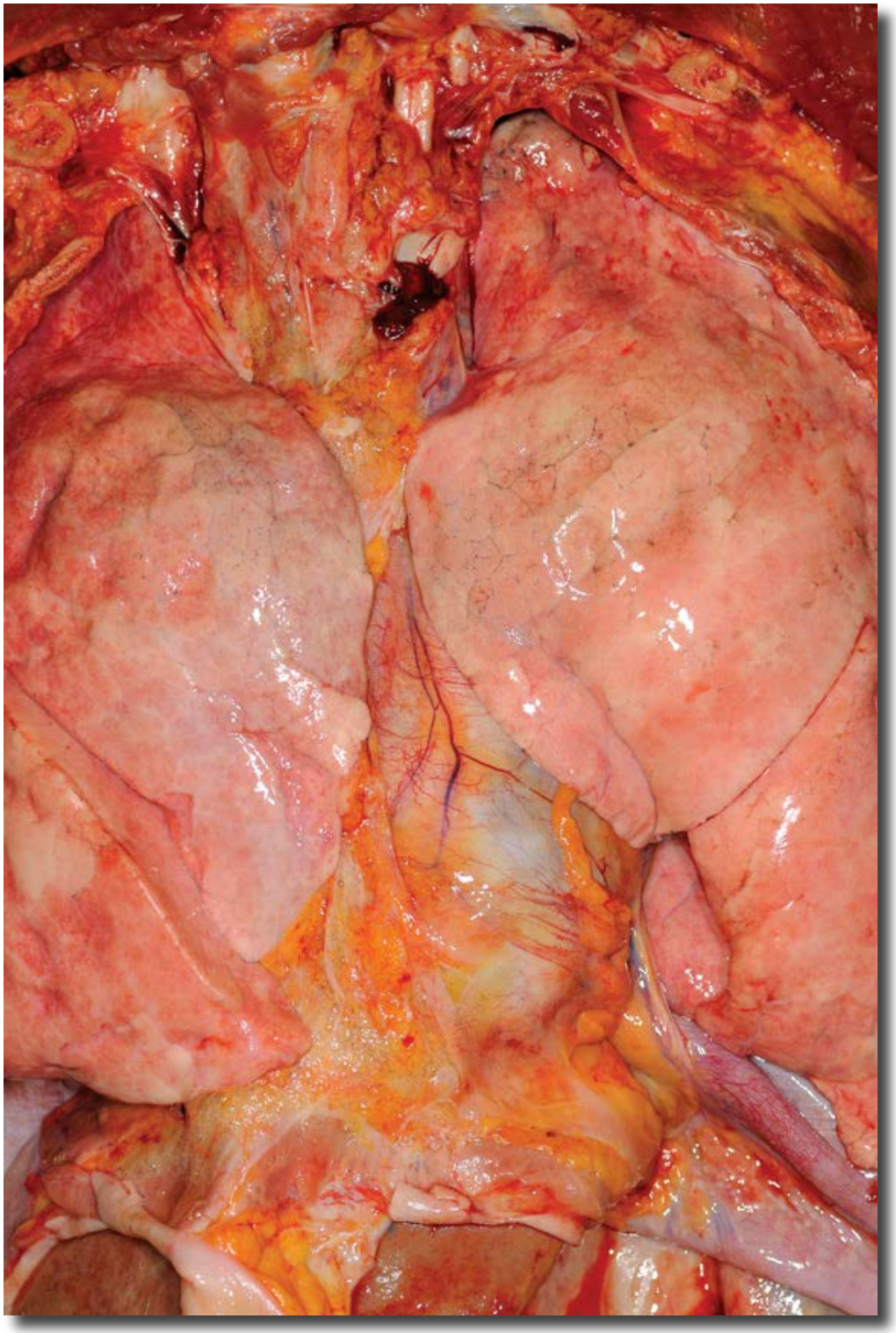
Respiratory Diseases I

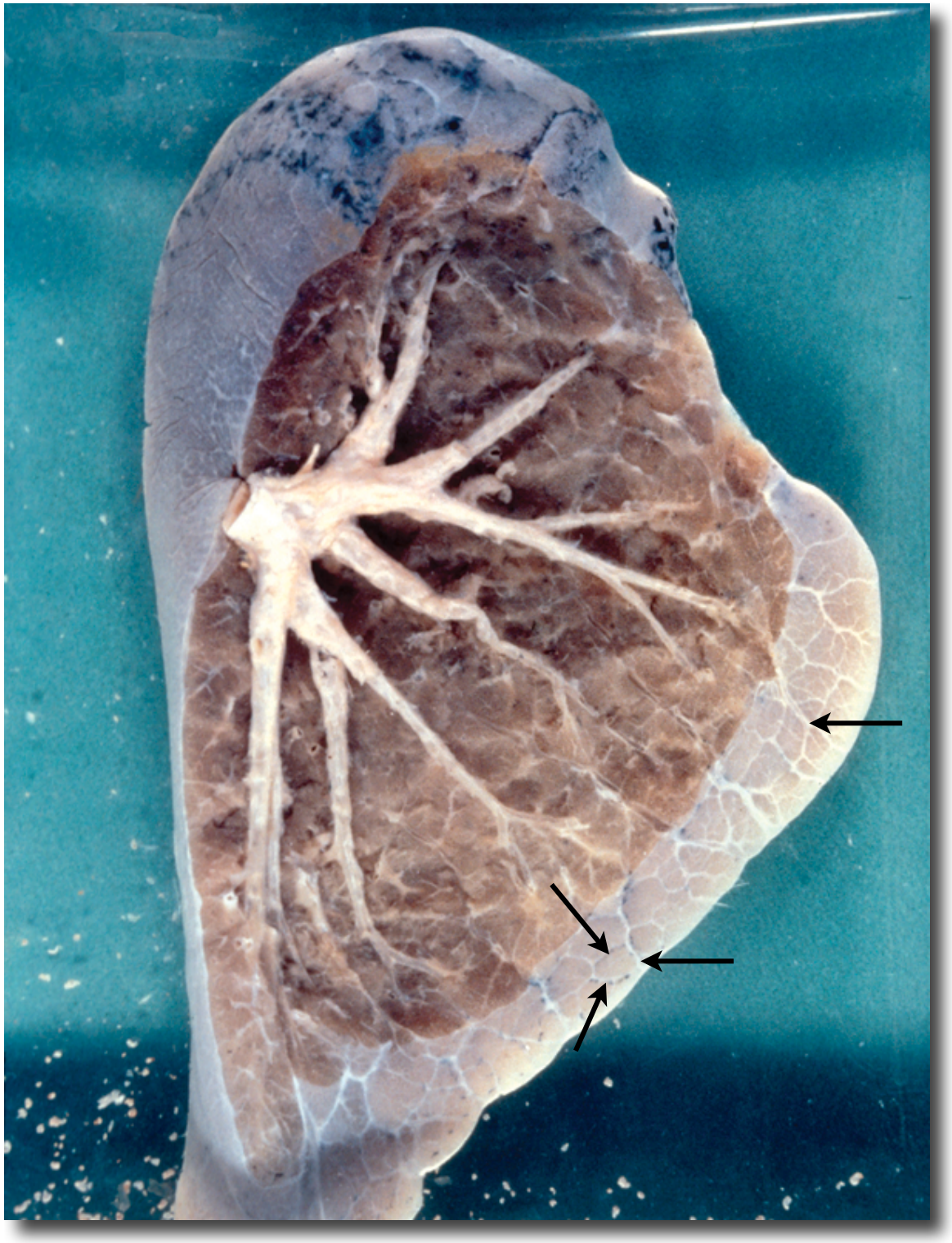
Henry Sánchez, M.D.

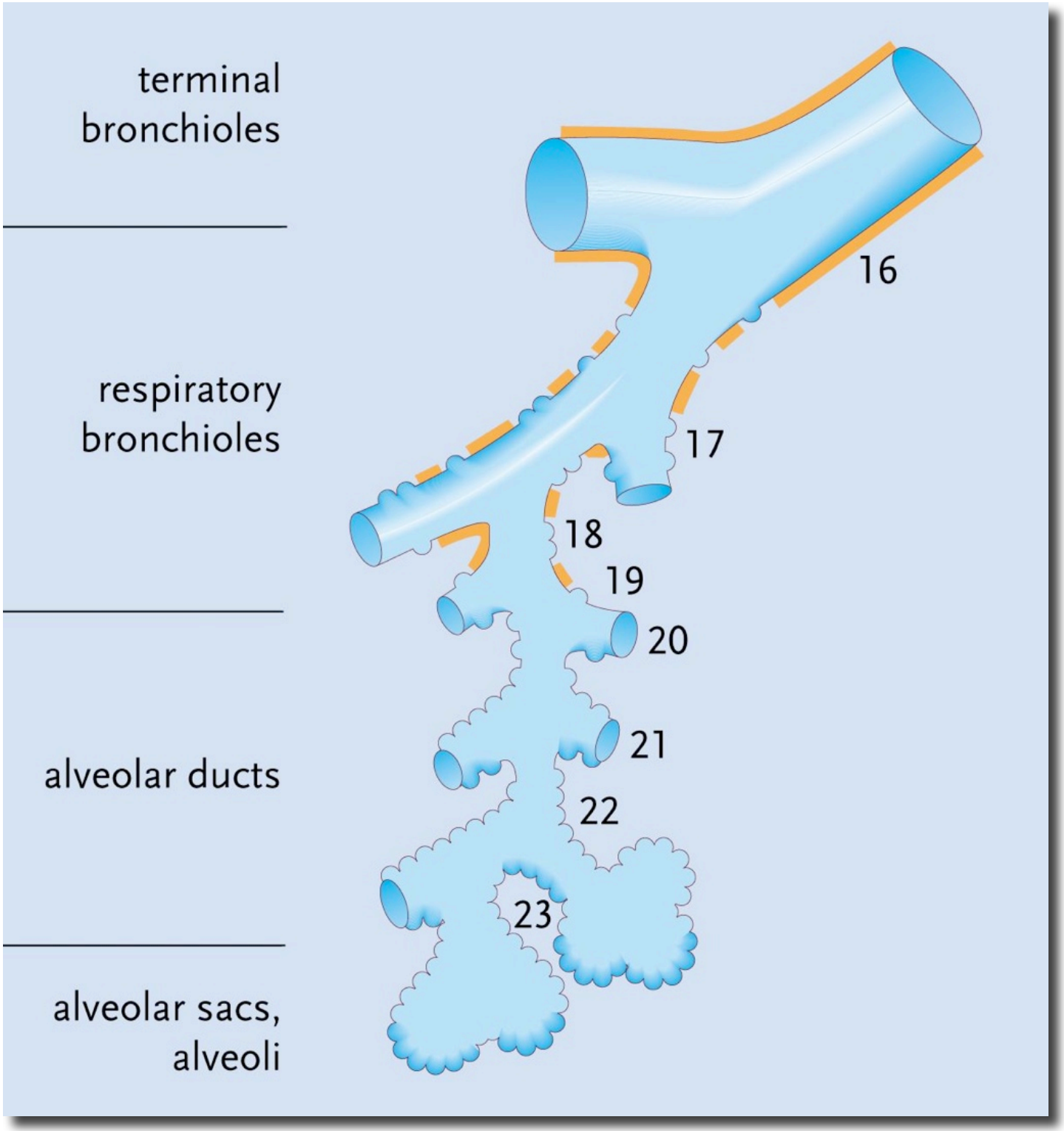
Normal Lungs

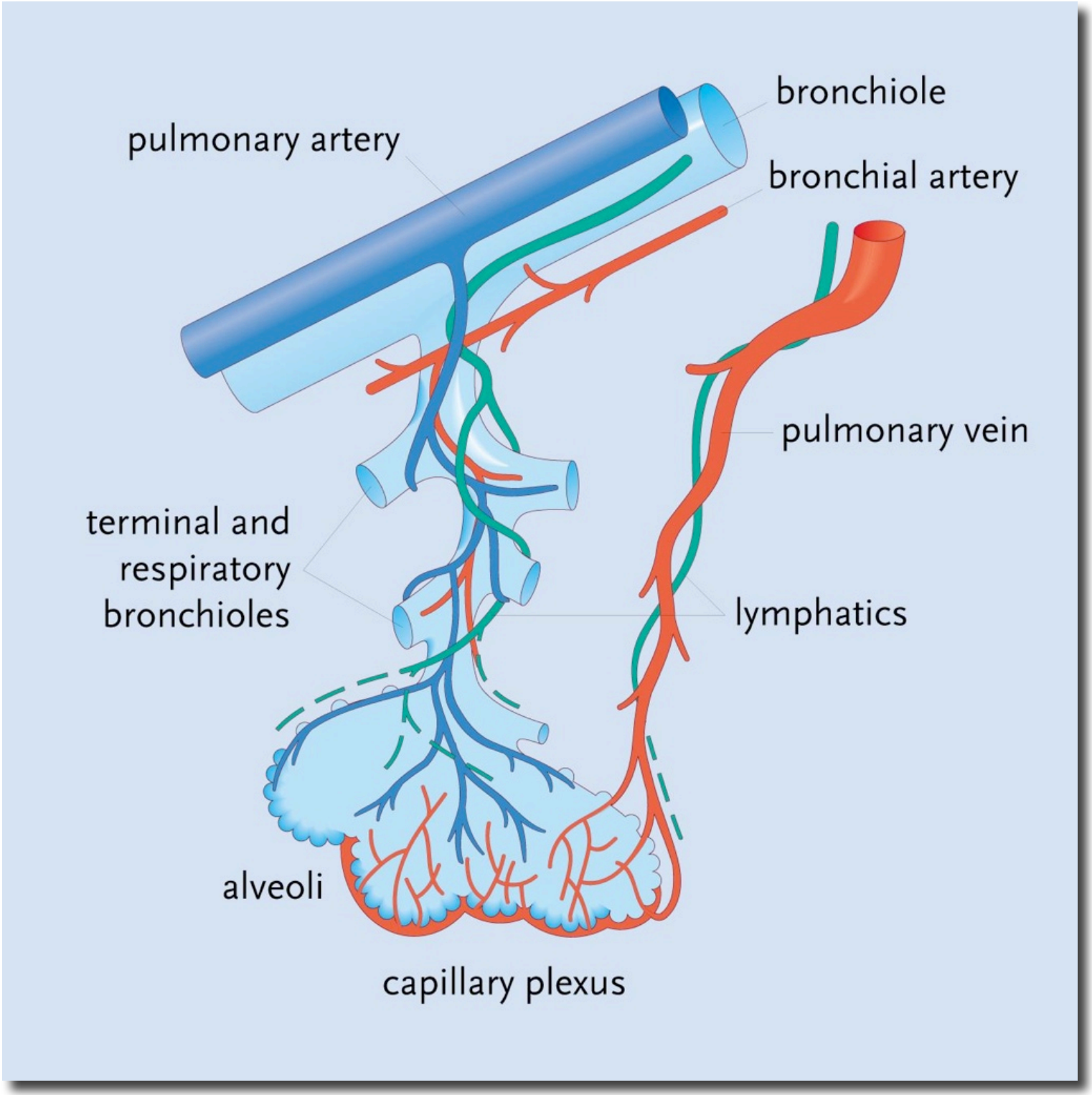


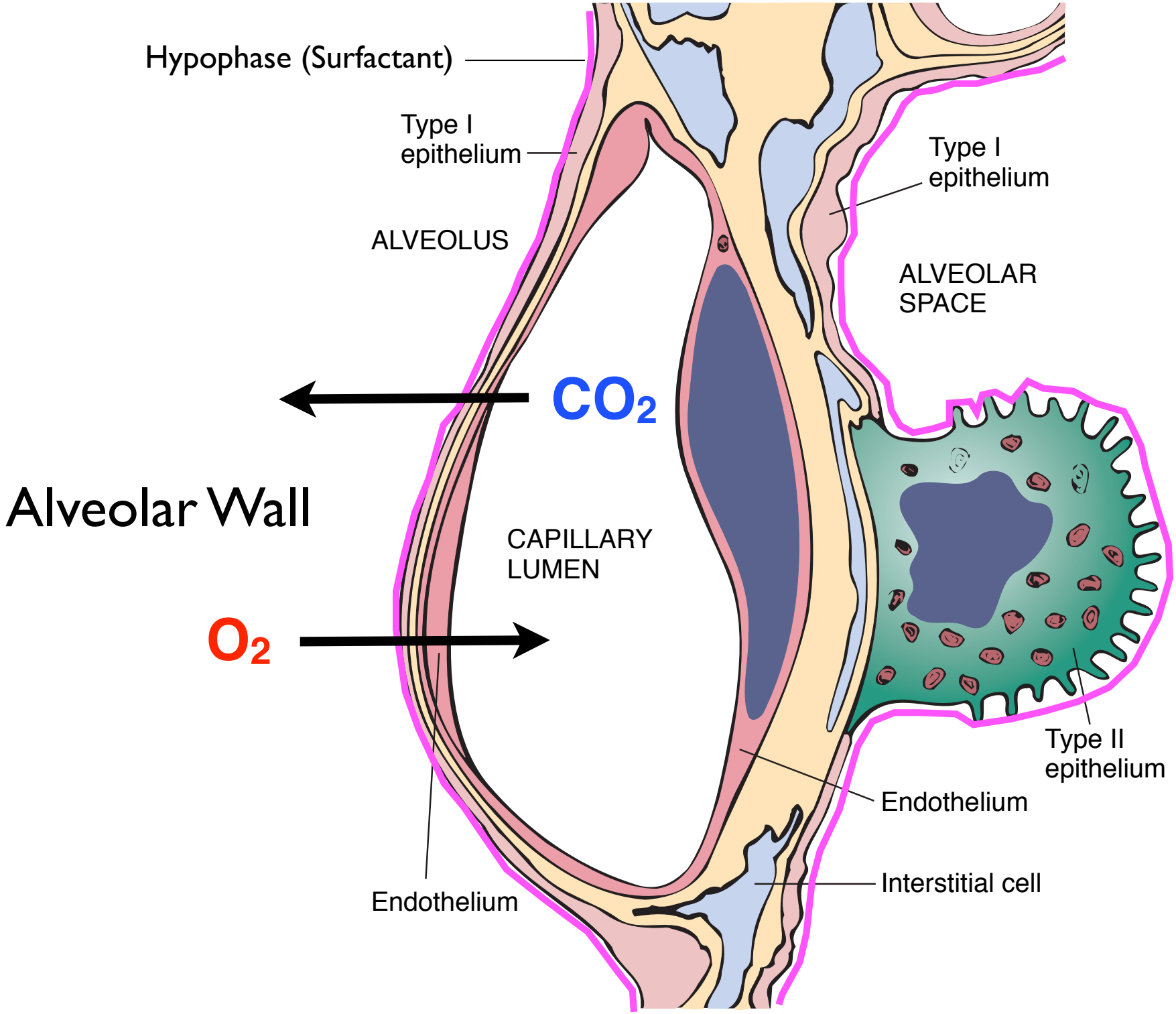
Normal Lung

Normal Lung

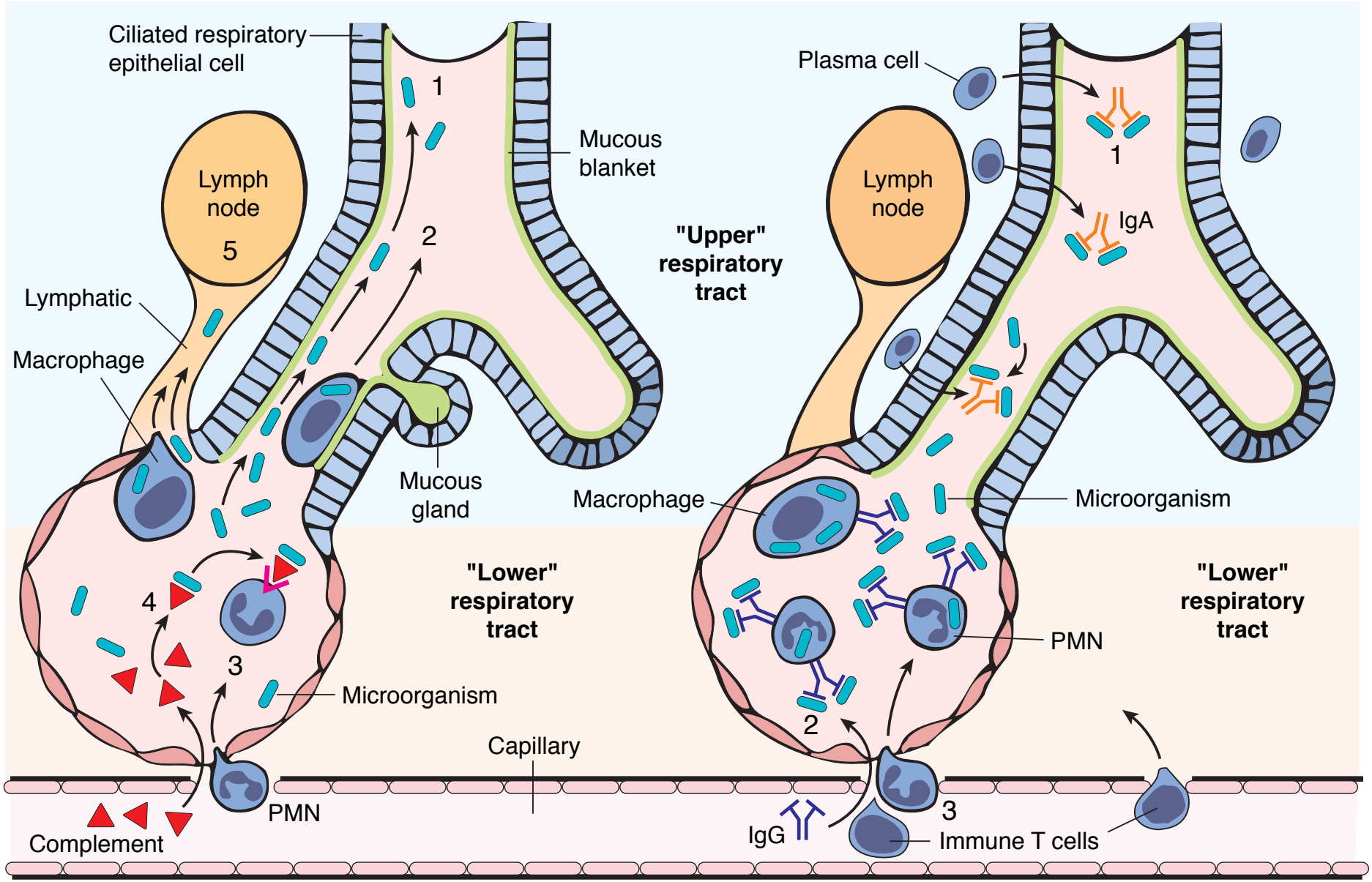



terminal bronchioles
respiratory bronchioles
alveolar ducts
alveolar sacs, alveoli
16
17
18
19
20
21
22
23

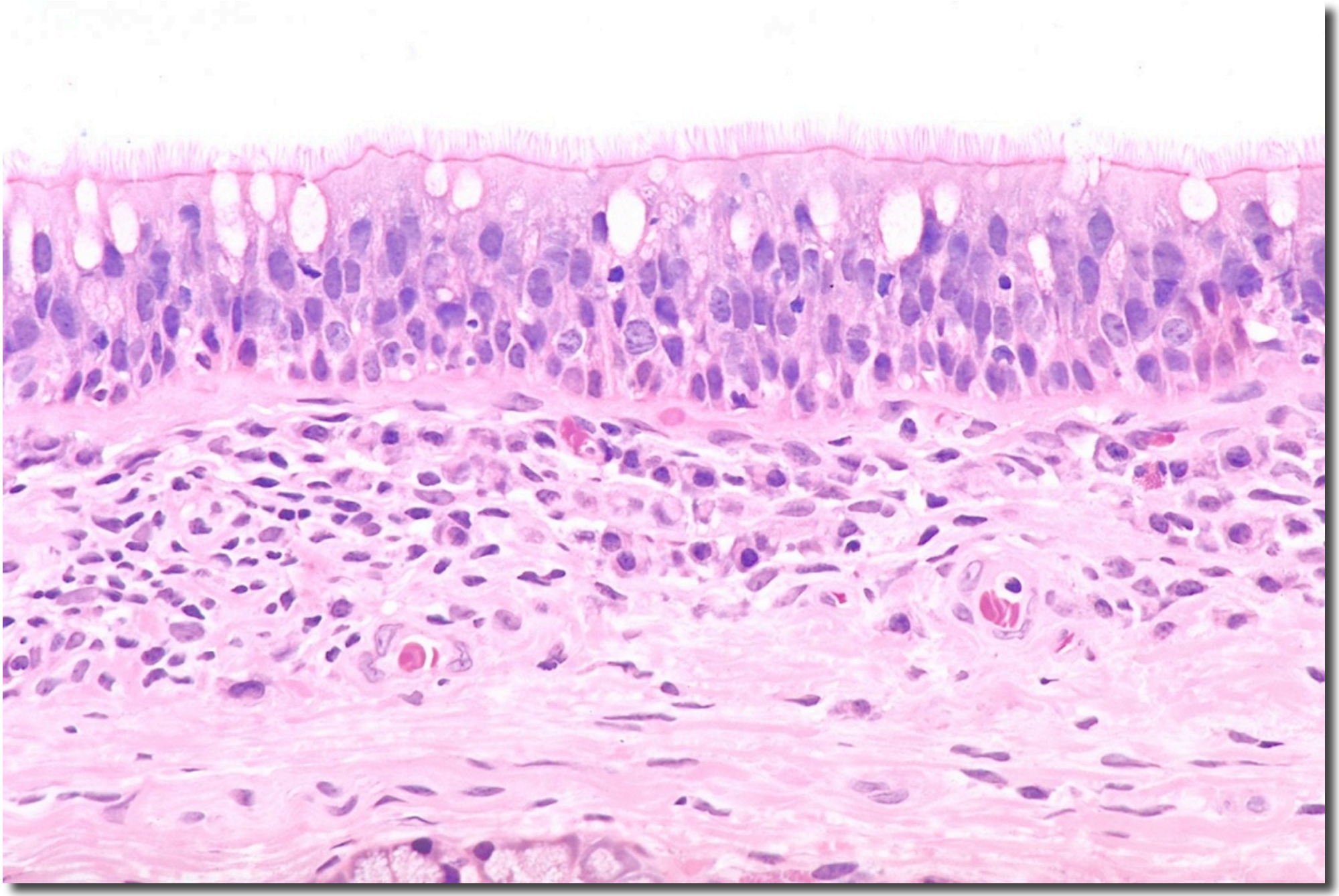

bronchiole
pulmonary artery
bronchial artery
pulmonary vein
terminal and
respiratory
bronchioles
lymphatics
alveoli
capillary plexus


Hypophase (Surfactant)
Type I epithelium
ALVEOLUS
Type I epithelium
ALVEOLAR SPACE
CO_2
Alveolar Wall
CAPILLARY LUMEN
O_2
Type II epithelium
Endothelium
Endothelium
Interstitial cell

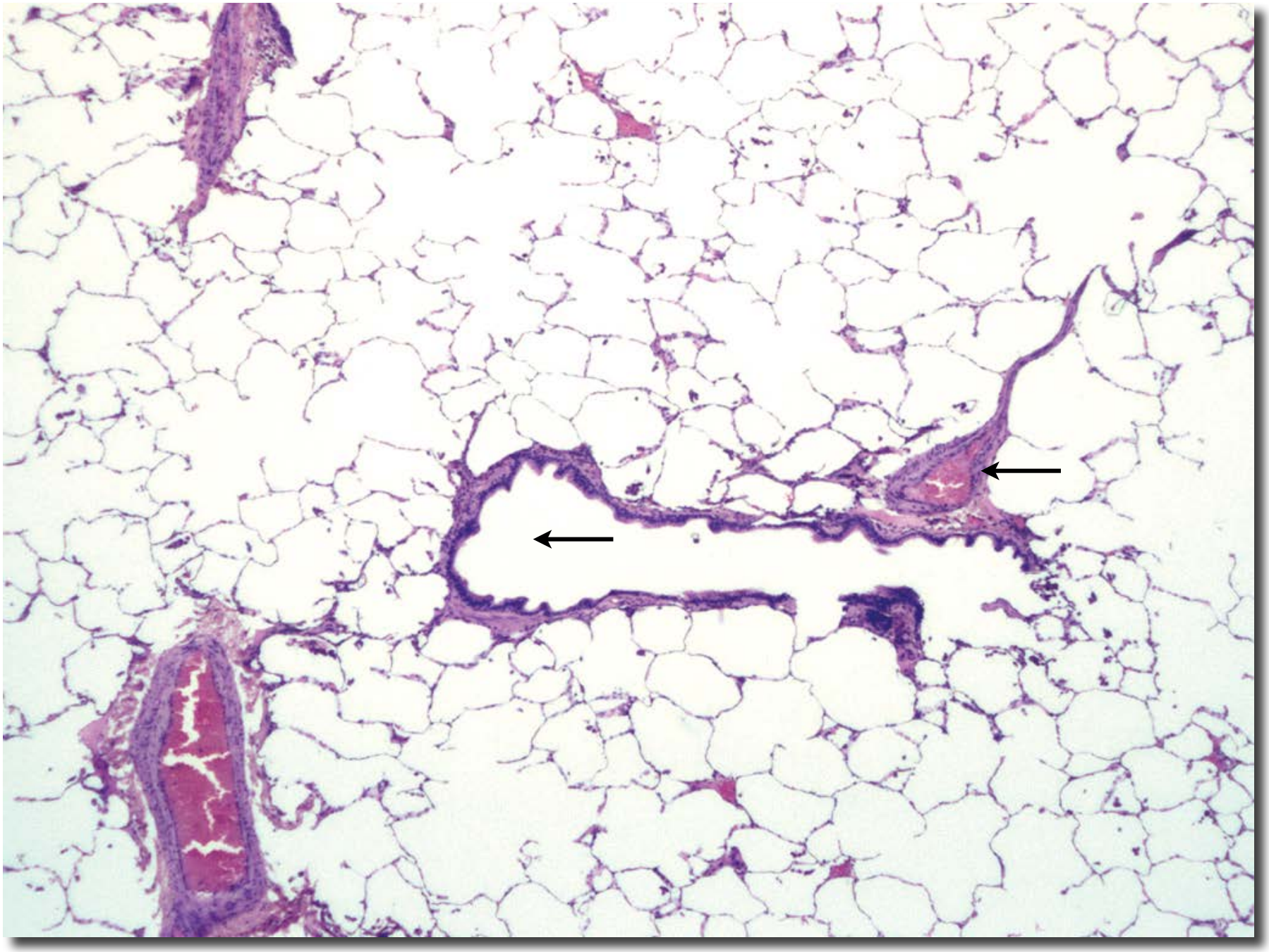
Pulmonary Defense Mechanisms



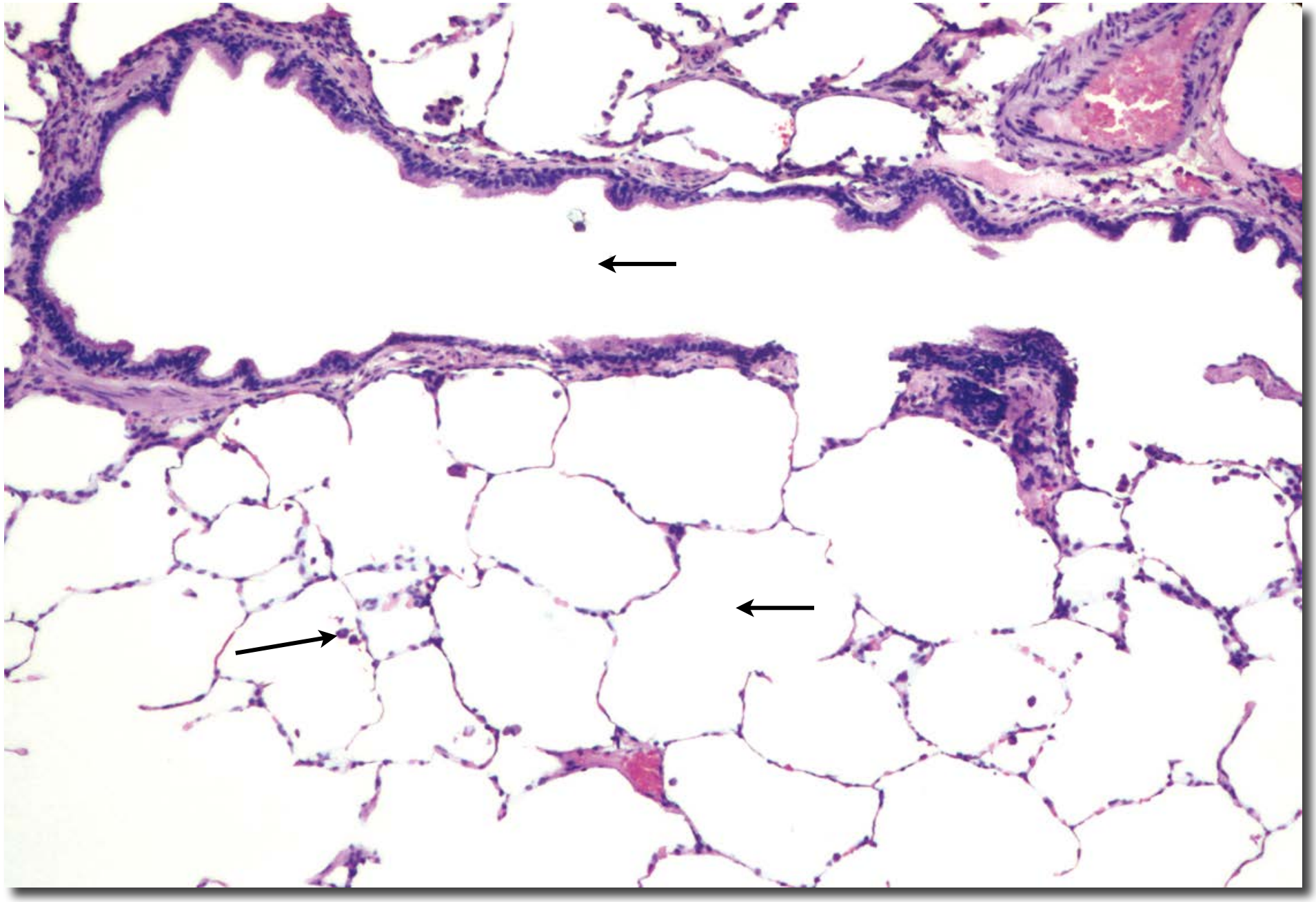
Respiratory Epithelium: Ciliated Pseudostratified Columnar Epithelium



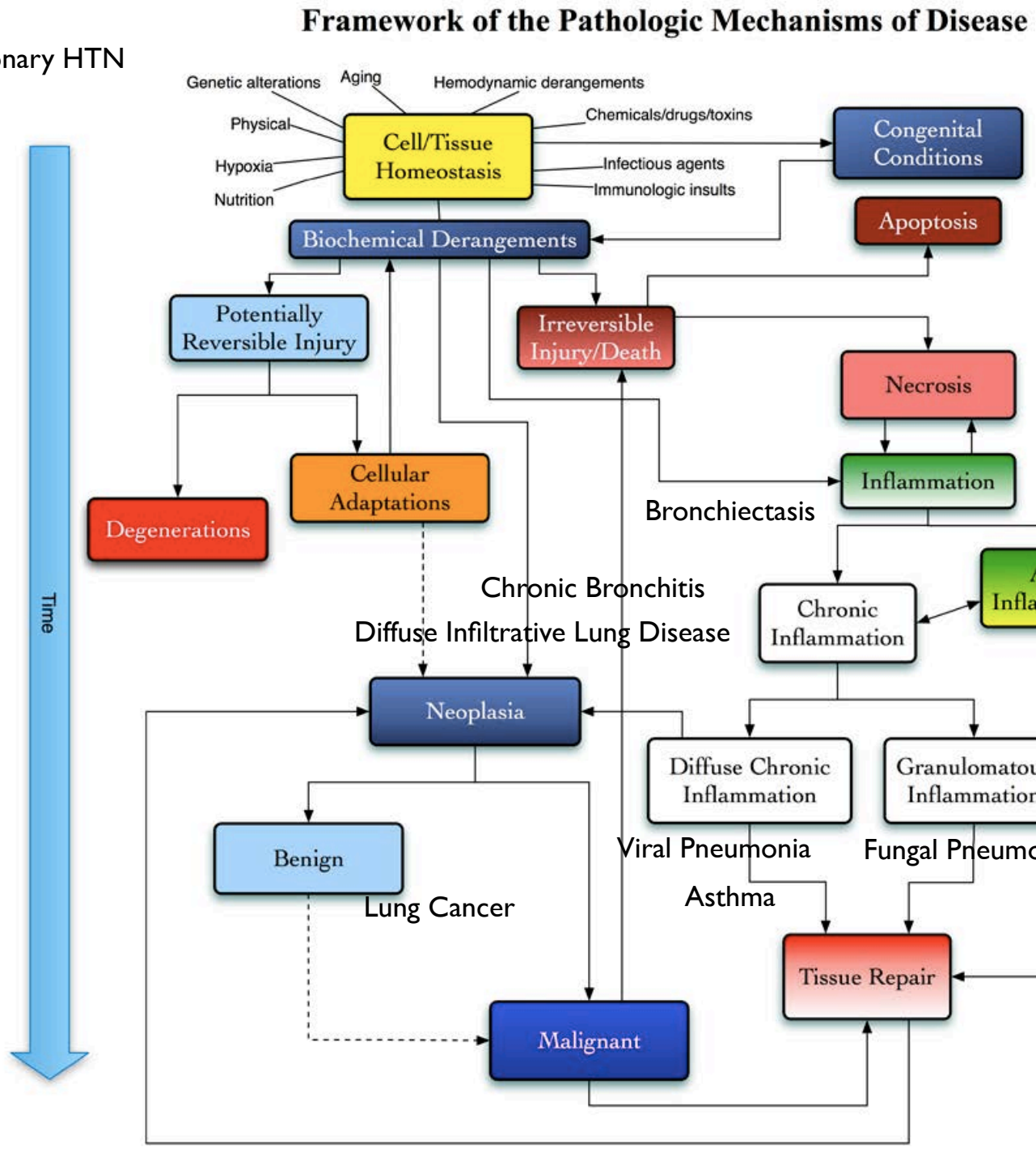
Normal Lung



Normal Lung



Pulmonary HTN



Pulmonary Embolus

Bronchiectasis

Bacterial Pneumonia

Chronic Bronchitis

Diffuse Infiltrative Lung Disease

Emphysema

Tuberculosis

Viral Pneumonia

Fungal Pneumonia

Asthma

Lung Cancer

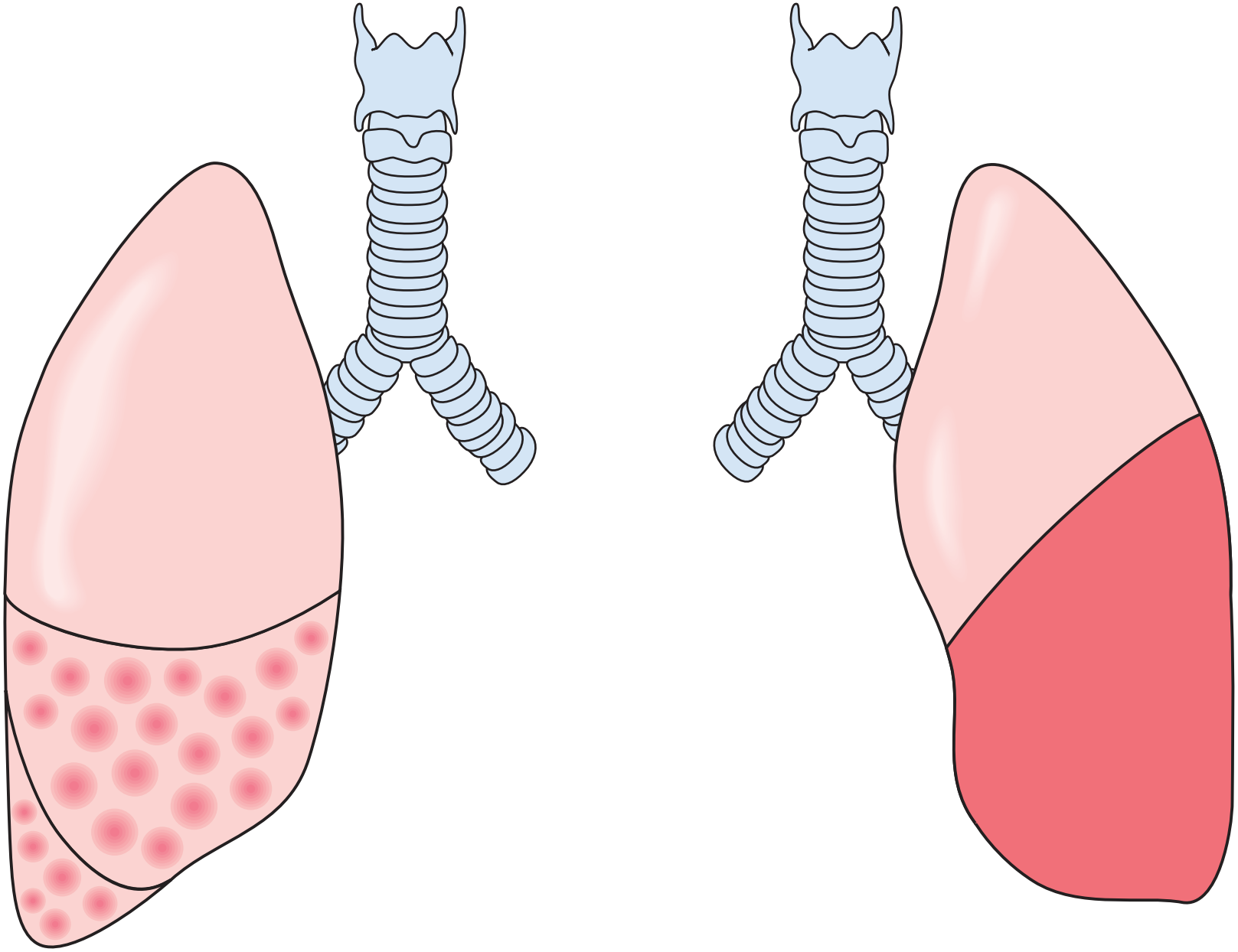
Pulmonary Infections

- Definition
  - Inflammation of the lungs = pneumonitis or pneumonia
- Cause 8.5% of the hospitalizations in US
- Nosocomial pneumonia - 0.7%
  - 13% occurs in Intensive Care Units
- Occurs in one third of immunocompressed patients

Pulmonary Infections

- Classification of pneumonias
  - Acute versus chronic pneumonia
  - Alveolar versus interstitial pneumonia
  - Primary (previously health individual) vs secondary (underlying disease predisposing to lung infection)
  - Etiology

Patterns of Pneumonia



Bronchopneumonia

Lobar pneumonia

Lobar Pneumonia

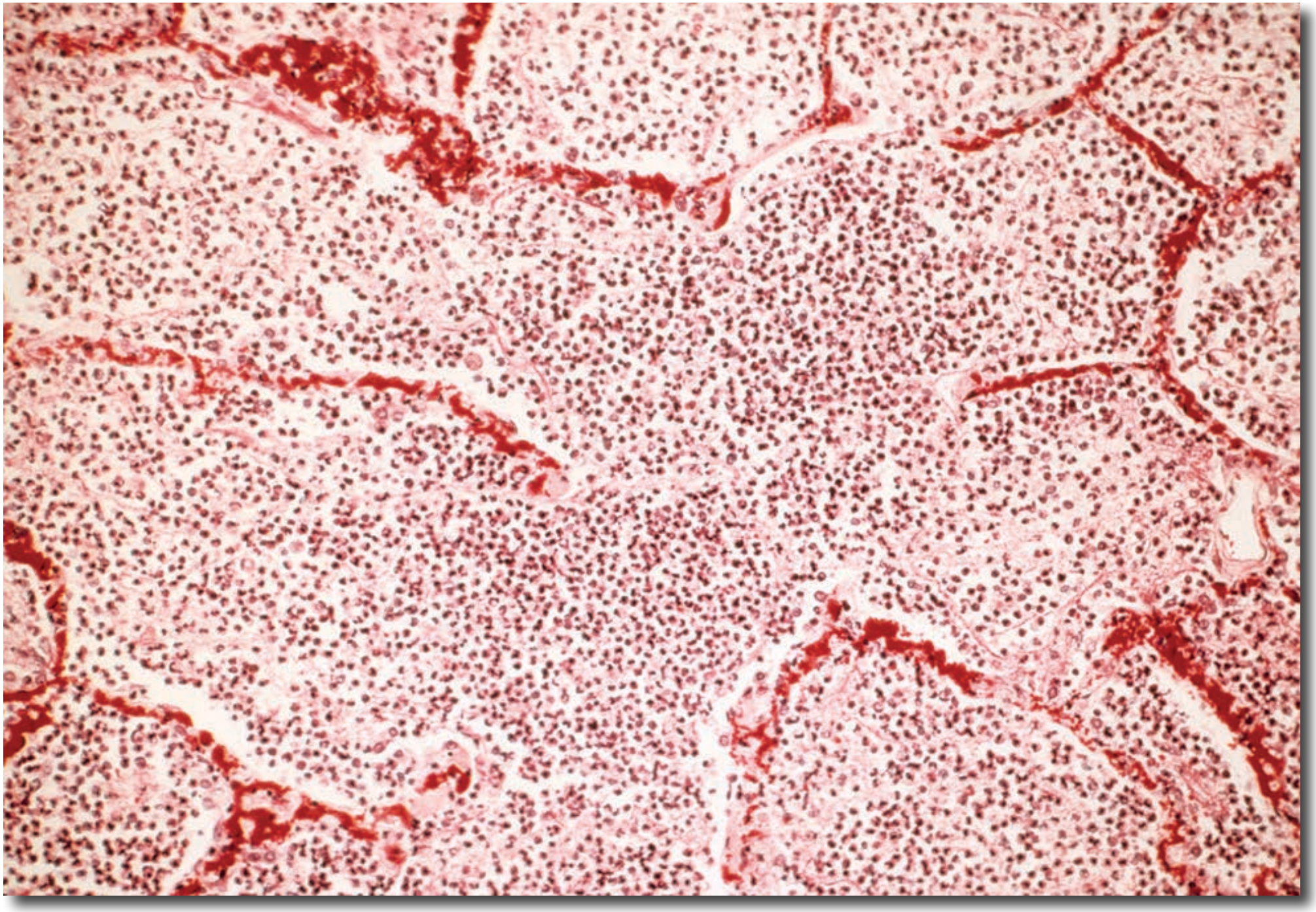
- Etiology
  - 90% *Streptococcus pneumoniae* (most commonly types 1, 2, 3, 7)
  - Other bacterial organisms include *Klebsiella pneumoniae*, *Staphylococcus aureus*, *Hemophilis influenzae*, *Pseudomonas aeruginosa*, *Proteus* species

Lobar Pneumonia

- Morphology
  - Congestion (hyperemia) - vascular dilatation and serous exudate
  - Red hepatization (days 1-3) - neutrophils, fibrin, extravasated RBC's and bacteria
  - Gray hepatization (days 4-8) - formation of a fibrinous network, degenerating WBC's
  - Resolution (day 9) - dissolution of fibrin
- Clinical manifestations - sudden onset of shaking chills, fever, prostration, chest pain, cough, dyspnea, rusty sputum, leukocytosis

Lobar Pneumonia
("Gray Hepatization")

Lobar Pneumonia - “Gray Hepatization”



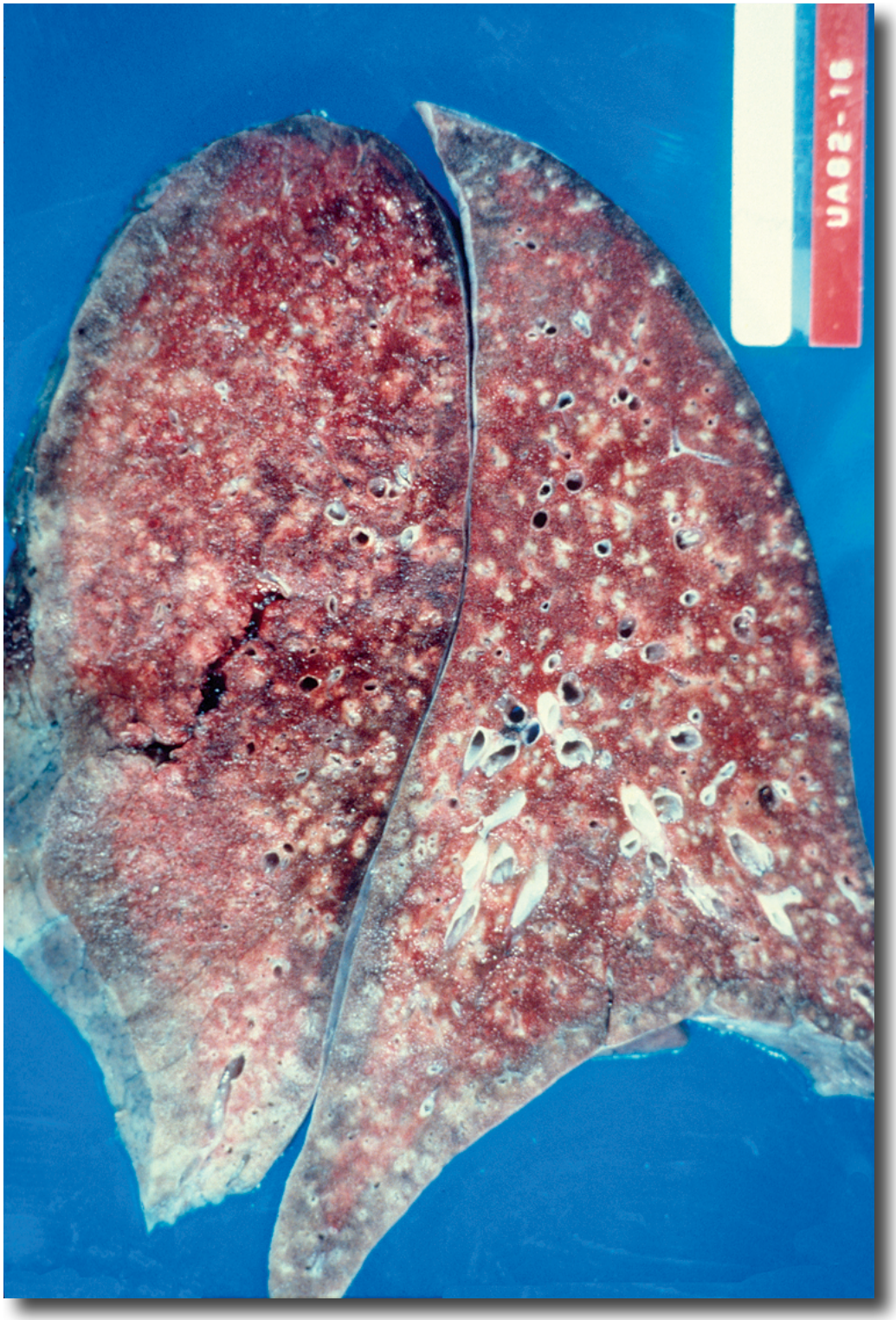
Bronchoneumonia

- Etiology
  - Most pathogenic bacteria - staphylococci, streptococci, *Hemophilis influenzae*, *Pseudomonas aeruginosa*, *Proteus* species
  - Secondary to lung congestion, aspiration, debilitation, or other respiratory tract disease

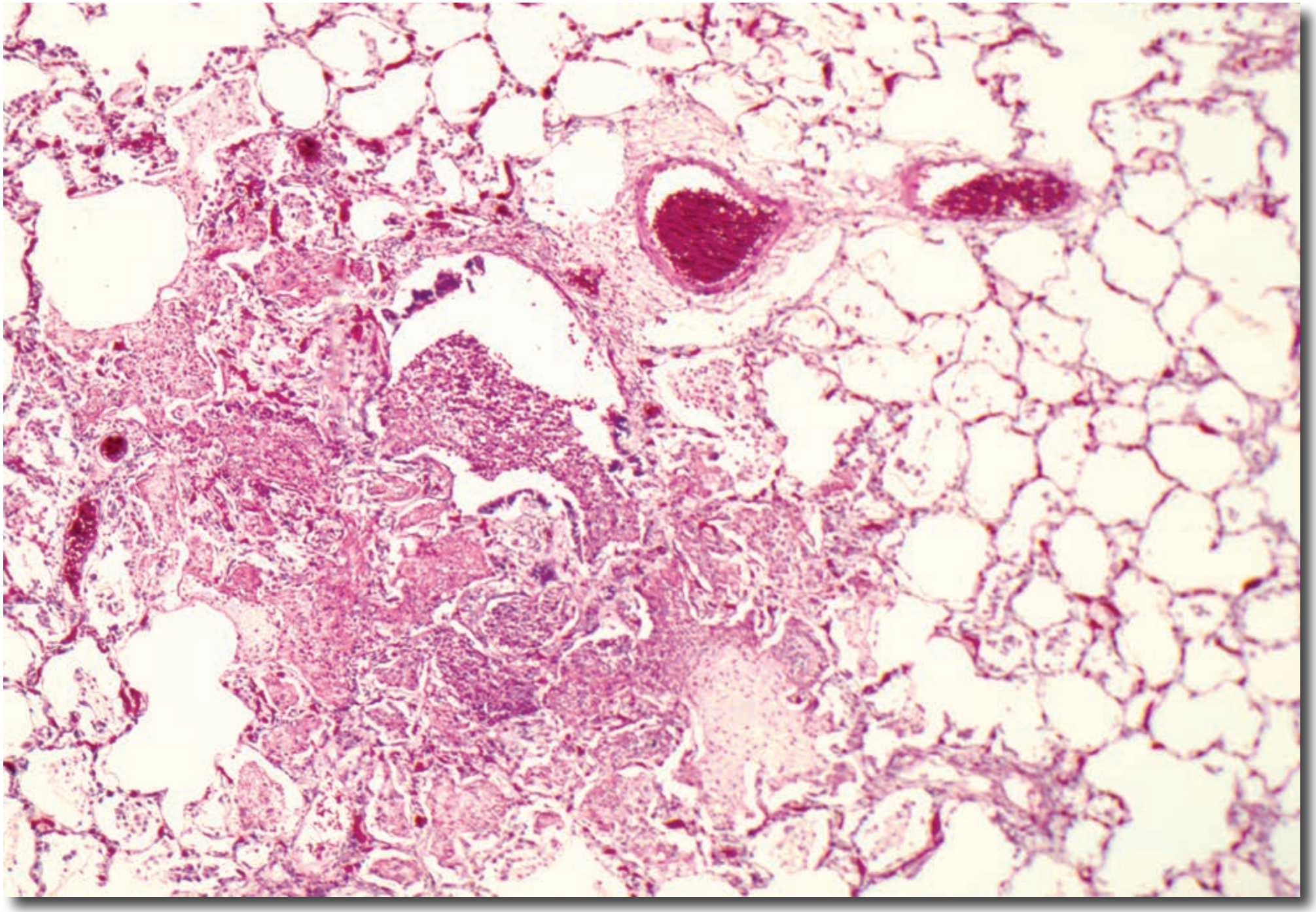
Bronchoneumonia

- Morphology
  - Inflammatory consolidation around small bronchi and bronchioles
  - Lesions are slightly elevated, dry, granular, gray-red to yellow
  - May become confluent
  - Airway lumens filled with neutrophils, fibrin, macrophages
- Clinical manifestations - variable including fever, cough, sputum production

Acute Bronchopneumonia



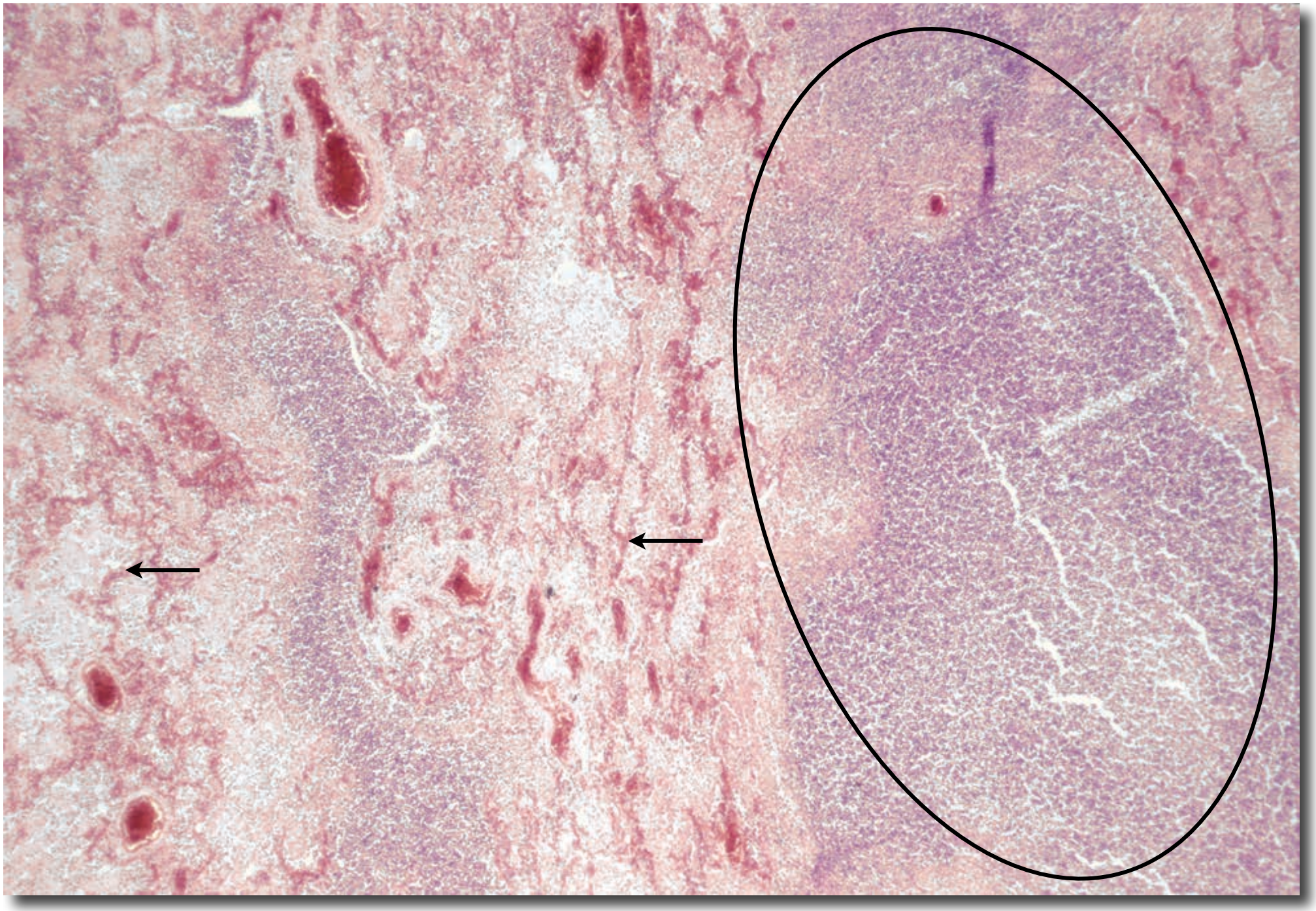
Acute Bronchopneumonia



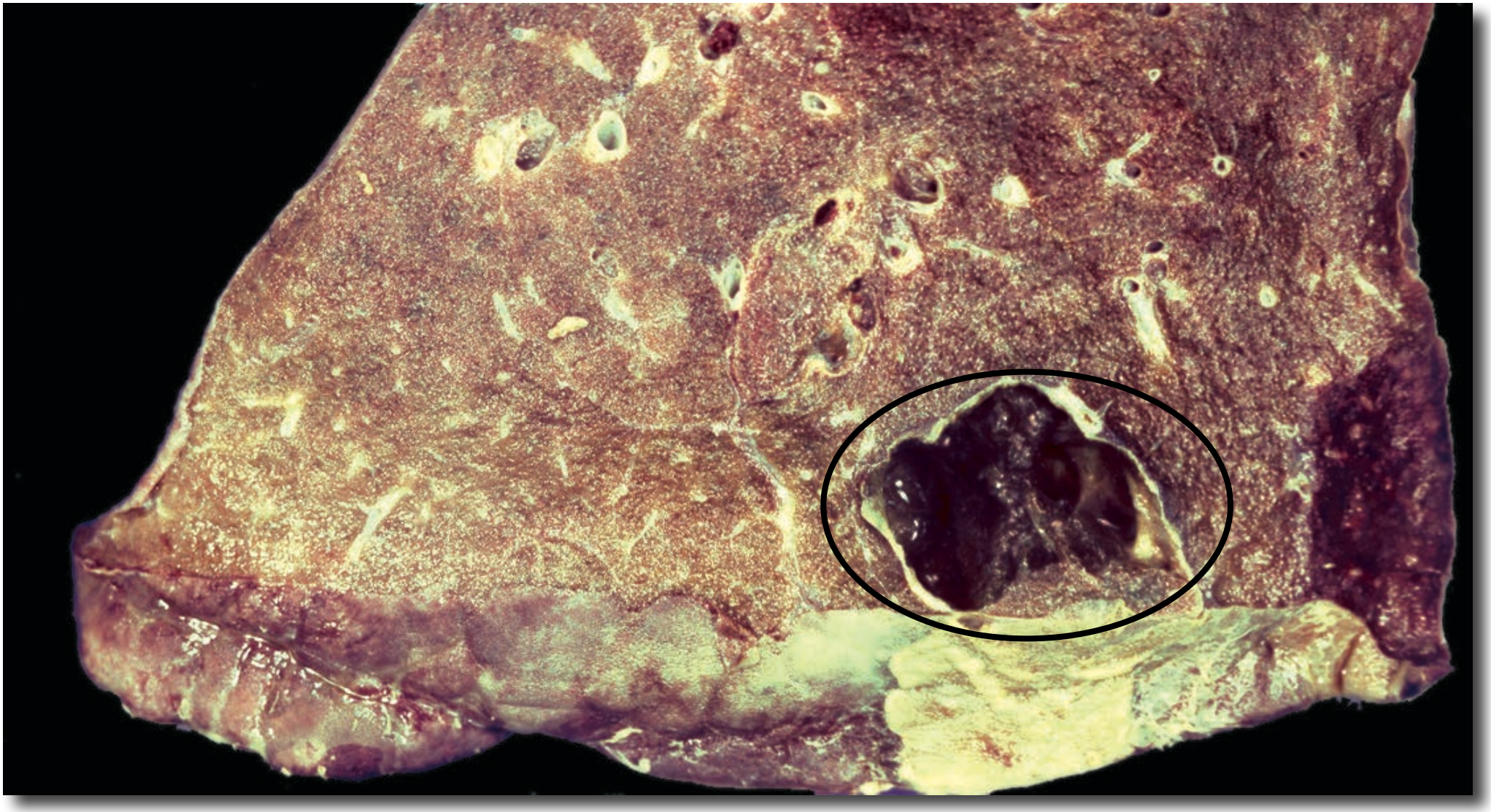
Pneumonia

- Complications
  - Abscess formation
  - Pleuritis, pleural effusions-fibrinous pleuritis (2/3 of cases)
  - Empyema (15-25% of cases)
  - Organization
  - Bacteremic dissemination (sepsis) more likely with lobar pneumonia (20-35%) than bronchopneumonia

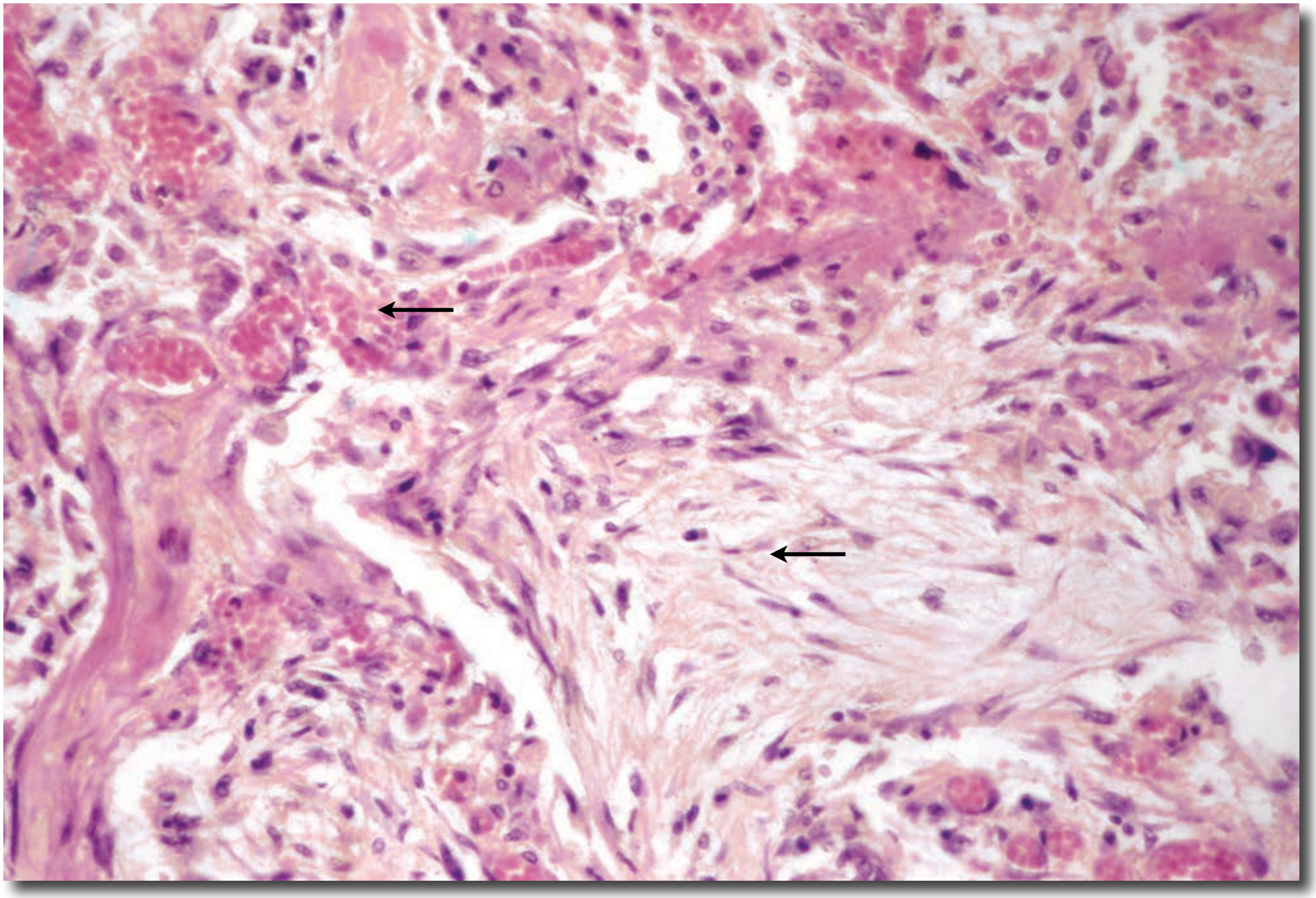
Lung Abscess



Lung Abscess



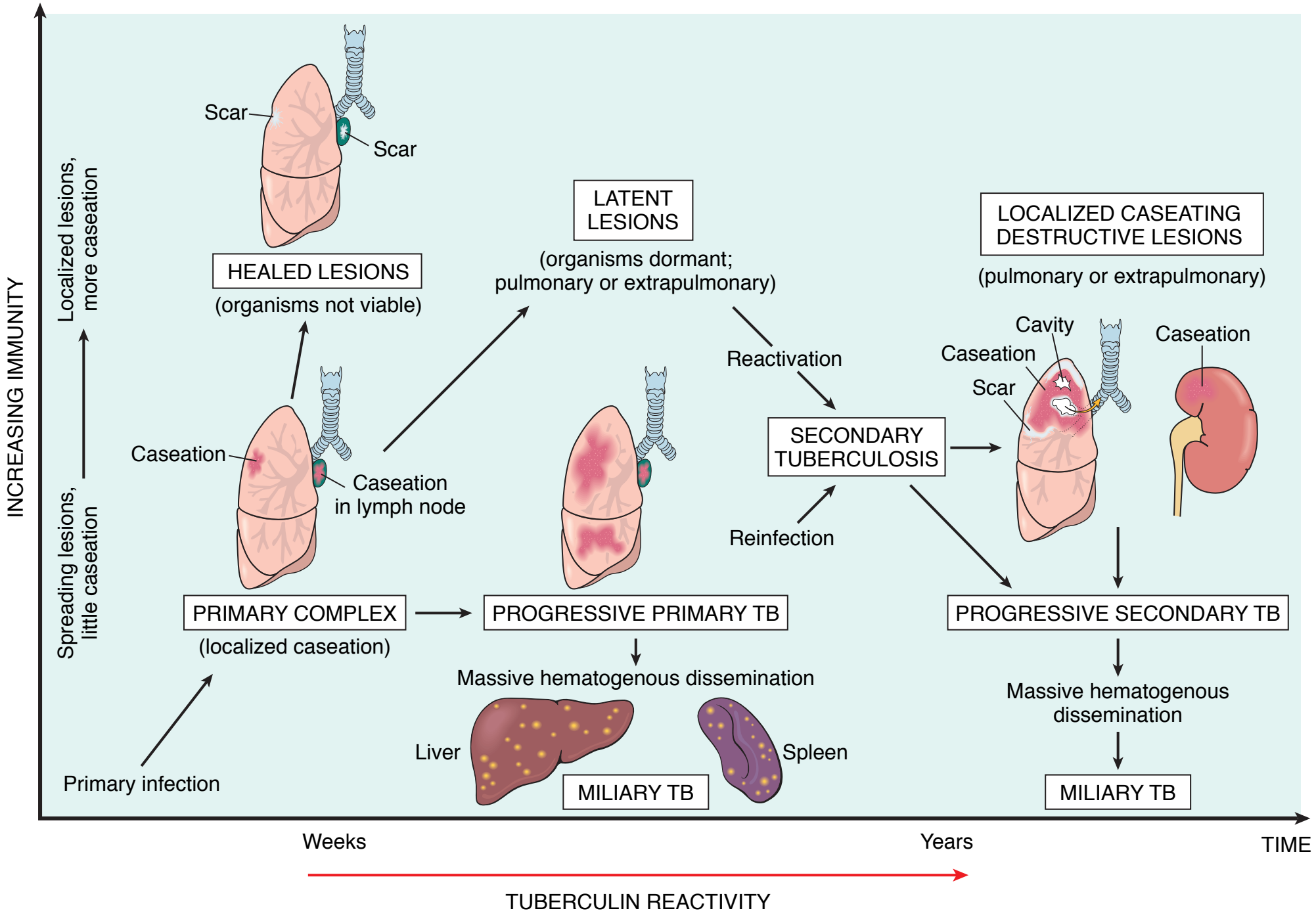
Organizing Pneumonia



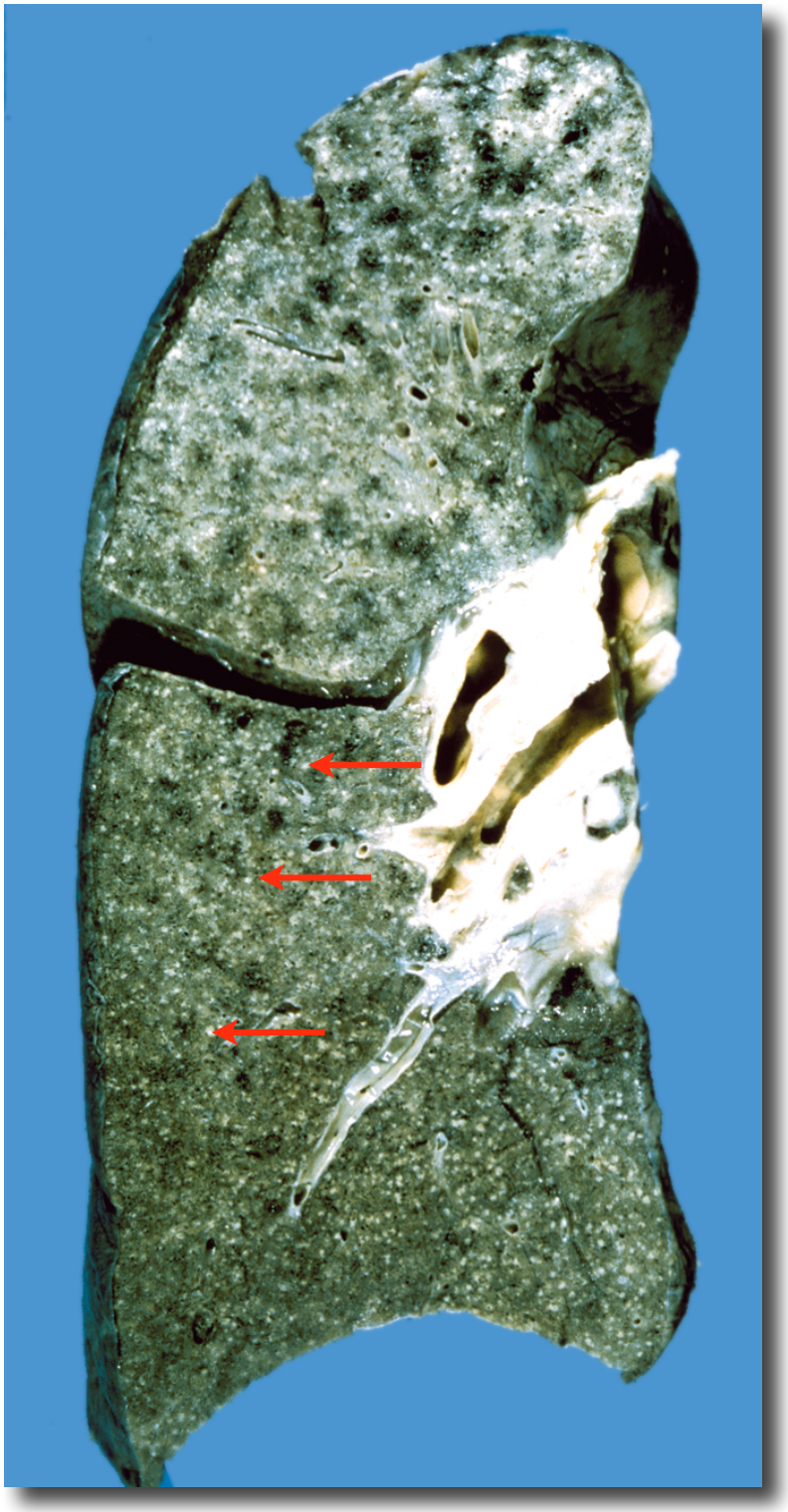
Tuberculosis

- Definition
  - Communicable disease resulting in necrotizing granulomatous inflammatory reactions
- World-wide - TB is a leading cause of death
- Death rate of TB in US declining, however incidence is increasing
- Increasing strains of drug-resistant *Mycobacterium tuberculosis hominus*

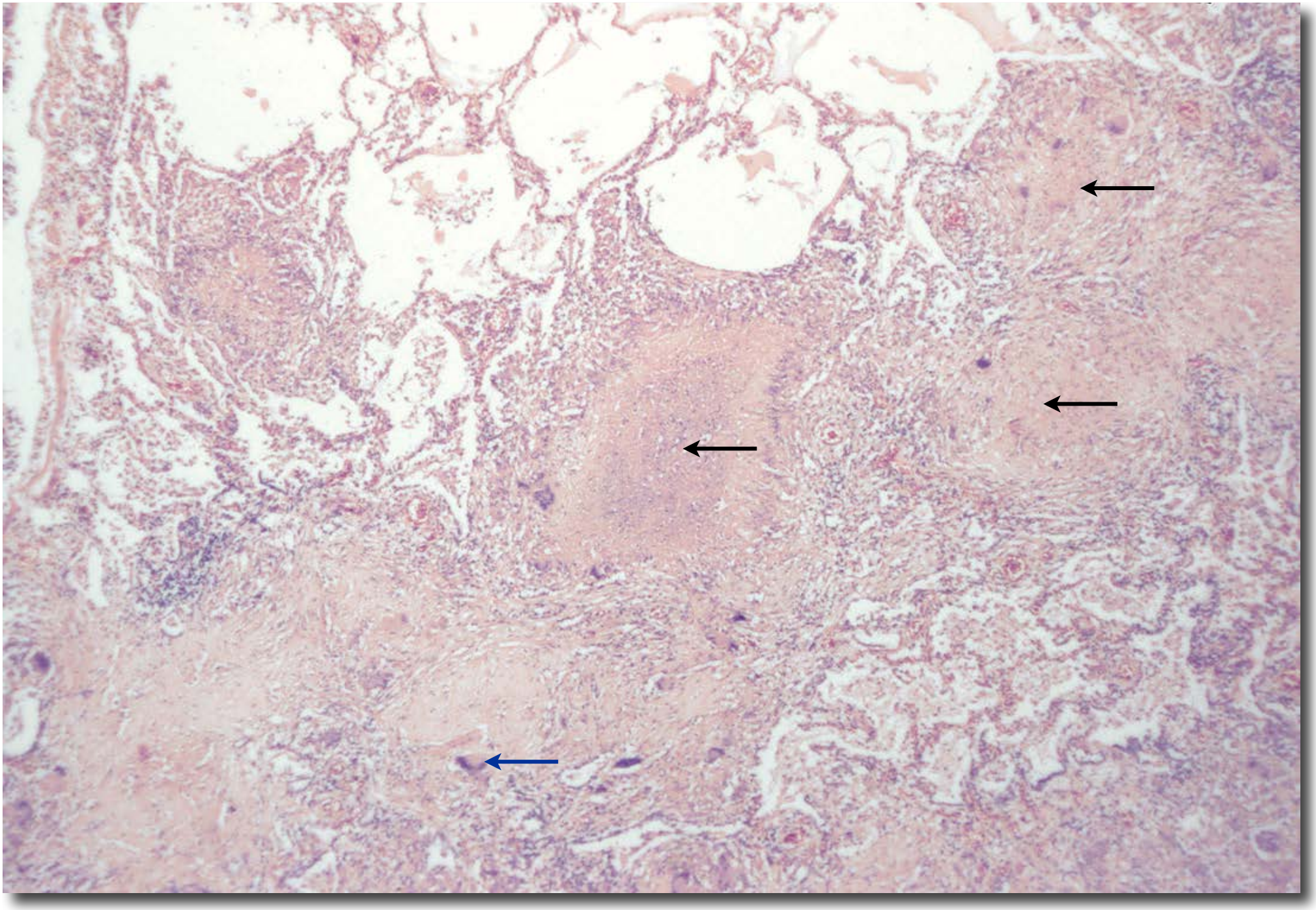
Pathogenesis of Tuberculosis



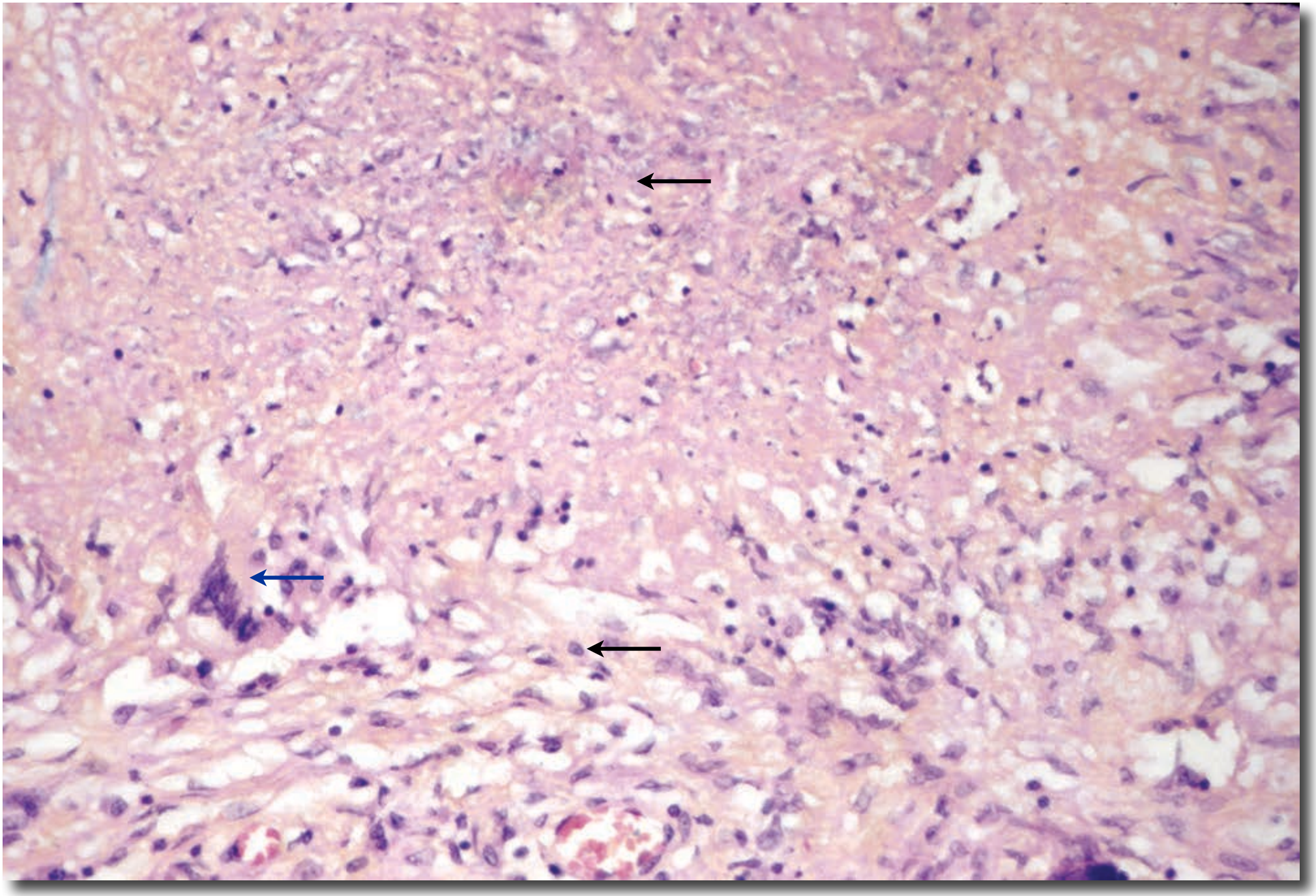
Miliary Tuberculosis



Miliary Tuberculosis



Caseating Granuloma



Secondary TB
(Simon Focus)

Fungal Pneumonia

- Definition
  - A visceral or deep mycosis leading to pneumonitis
- Can occur in otherwise health individuals
- Most frequently an opportunistic infection in chronic diseases
  - Cancer chemotherapy or radiation therapy
  - Prolonged antibiotic therapy
  - Immunosuppressive treatment

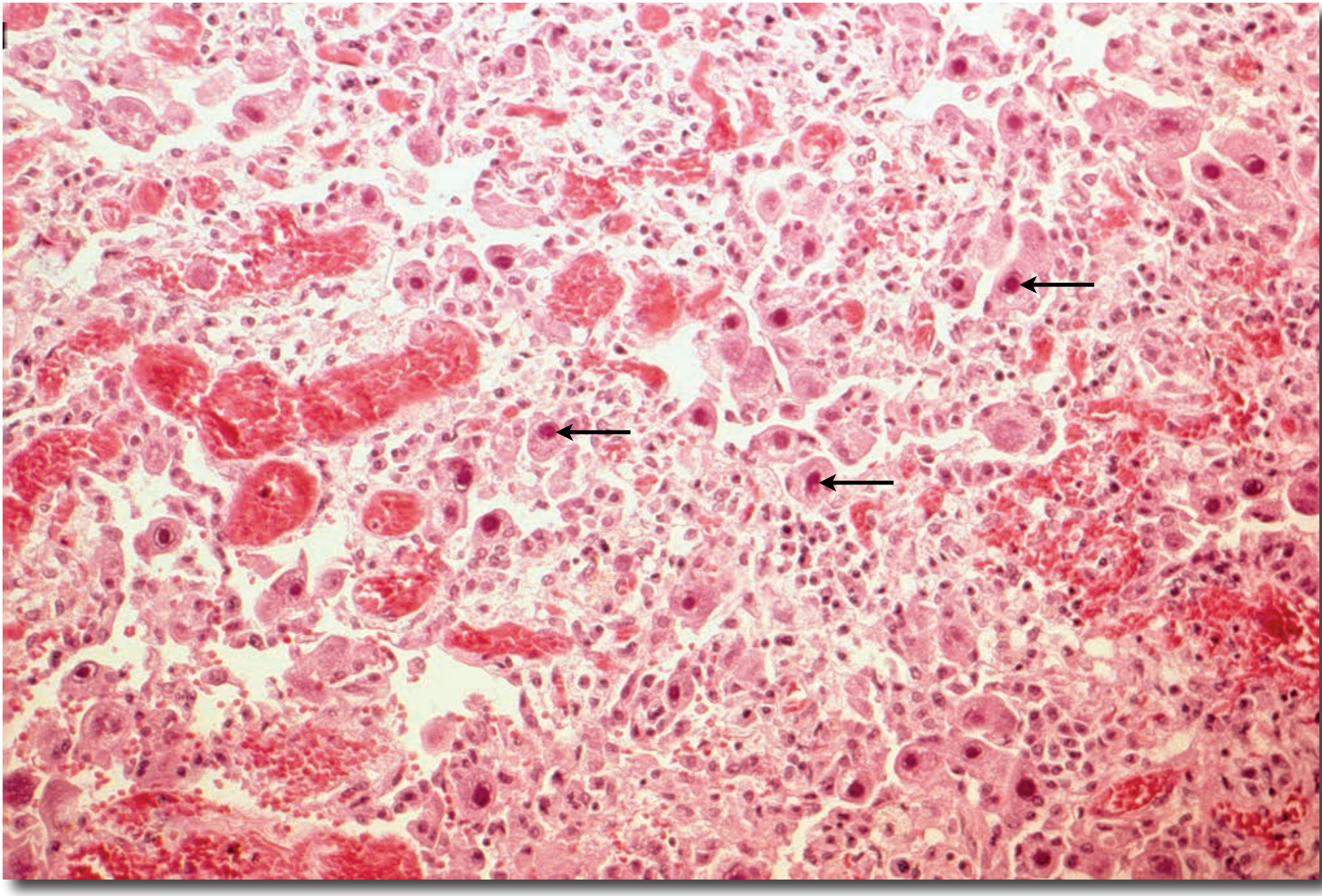
Fungal Pneumonia

- Normal and Immunocompromised Individuals
  - Histoplasmosis (*Histoplasma capsulatum*)
  - Coccidioidomycosis (*Coccidioides immitis*)
  - North American Blastomycosis (*Blastomyces dermatitidis*)
  - Cryptococcus (*Cryptococcus neoformans*)
- Immunocompromised Individuals
  - Candidiasis (*Candida* species)
  - Aspergillosis (*Aspergillus* species)

Viral Pneumonia

- Viruses are a common causes of respiratory tract infections
- Viral pneumonias cause significant morbidity and mortality among infants, the elderly and immunocompromised individuals
- Types of viral respiratory tract infections
  - "Common cold"
  - "Flu"
  - "Acute bronchitis"
  - Pneumonia

Acute Cytomegalovirus Pneumonia



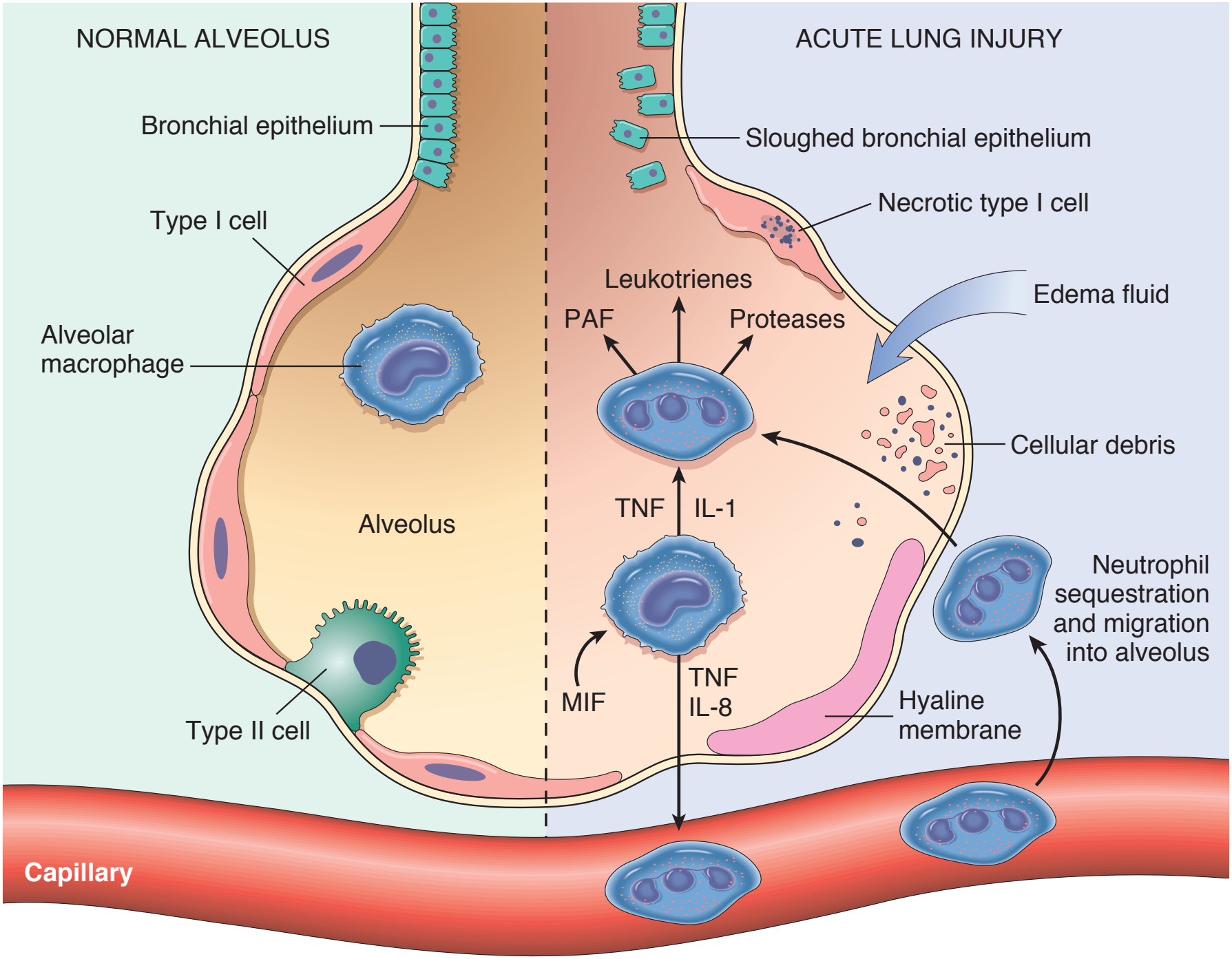
Diffuse Infilrative Lung Disease

- A large group of lung diseases that share some common clinical and radiologic features
- Etiology, pathogenesis and pathologic anatomy often have little in common
- Common clinical manifestation - “dyspnea”; others include cough, sputum production, weight loss, fever & night sweats joint pain
- Chest radiographs - diffuse “infiltration”
- Laboratory studies - hypoxemia, impaired oxygen exchange (diffusion capacity), decreased lung volumes and compliance

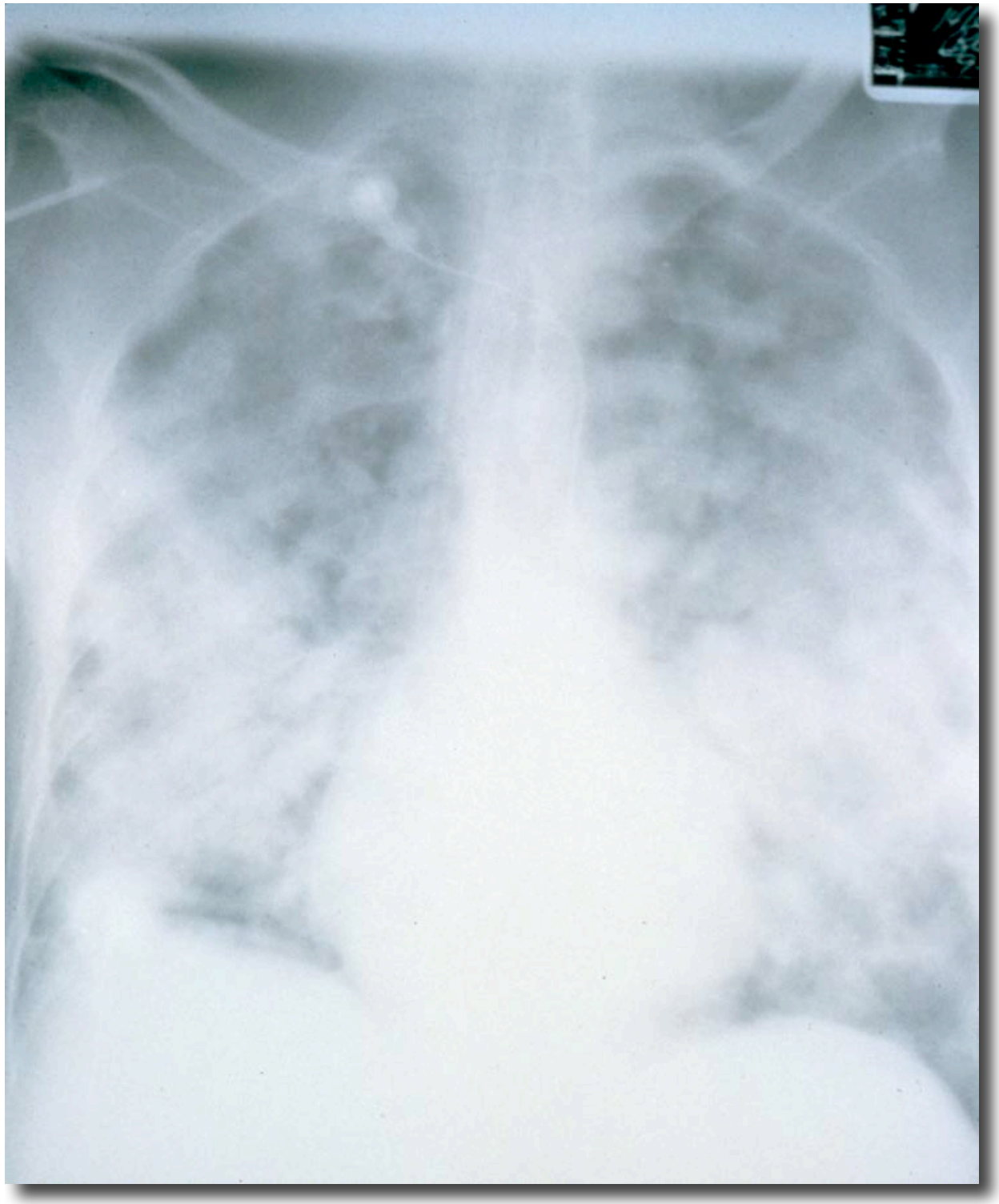
Diffuse Infilrative Lung Disease

- Etiologies
  - Infections
  - Neoplasms
  - Occupational and environmental diseases
  - Drugs, toxins and therapeutic agents
  - Connective tissue disease
  - Pulmonary vascular diseases
  - Specific disorders of unknown etiology
  - Interstitial pneumonias

Pathogenesis of Acute Diffuse Lung Injury

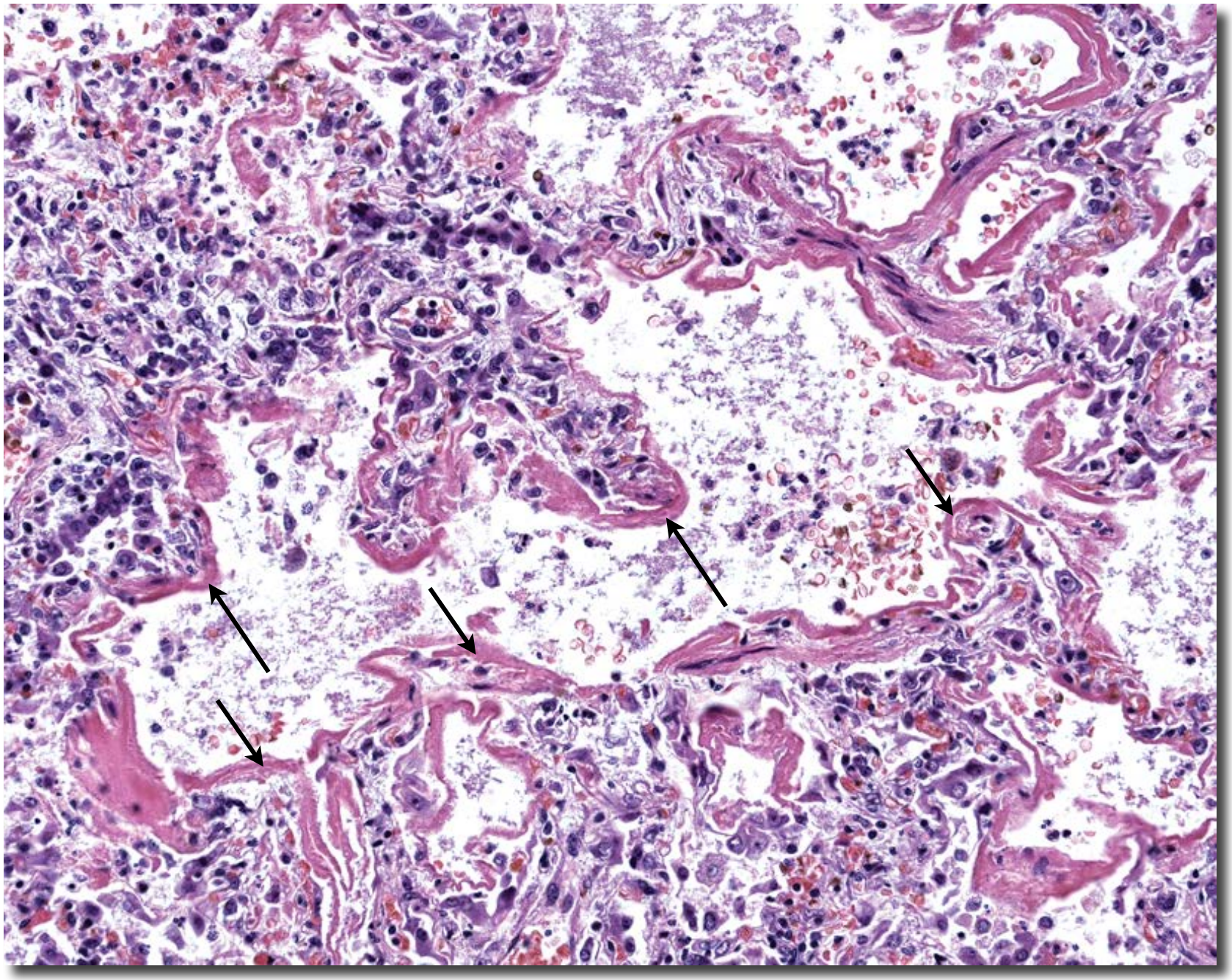


Diffuse Alveolar Damage



Diffuse Alveolar Damage

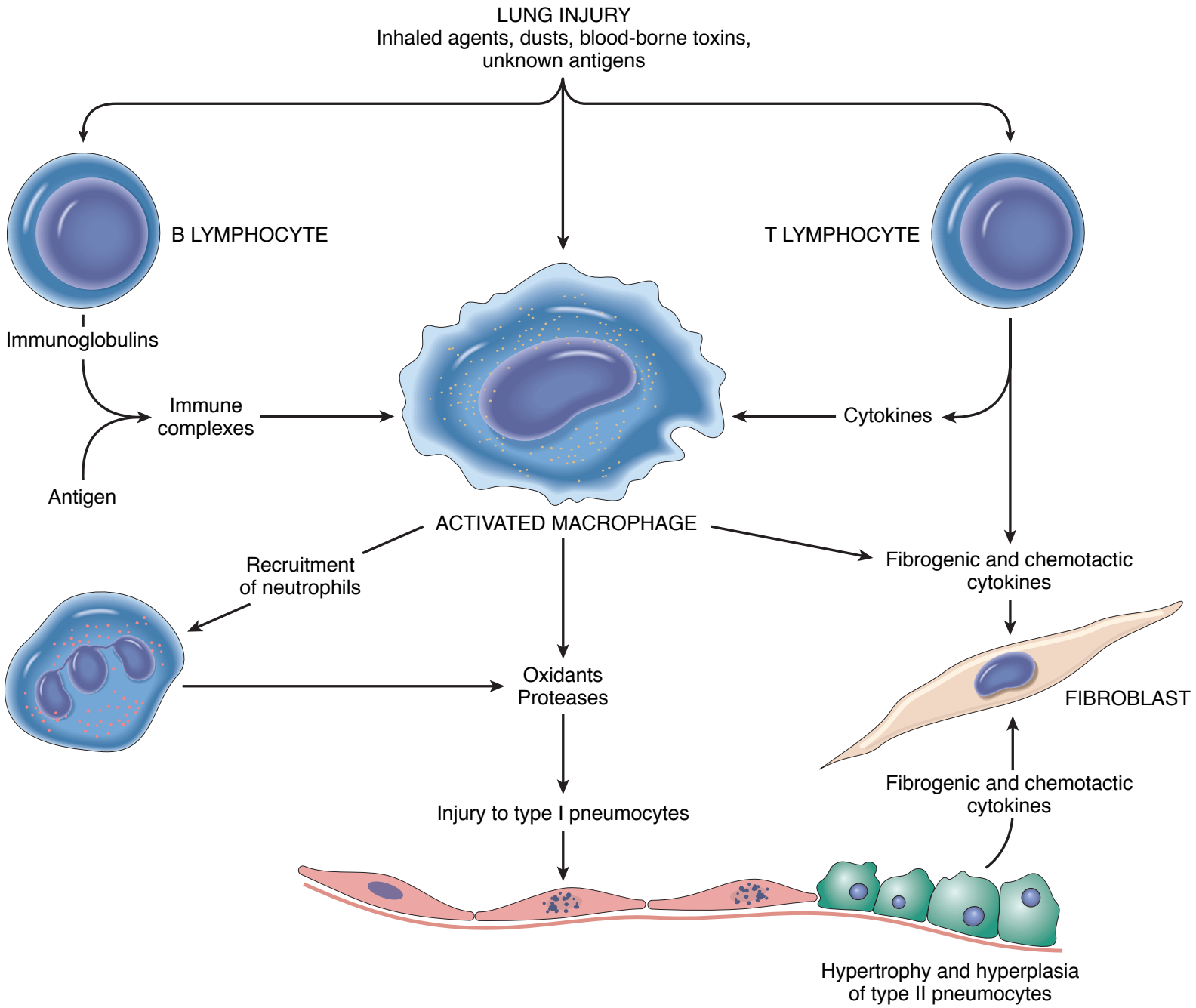
DAD: Hyaline Membranes



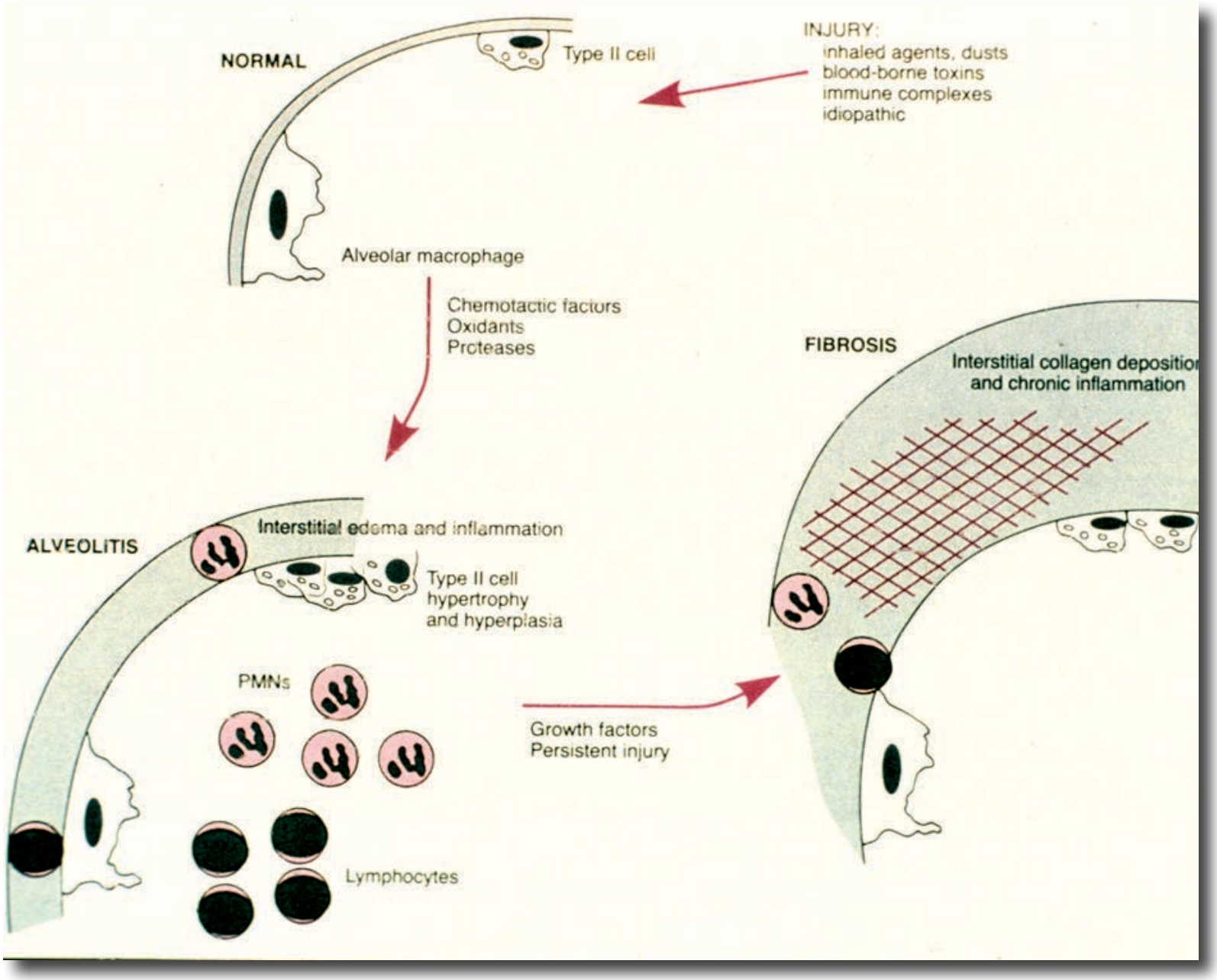
Chronic Diffuse Infiltrative Lung Disease

- Idiopathic pulmonary fibrosis (IPF or UIP)
- Hypersensitivity pneumonitis (extrinsic allergic alveolitis)
- Connective tissue diseases (e.g., rheumatoid arthritis, SLE and scleroderma)
- Pneumoconiosis (e.g., asbestosis, silicosis, anthracosis, beryllium disease)

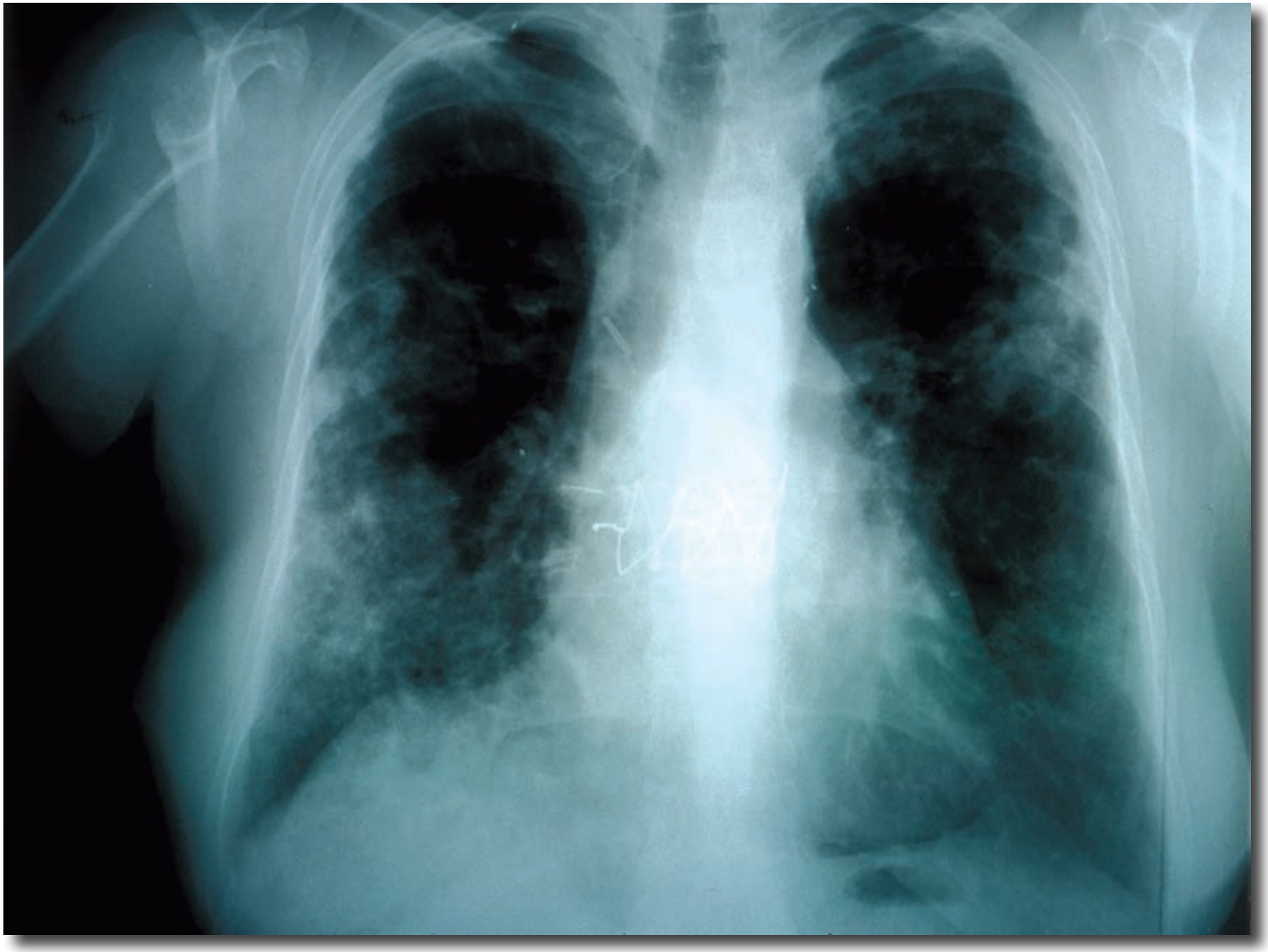
Pathogenesis of Chronic Diffuse Infiltrative Lung Disease



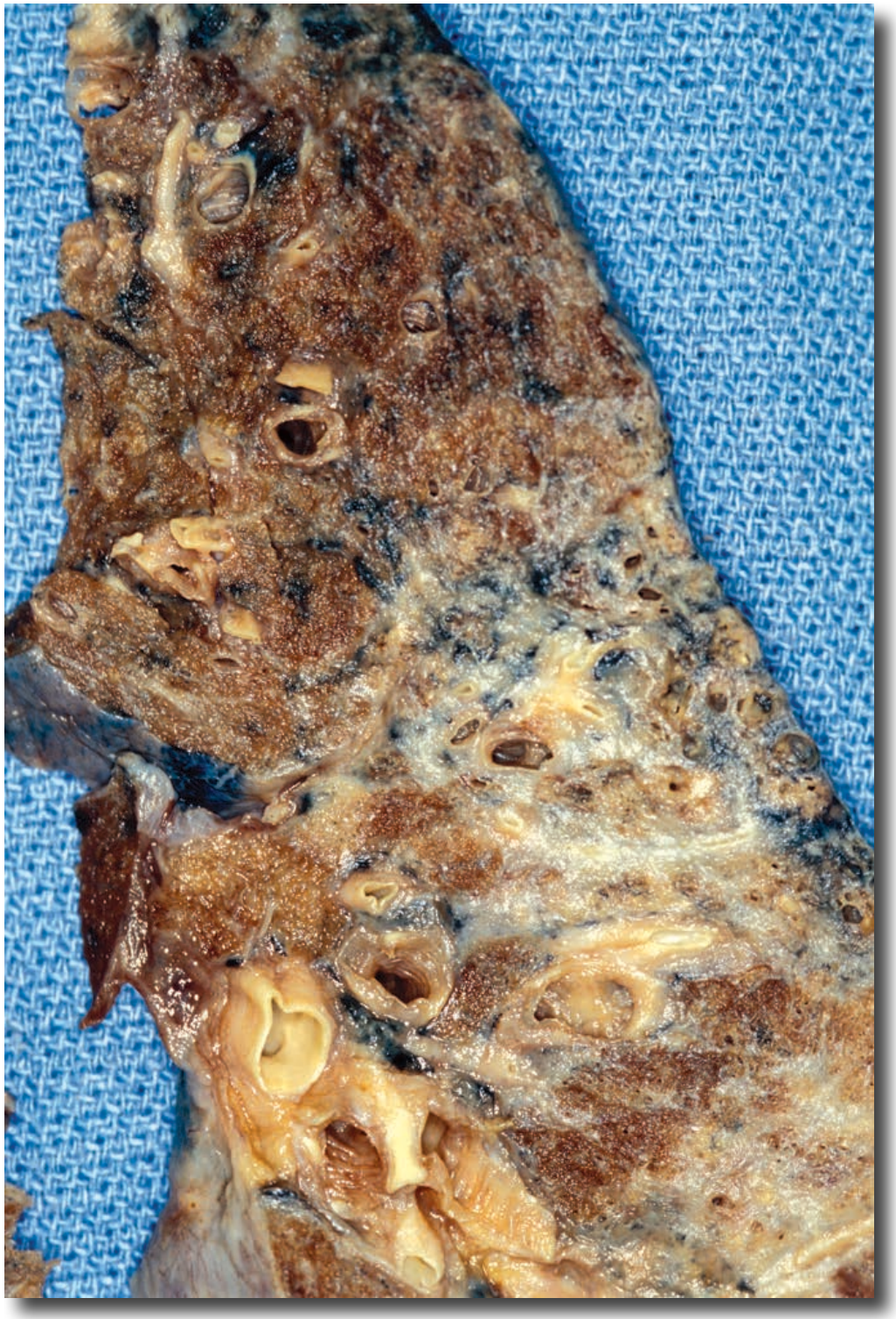
Pathogenesis of Chronic Diffuse Infiltrative Lung Disease



Pulmonary Interstitial Fibrosis

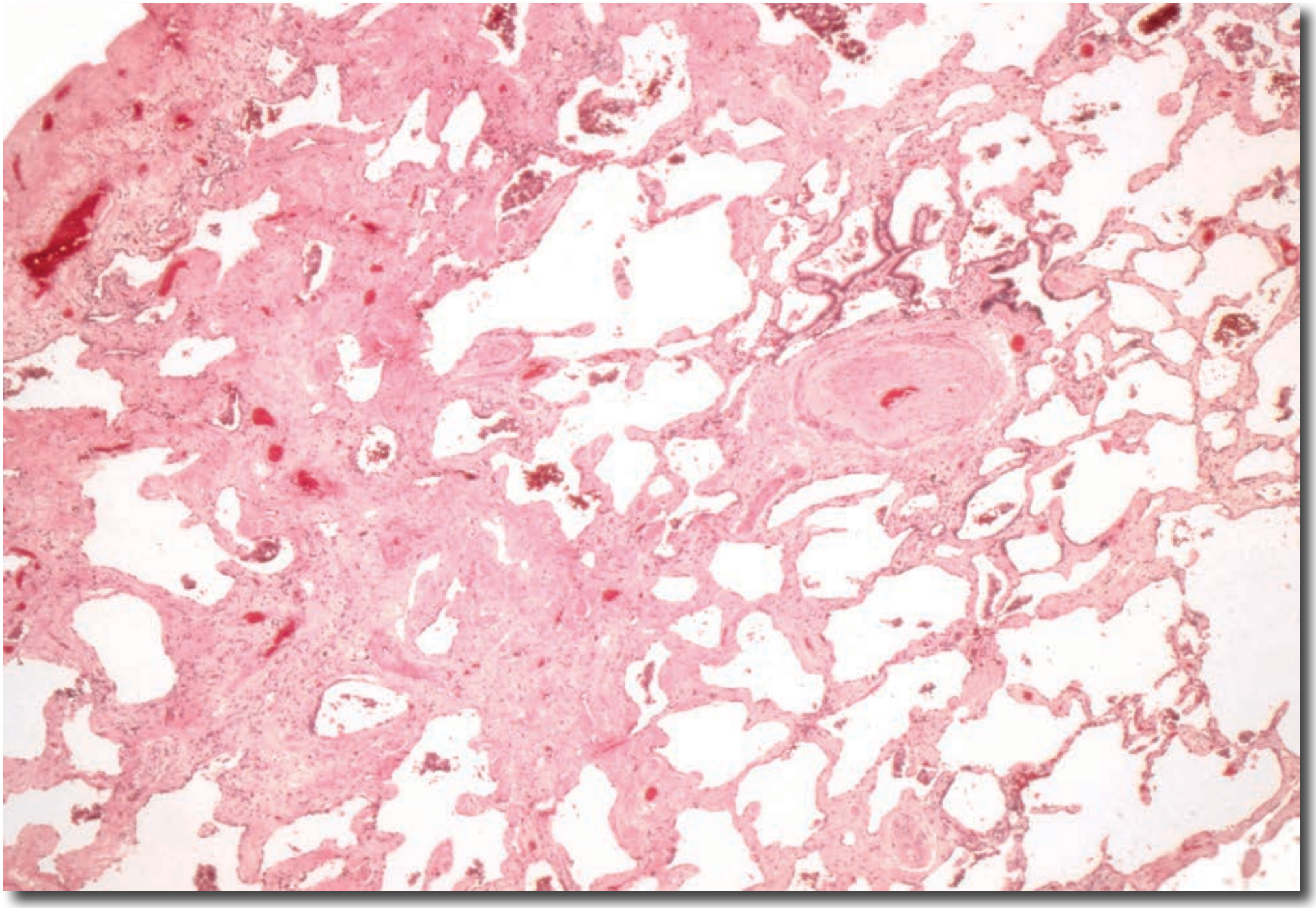


Pulmonary Interstitial Fibrosis

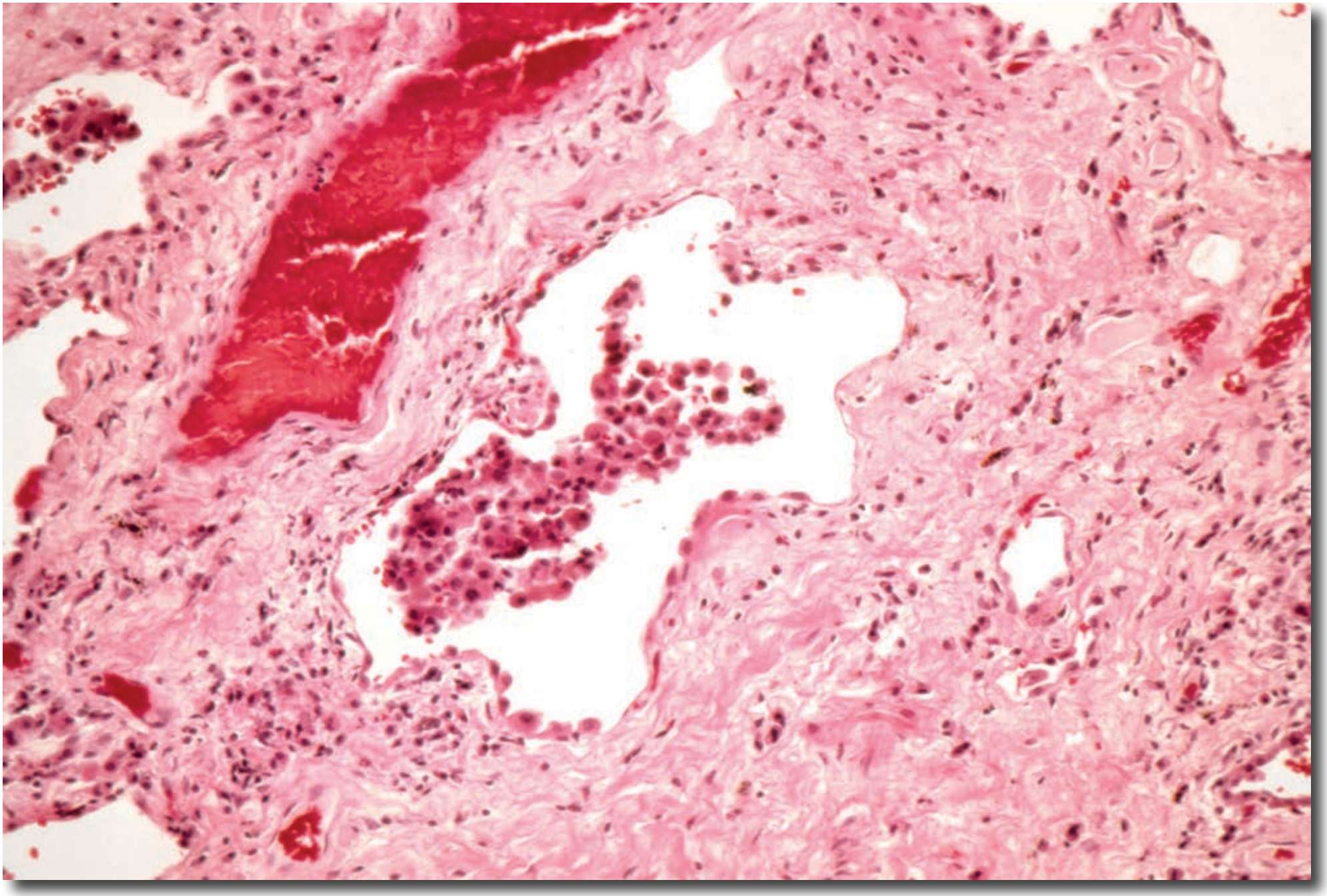


Pulmonary
Interstitial
Fibrosis
("Honeycombs")

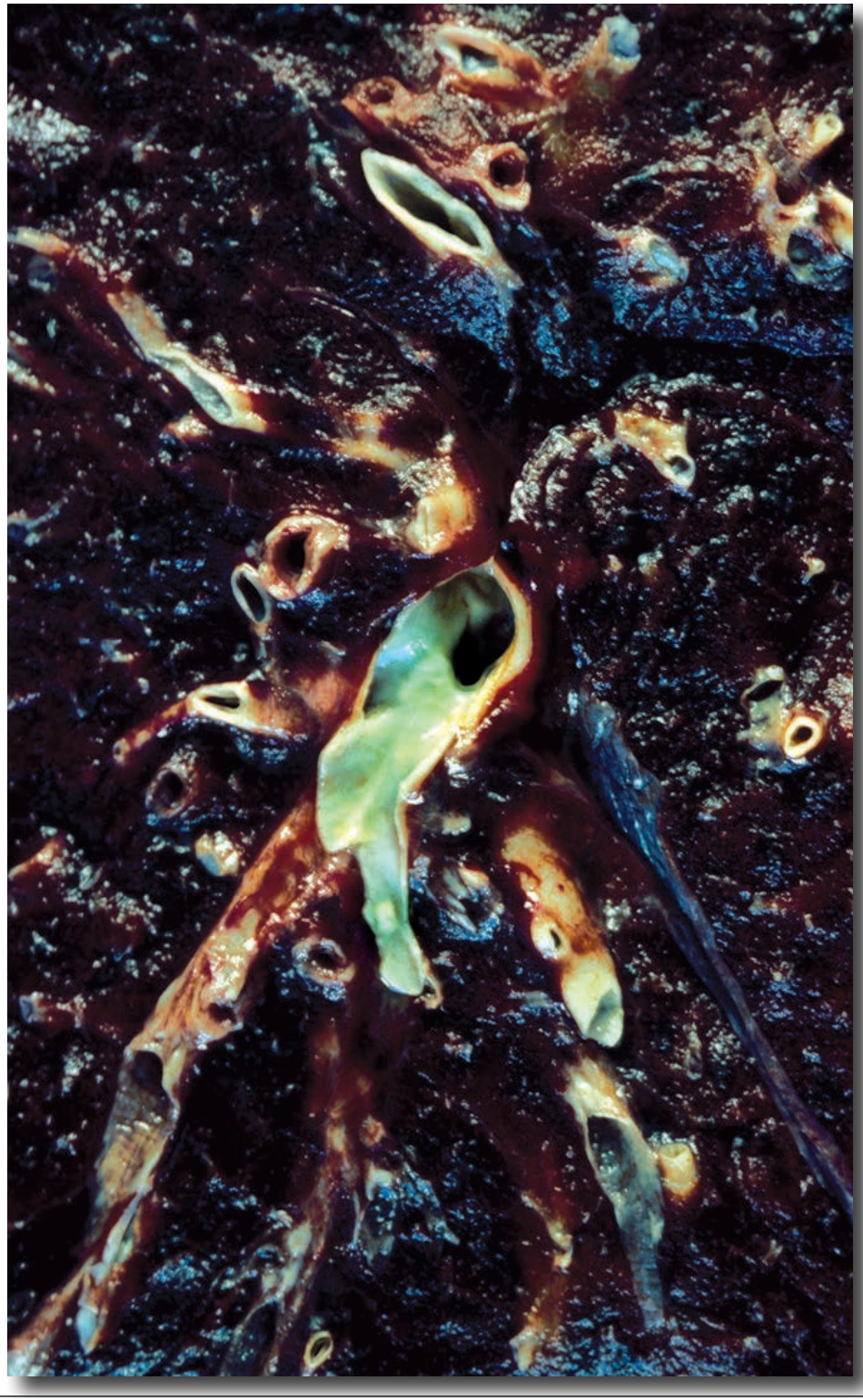
Pulmonary Interstitial Fibrosis



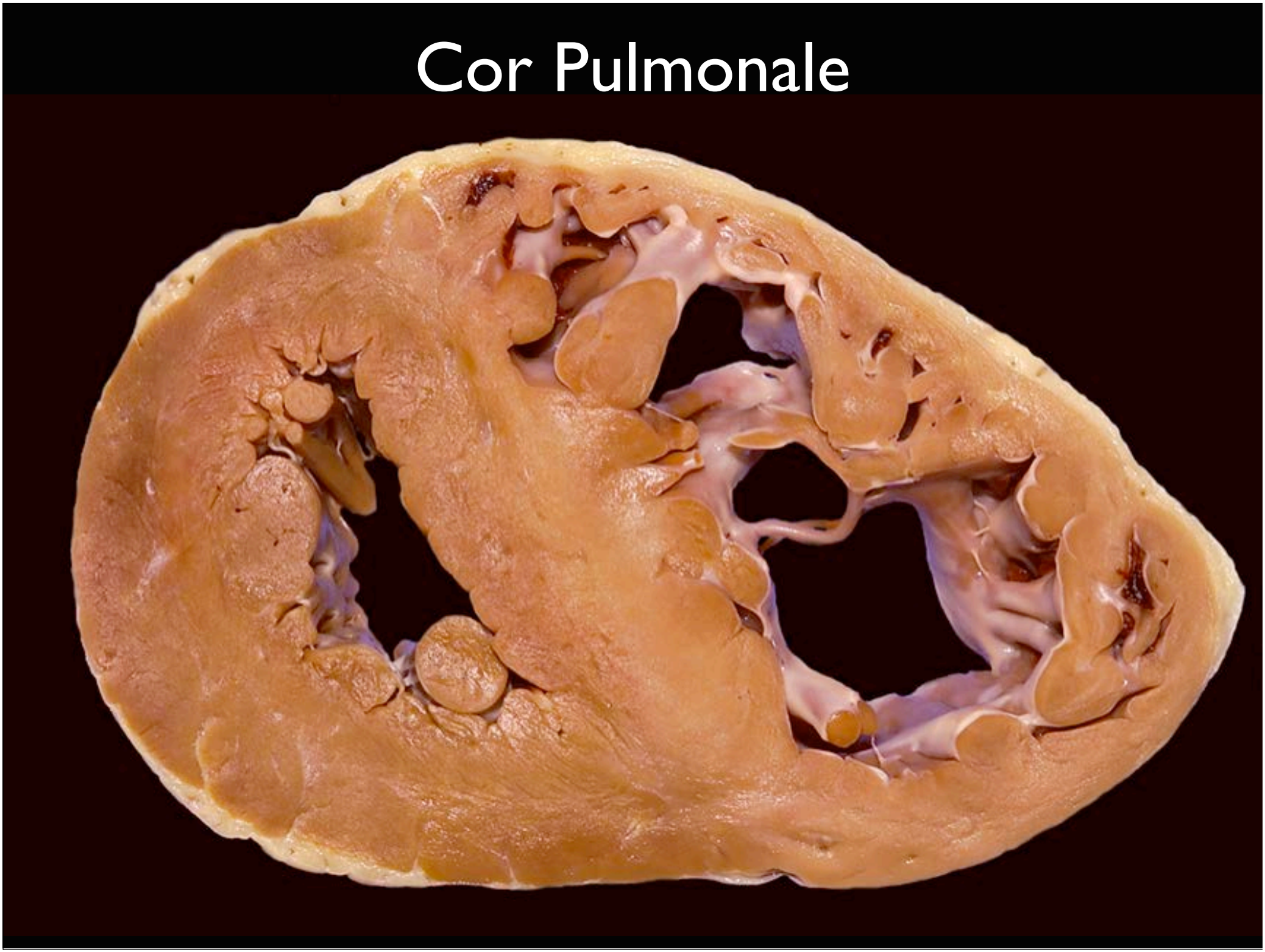
Pulmonary Interstitial Fibrosis



Pulmonary Artery with Atherosclerotic Plaque



Cor Pulmonale



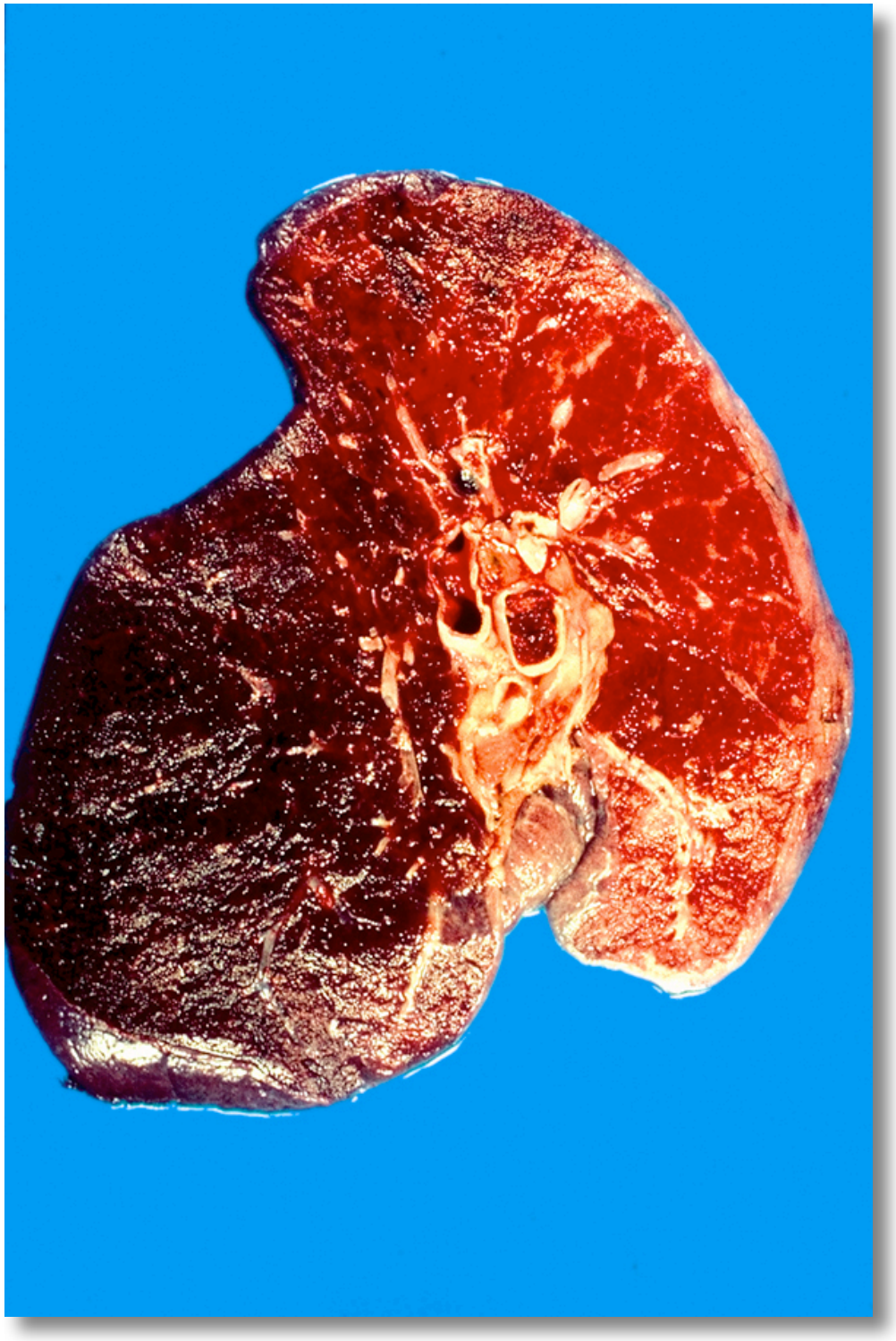
Pulmonary Embolism

- Origins of Pulmonary Emboli
  - Most frequently from deep leg venous thrombi
  - Air, amniotic fluid, right-sided infective endocarditis
- Venous thrombosis and pulmonary emboli
  - Immobilization of an extremity
  - Congestive heart failure
  - Following trauma (blunt trauma, fractures, burns)
  - During delivery or postpartum

Pulmonary Embolism

- Clinical Manifestations
  - Depend upon size of the emboli
  - State of the occluded arteries
  - State of the general pulmonary circulation
- Sudden death - massive pulmonary embolus (saddle embolism)
- Sudden chest pain, syncope, dyspnea - hemoptysis may occur due to hemorrhage or infarction
- Asymptomatic - smaller emboli

Acute Pulmonary Infarct



Pulmonary Hypertension

- Primary pulmonary hypertension
  - 1% of total cases of pulmonary hypertension
  - Unknown etiology
  - Young individuals, primarily young women
  - Clinical manifestations - fatigue, syncope, dyspnea on exertion and occasionally chest pain
- Secondary pulmonary hypertension
  - Occurs in conditions (e.g., chronic pulmonary emboli, congenital heart disease, AIDS, PIF) leading to pulmonary vascular resistance

Pulmonary Hypertension

- Morphology
  - Main pulmonary arteries - atheromas
  - Medium-sized pulmonary arteries - intimal thickening (fibrosis) and medial hypertrophy (smooth muscle cells)
  - Smaller pulmonary arteries and arterioles - intimal thickening, medial hypertrophy, fibrinoid necrosis, reduplication of the internal and external laminae (plexogenic lesions)

Pulmonary Hypertensive Arteriopathy