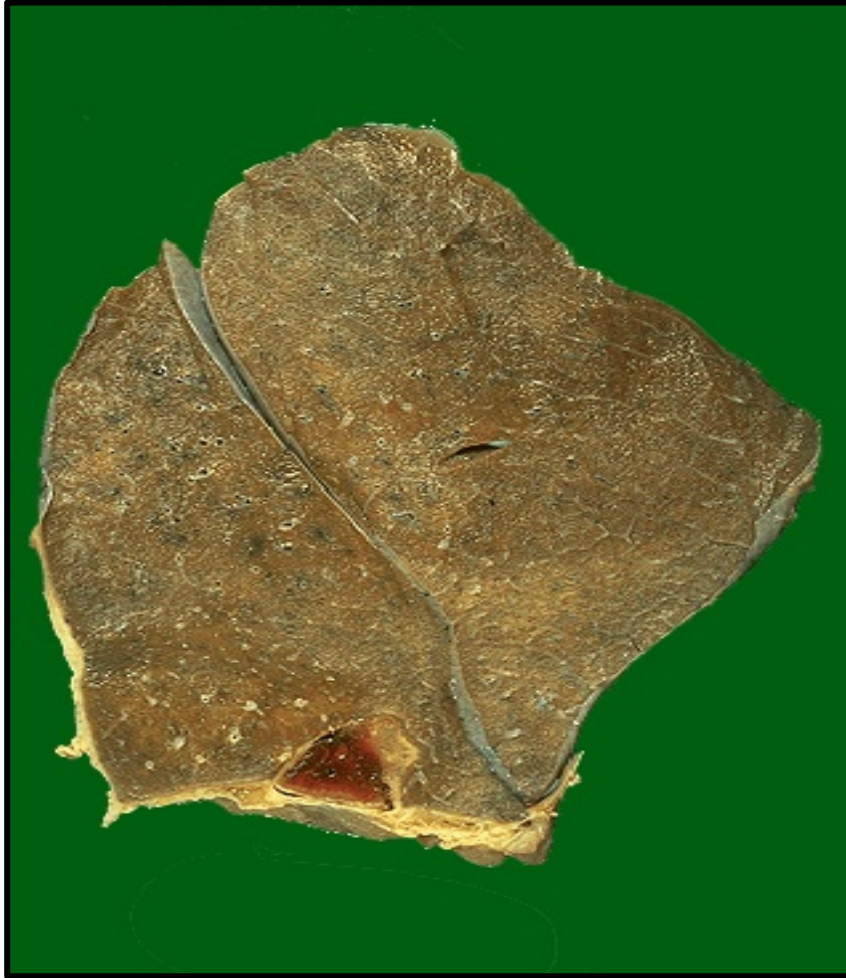
Predisposing factors :

- Prolonged bed rest
- Contraceptive pills
- Deep vein thrombosis
- Immobility
- Hypercoagulability
- Carcinomatosis



A large pulmonary thromboembolus is seen in the pulmonary artery to the left lung. Such thromboemboli typically originate in the leg veins or pelvic veins of persons who are immobilized

Thromboembolism in the Lung – Gross



Large thromboemboli can cause death. Medium sized thrombemboli (blocking a pulmonary artery to a lobule or set of lobules) can produce the lesion seen here -a hemorrhagic pulmonary infarction which is a wedge-shaped and based on the pleura.

Pulmonary embolus and infarction in the Lung

A Longitudinal transection of a lung showing a wedge shaped peripheral hemorrhagic infarction

A thrombus is seen in a major branch of pulmonary artery (arrow head)



Pulmonary Embolus with infarction – CT scan



CT scan - white arrows show pulmonary embolus with lung infarction

Pulmonary artery thromboembolus - LPF



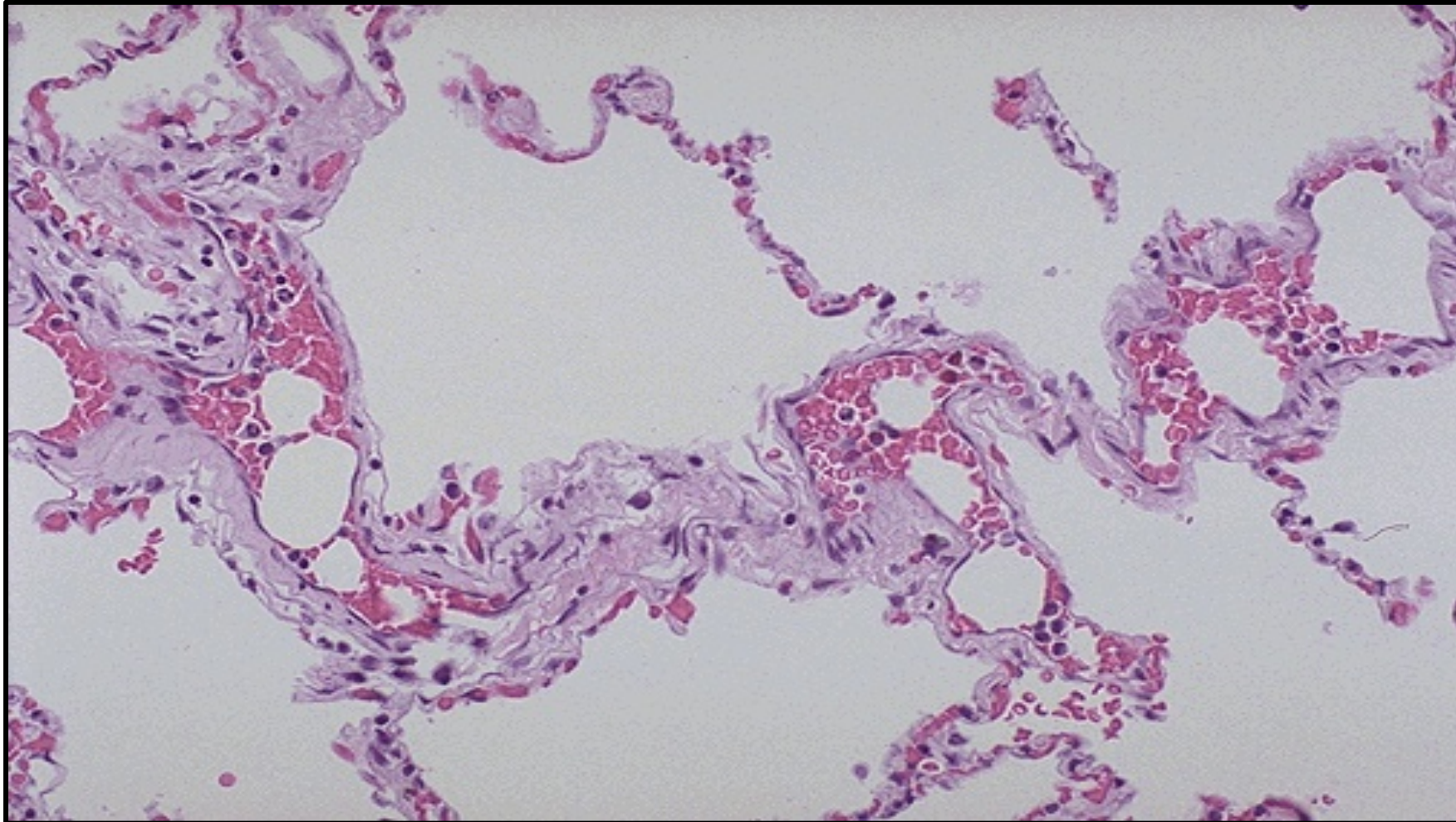
Microscopic appearance of a pulmonary thromboembolus in a large pulmonary artery. There are interdigitating areas of pale pink and red that form the "lines of Zahn" characteristic for a thrombus.

Small pulmonary artery thromboembolus - HPF



A small peripheral pulmonary artery thromboembolus. If these small PE are showered into the pulmonary circulation at once or over a period of time will lead to pulmonary hypertension.

Fat Embolism in the Lung - HPF



The rounded holes that appear in the vascular spaces here in the lung are fat emboli. Fat embolization syndrome occurs most often following trauma with fracture of long bones that releases fat globules into the circulation which are trapped in pulmonary capillaries