Armed Forces Institute of Pathology

Inhalation Injury

Teri J. Franks, MD

Chairman
Department of Pulmonary and Mediastinal Pathology

Main Topics

- Anatomy
- Physiology
- Abnormalities
  - Etiology
- AskAFIP Hot Topic

Anatomy

- Upper respiratory tract
- Lower respiratory tract

Anatomy

Secondary Lobule

Secondary Lobule

- As defined by Miller
  - Polygonal
  - 1-2.5 cm
  - Smallest unit demarcated by connective tissue septa
- Most useful diagnostically
  - Readily identified on:
    - HRCT
    - Gross examination
    - Histologic section
  - Explains HRCT appearance
    - Broad range of lung diseases
    - Especially interstitial disease

Anatomy

Secondary lobule

- Core structures
- Septal structures
- Parenchyma

Anatomy

Secondary lobule

- Core structures
  - Axial interstitium
  - Bronchiole
  - Pulmonary artery
  - Lymphatics
- Septal structures
- Parenchyma

Anatomy

Secondary lobule

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  - Pulmonary artery
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- Septal structures
  - Peripheral interstitium
  - Pulmonary veins
  - Lymphatics
- Parenchyma

Anatomy

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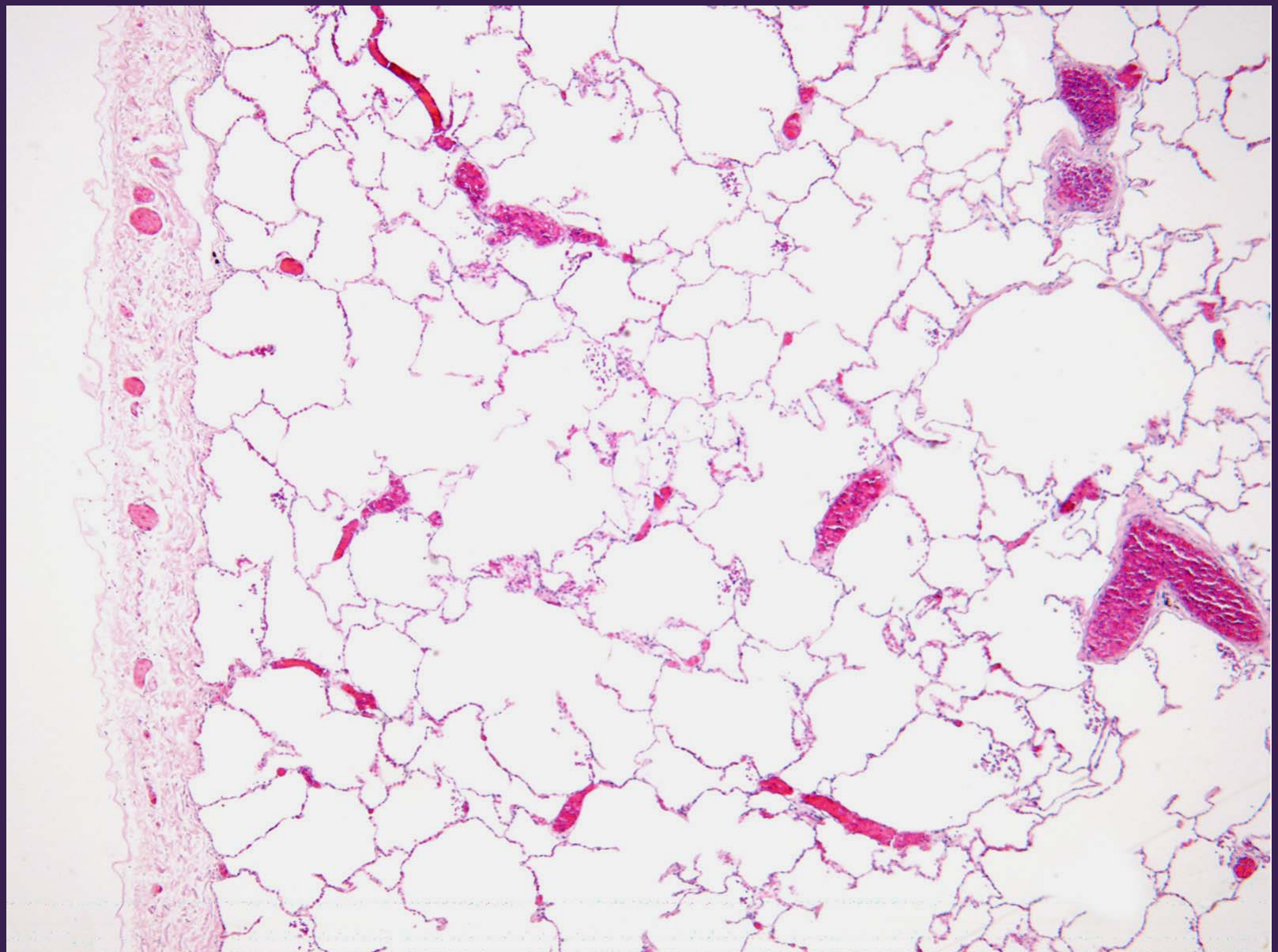
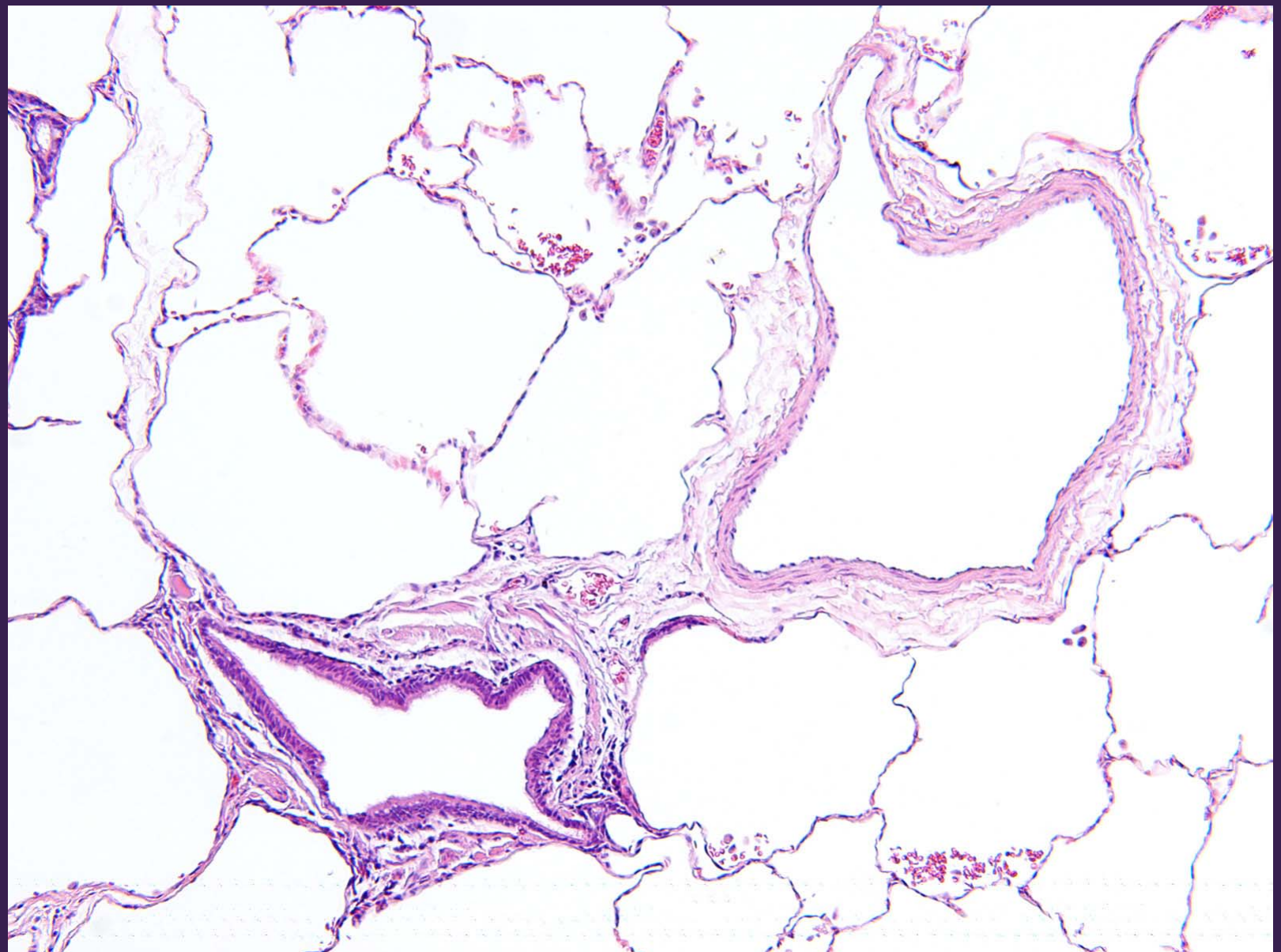
  - Axial interstitium
  - Bronchiole
  - Pulmonary artery
  - Lymphatics
- Septal structures
  - Peripheral interstitium
  - Pulmonary veins
  - Lymphatics
- Parenchyma
  - Alveolar interstitium
  - Alveoli
  - Pulmonary capillary bed

Anatomy



Anatomy



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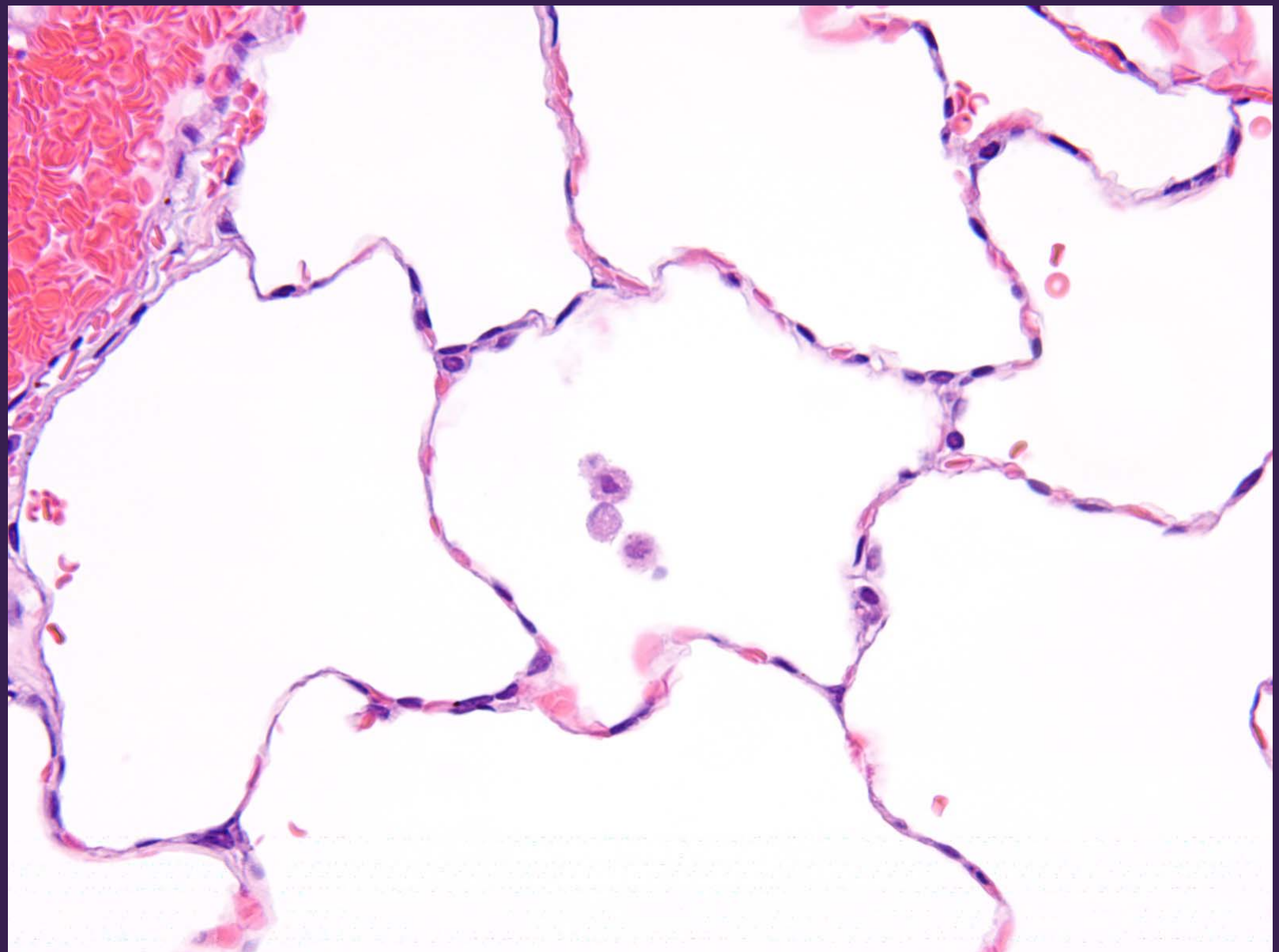


Physiology

- External organ
  - Exchange gas
  - Filter inspired air
- Distribution of inhaled particles
  - Ventilation
  - Perfusion
  - Lymphatics

Ventilation

Ventilation

Perfusion

Lymphatics

Physiology

- Filter
  - 10,000-20,000 liters/day
  - Deposition
    - Particle size
      - > 10 μm, nasopharynx and large airways (100%)

Physiology

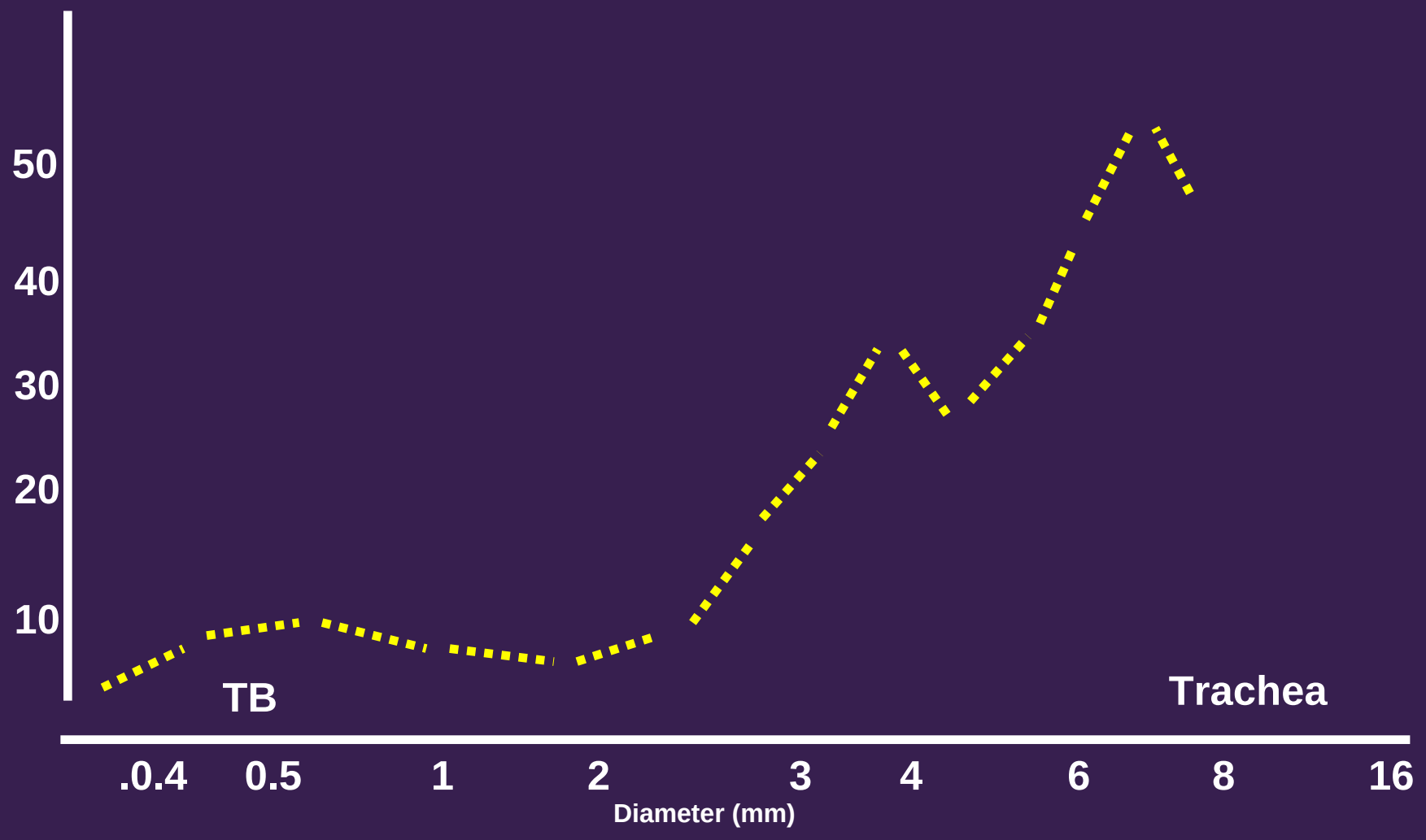
- Filter
  - 10,000-20,000 liters/day
  - Deposition
    - Particle size
      - > 10 μm, nasopharynx and large airways
      - 1-5 μm, lung parenchyma
      - < 0.5 μm, alveoli

Physiology

- Filter
  - 10,000-20,000 liters/day
  - Deposition
    - Particle size
    - Velocity of airflow
      - Inertial impaction
      - Sedimentation
      - Diffusion

Airway Velocity

Inertial impaction, sedimentation and diffusion



Airway Velocity

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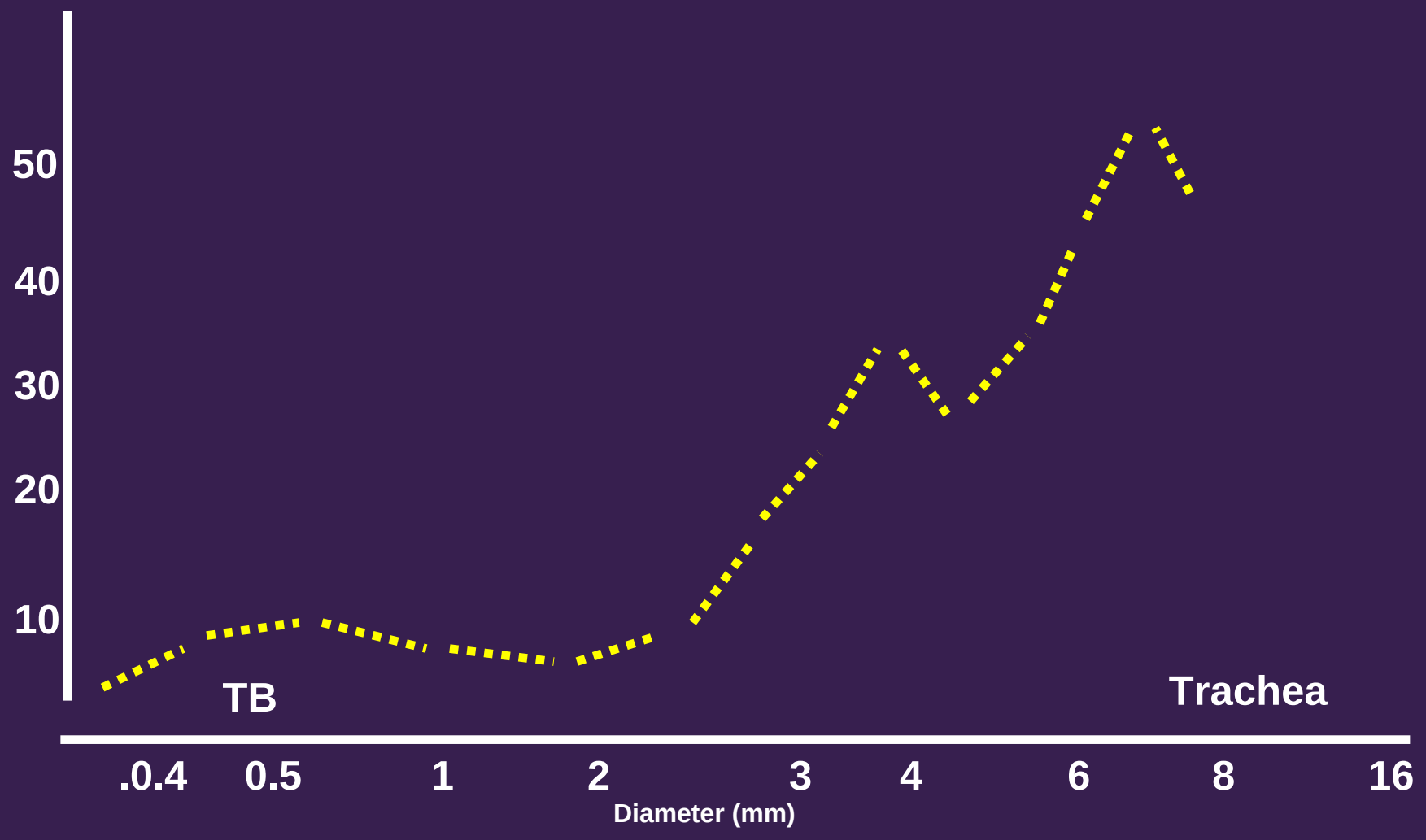

Airway Velocity

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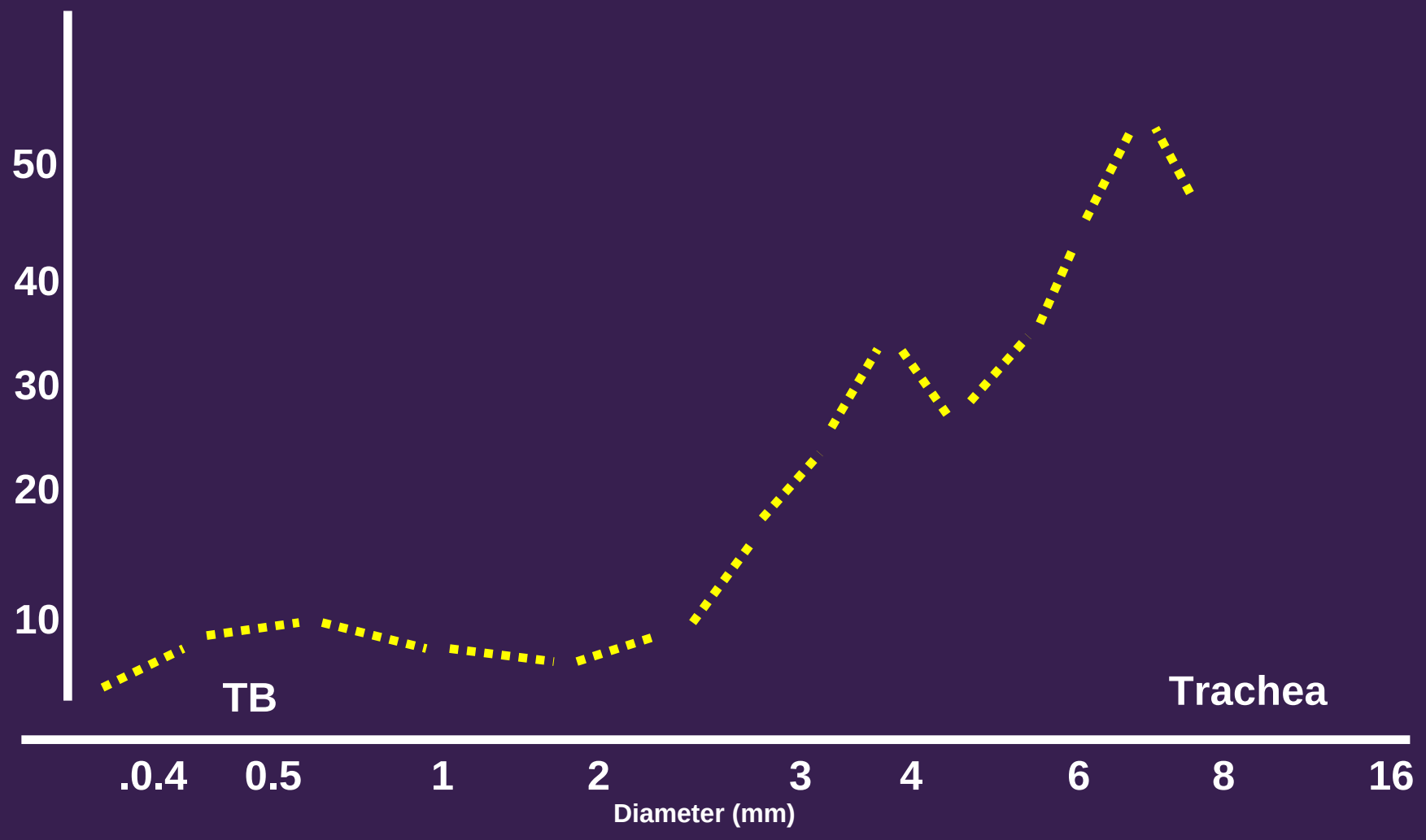

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- Filter
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  - Clearance
    - Sneeze
    - Cough

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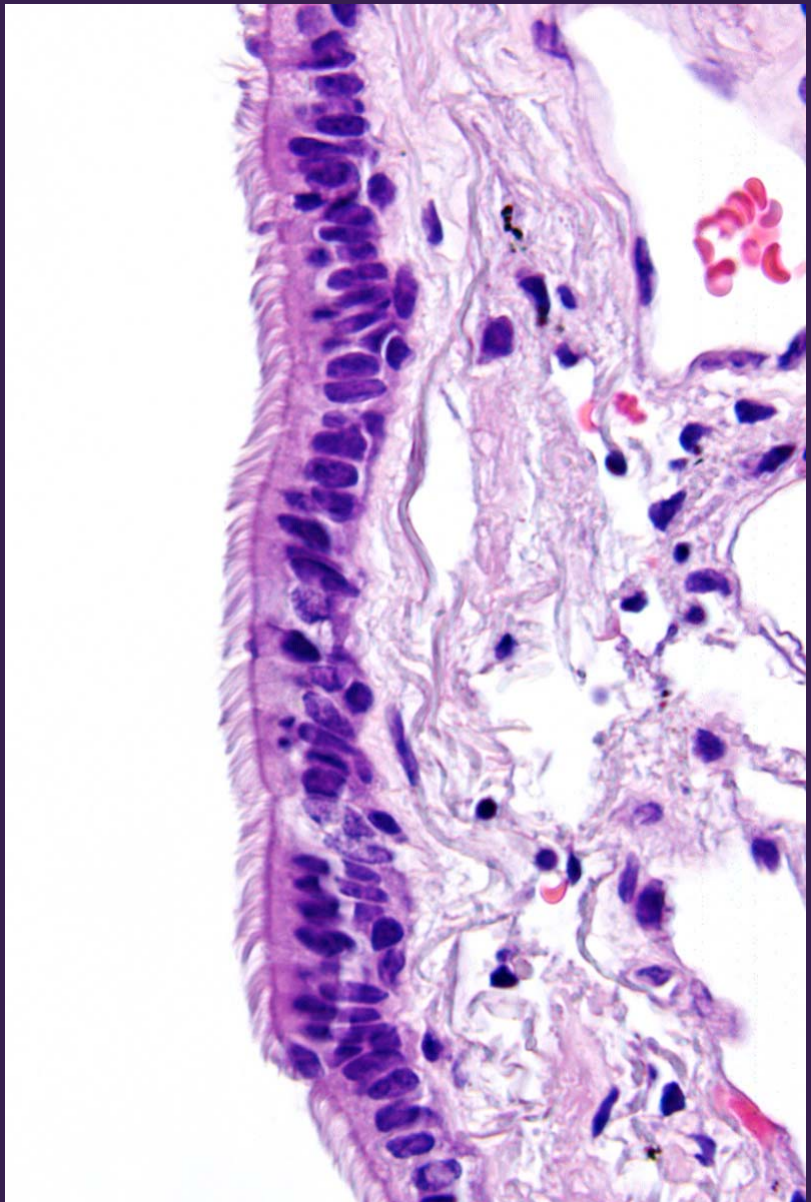
    - Mucocilliary escalator
      - 3 mm/min
      - 80-90% removal in 2 hours



Physiology

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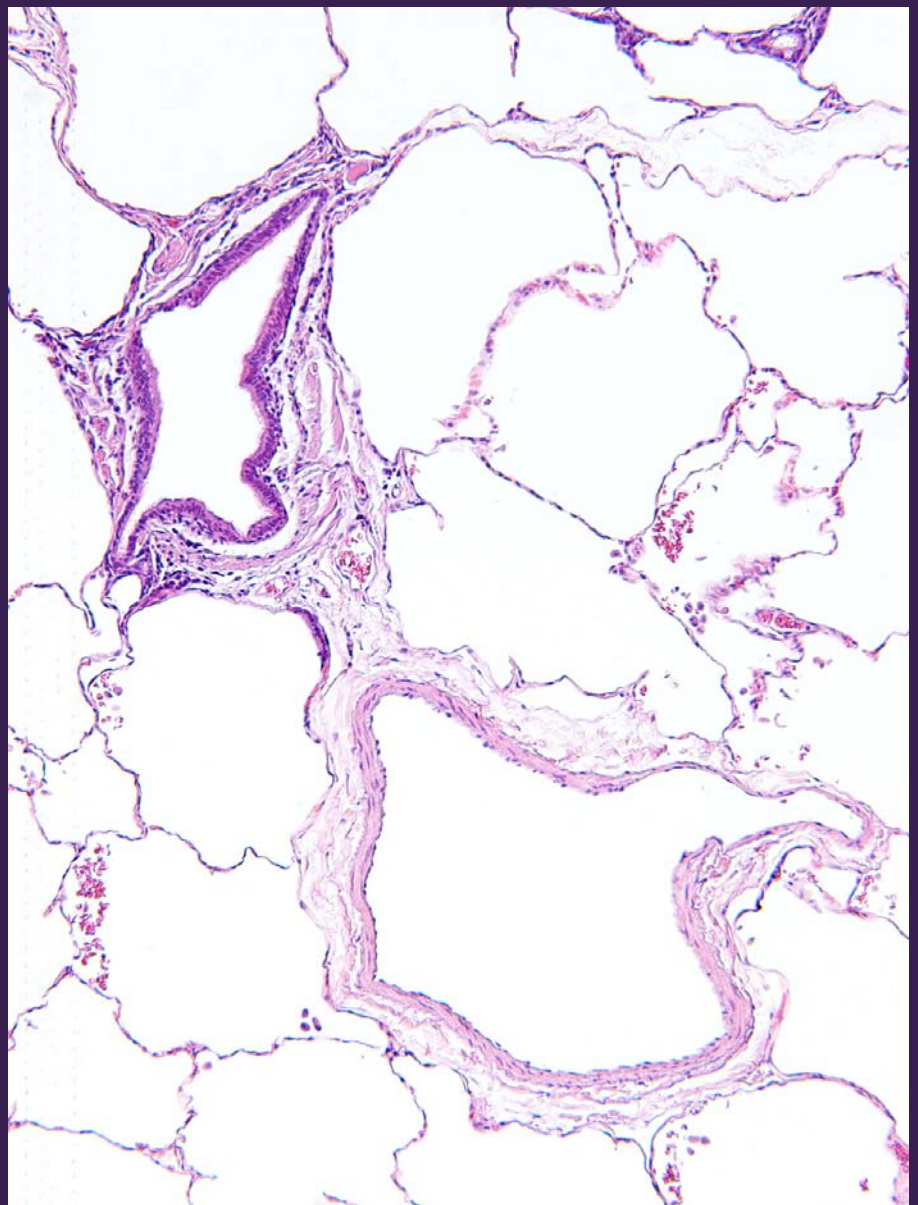
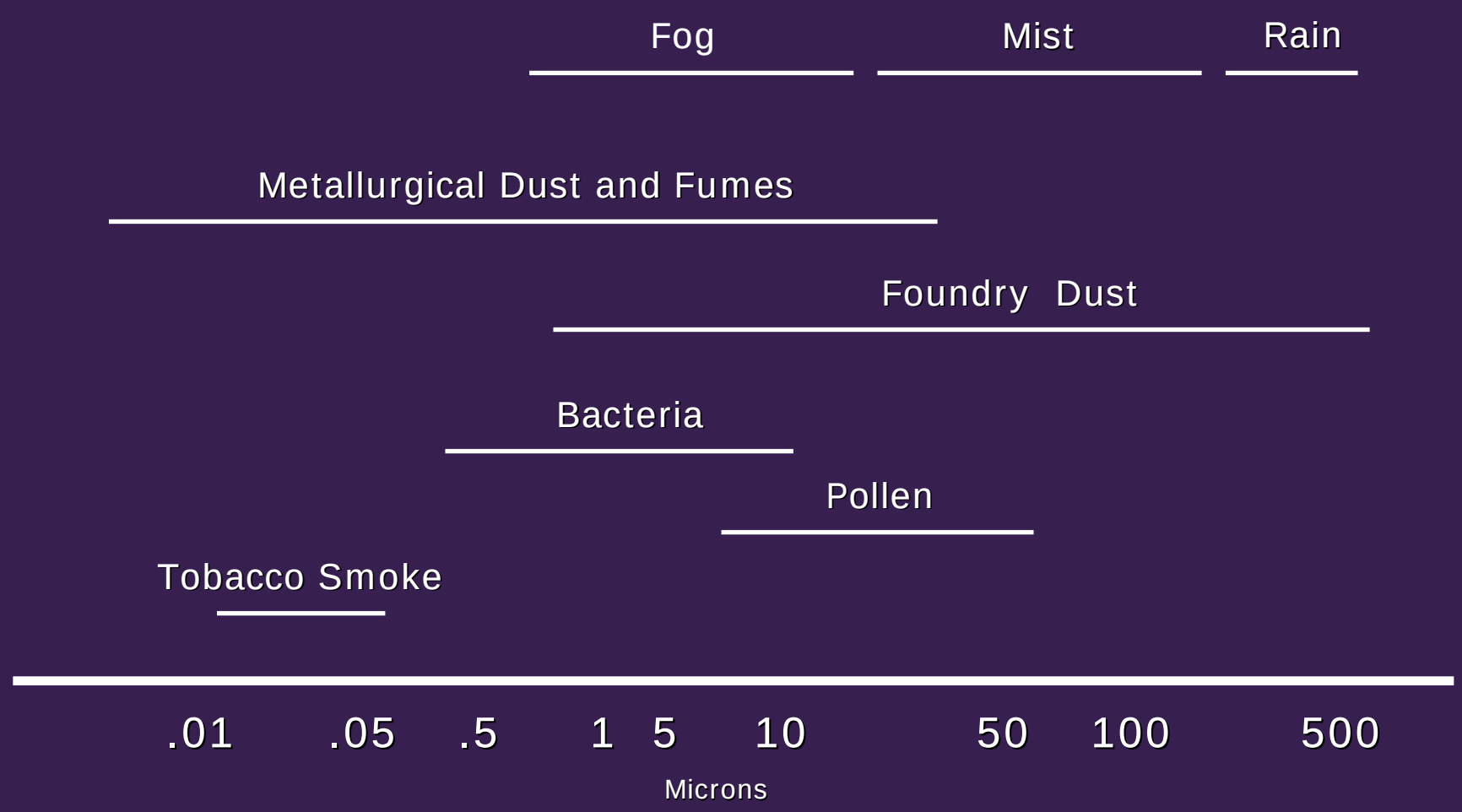
  - Deposition
  - Clearance
    - Sneeze
    - Cough
    - Mucocilliary escalator
      - 3 mm/min
      - 80-90% removal in 2 hours
    - Alveolar transport
      - Surface dissolution
      - Macrophage sequestration
        - » Days, months, years



Common Aerosols

Types and sizes



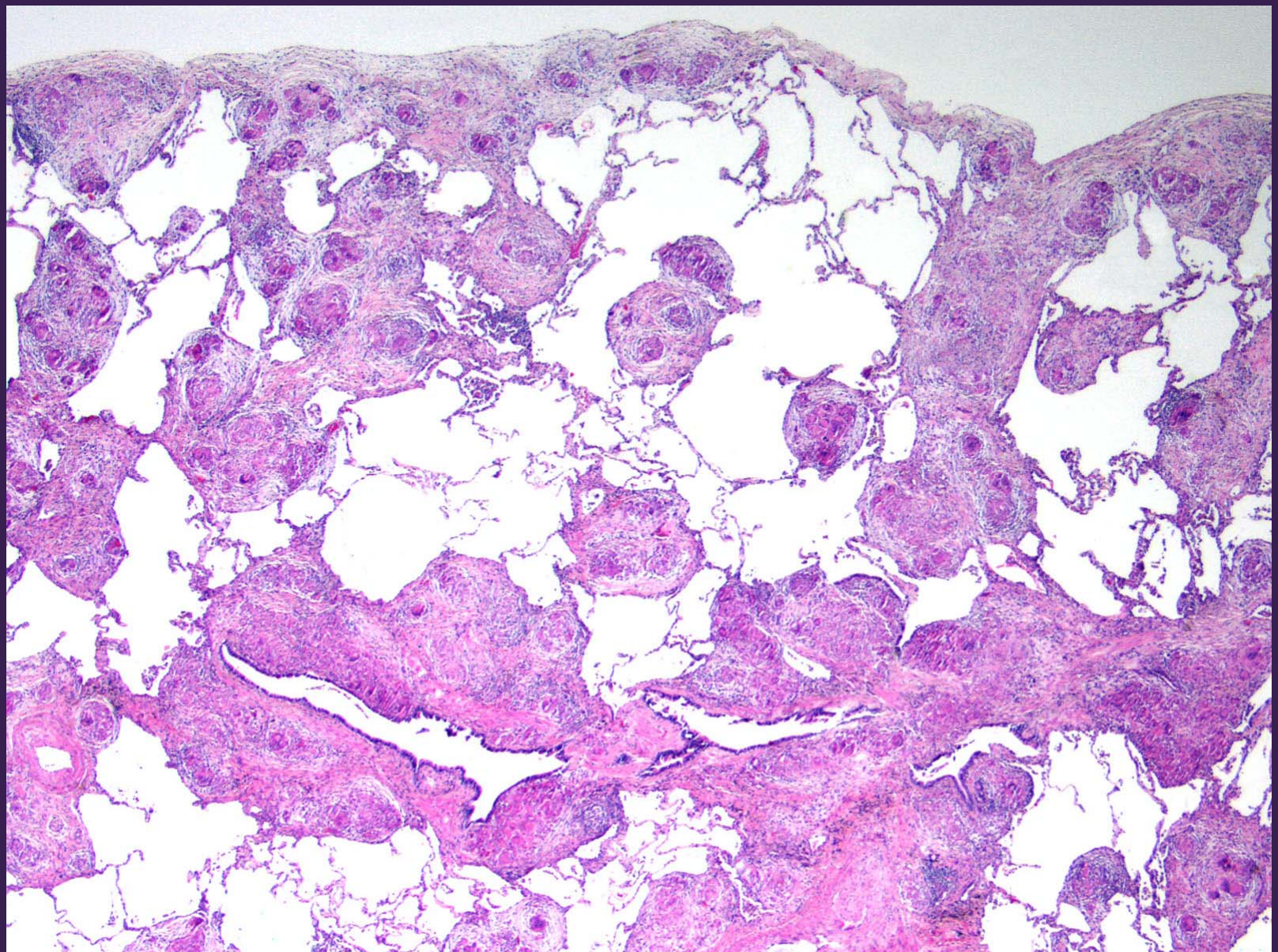
Abnormalities

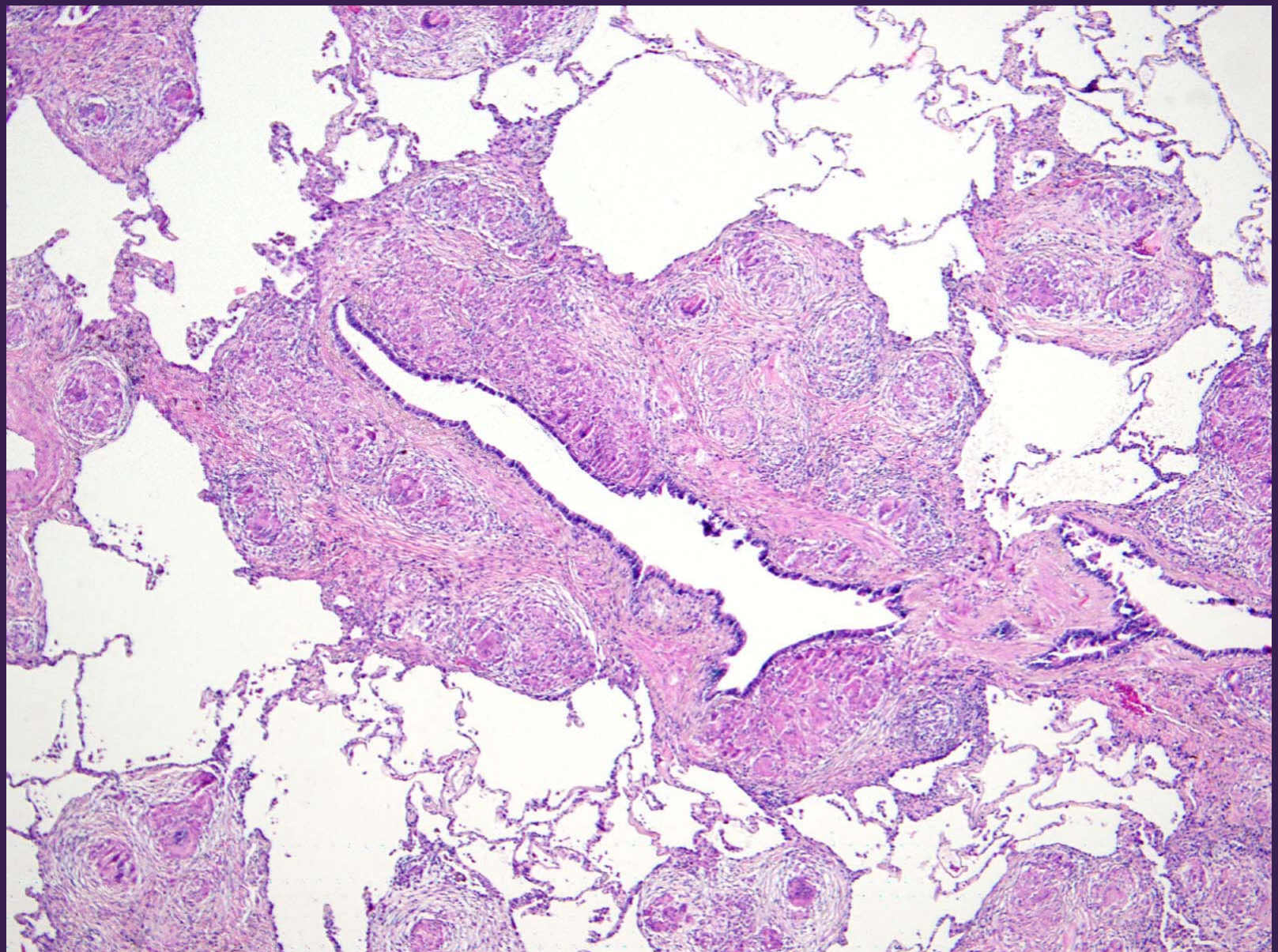
- Non-neoplastic lung disease
  - Pneumoconiosis
  - Diffuse interstitial fibrosis
  - Diffuse alveolar damage
  - Alveolar proteinosis
  - Giant cell and desquamative interstitial pneumonitis
  - Granulomatous inflammation
- Neoplastic lesions
  - Lung cancer

Abnormal Patterns

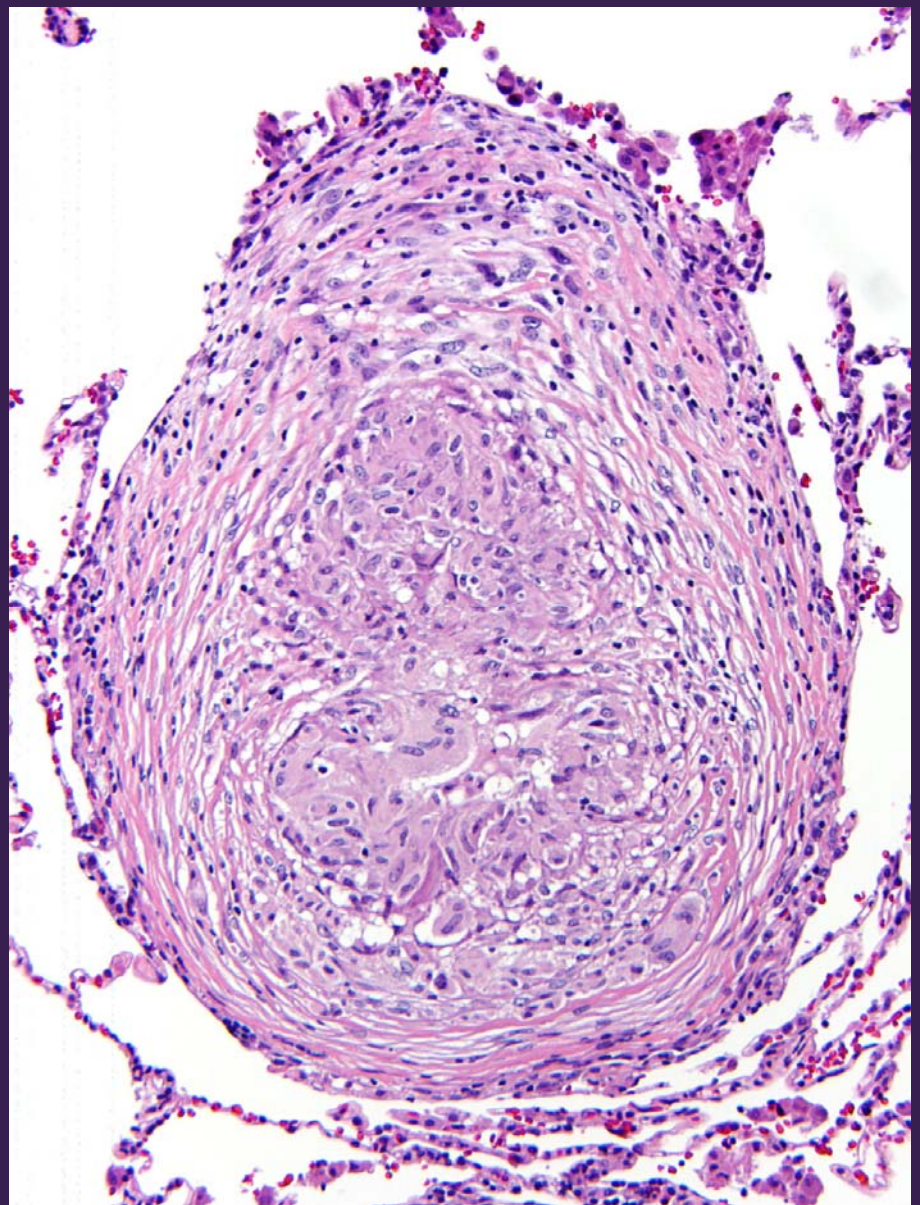
- Bronchovascular
- Centrilobular
- Panlobular
- Septal
- Random

Lymphatic Distribution

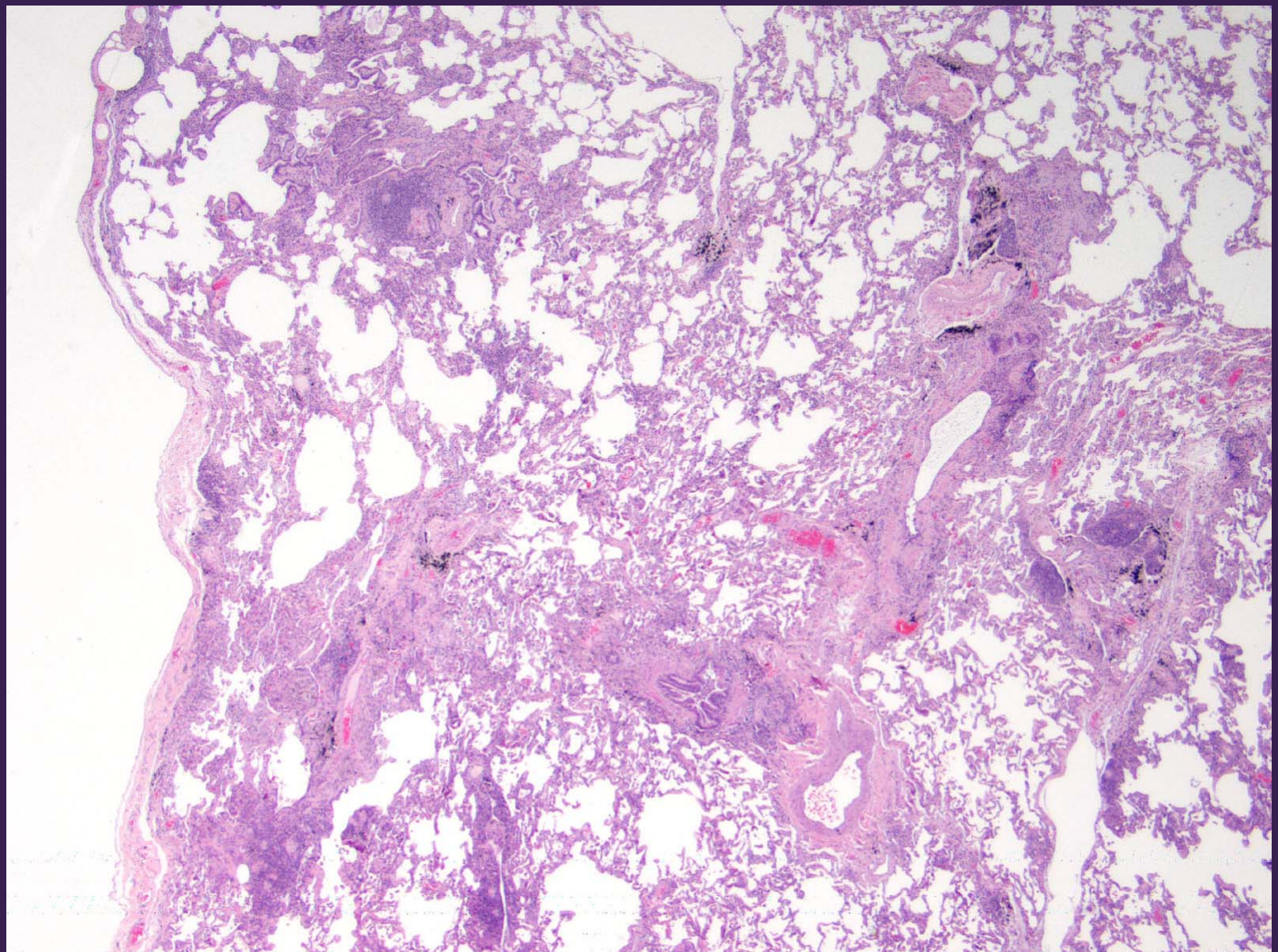


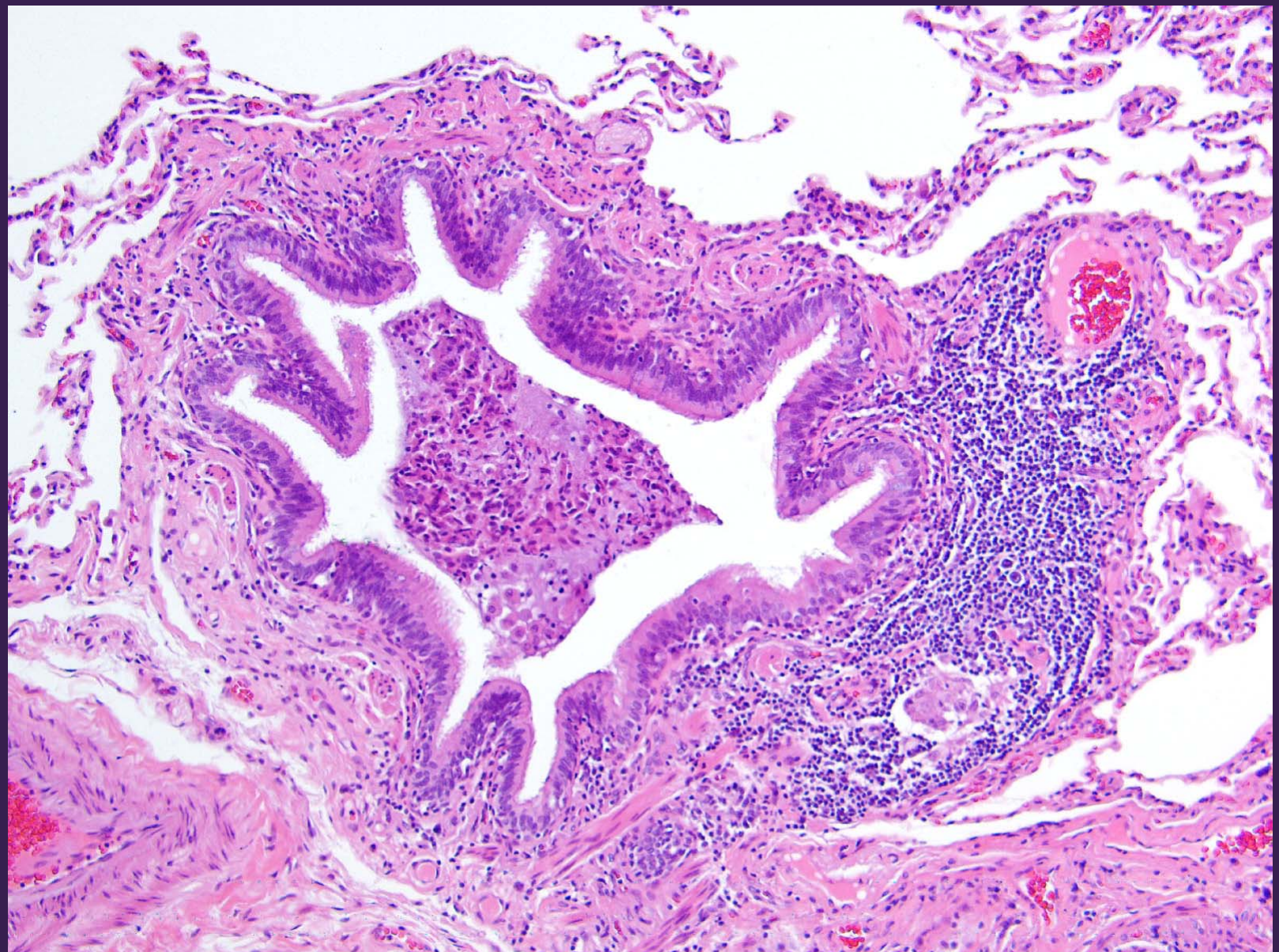


Sarcoid



Airway-centered

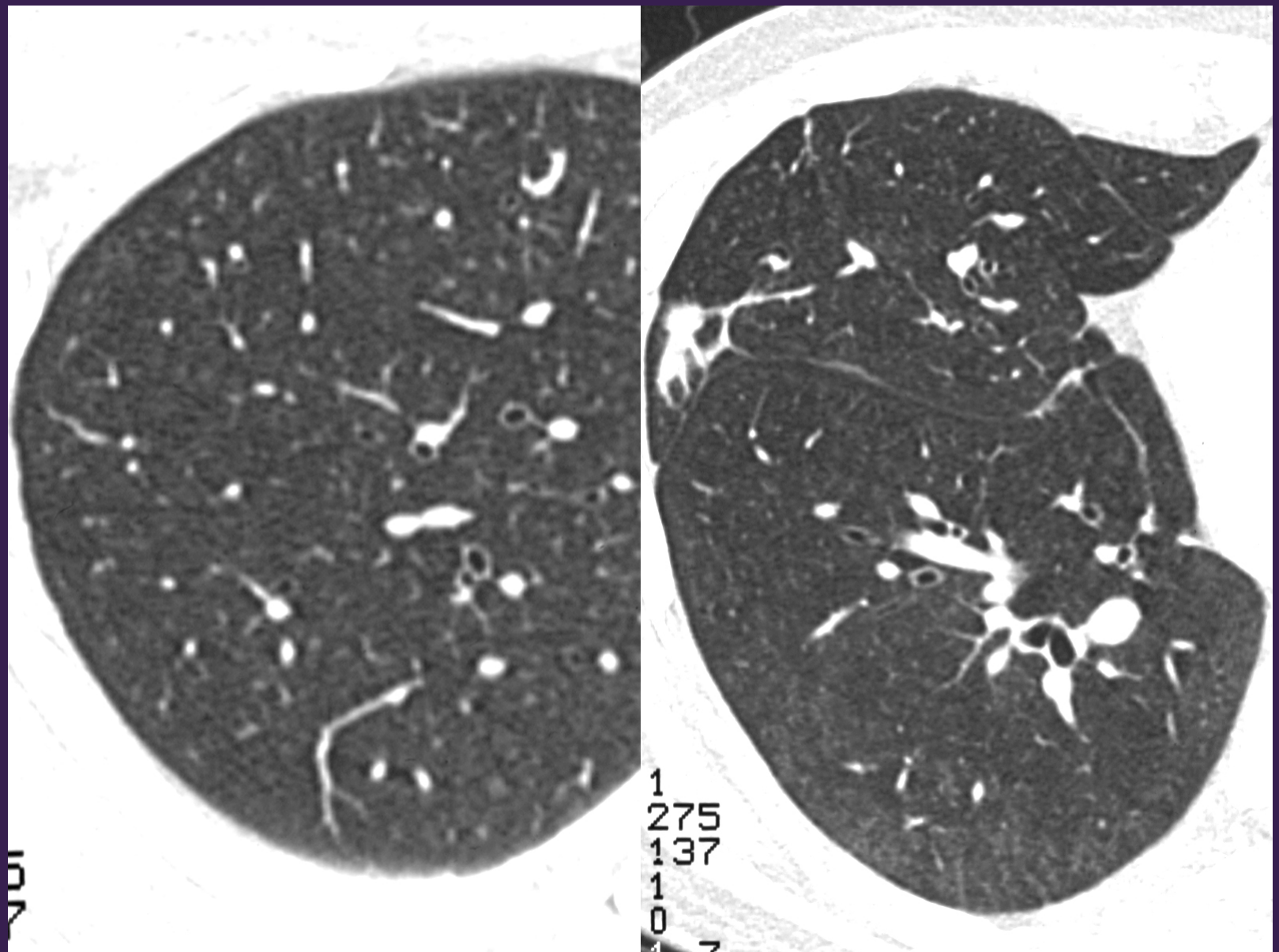




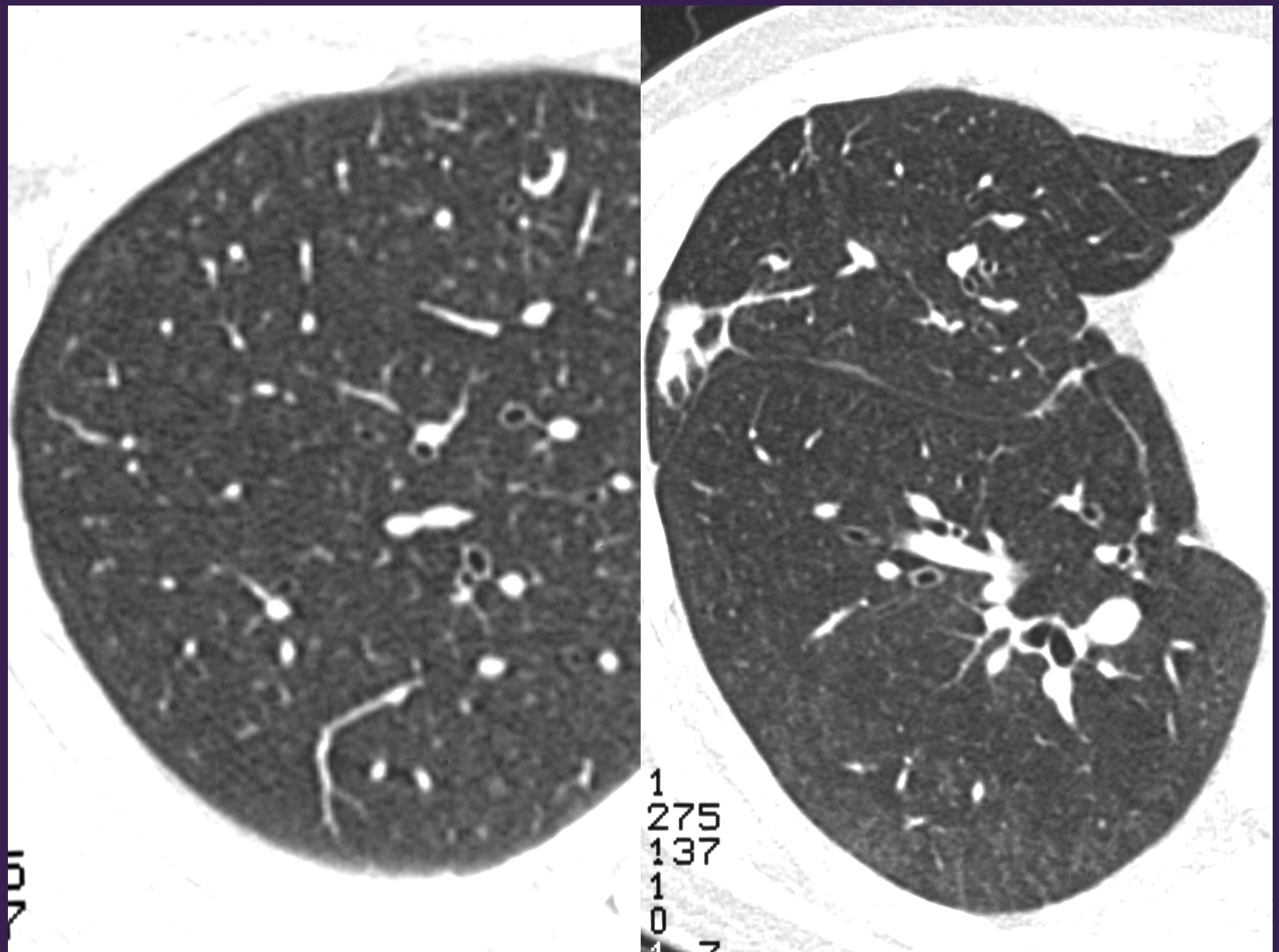
Histologic Differential Diagnosis

- Hypersensitivity pneumonitis
- Infection
- Collagen vascular disease
- Drug reaction

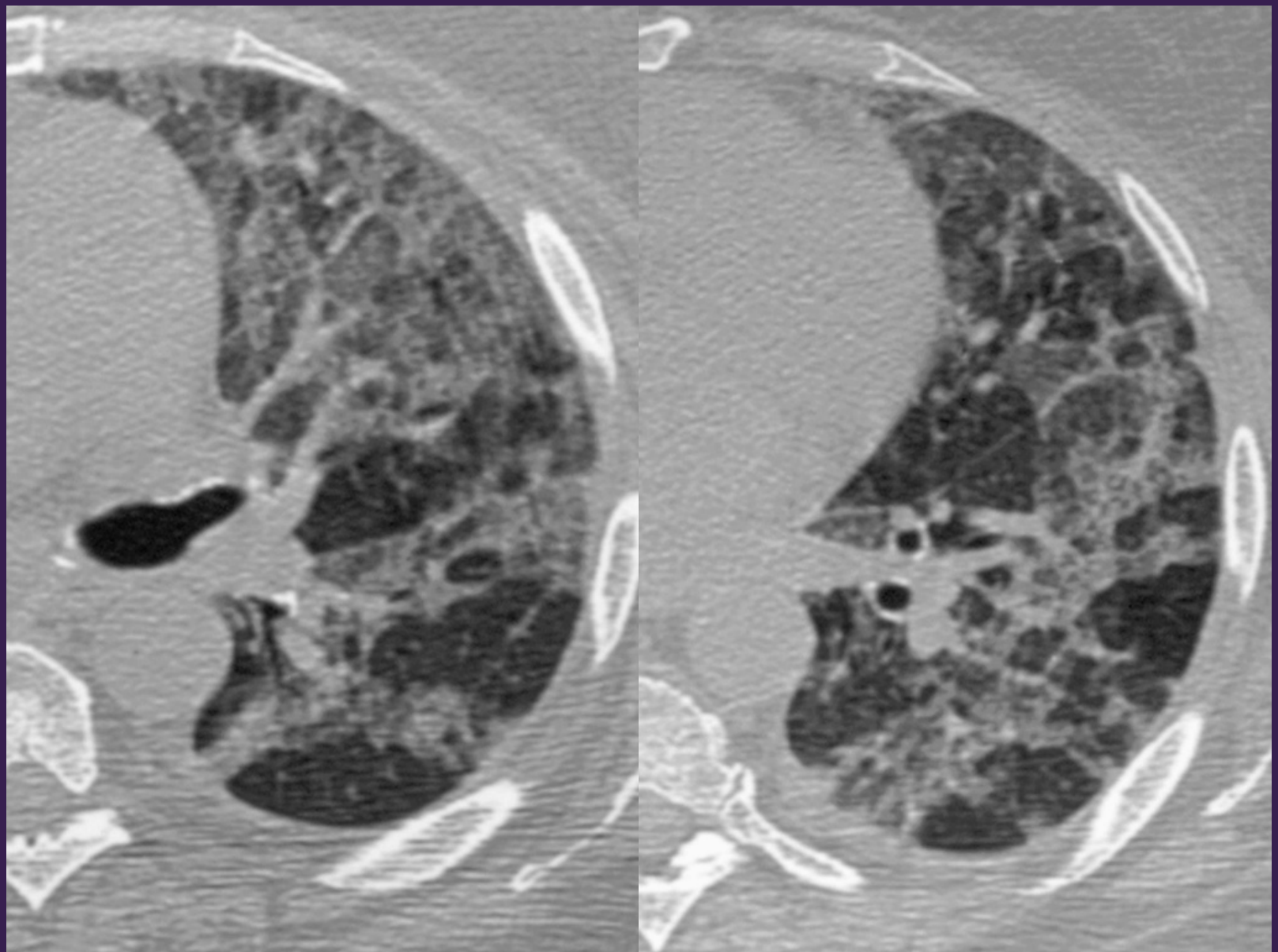
Correlation with Chest CT

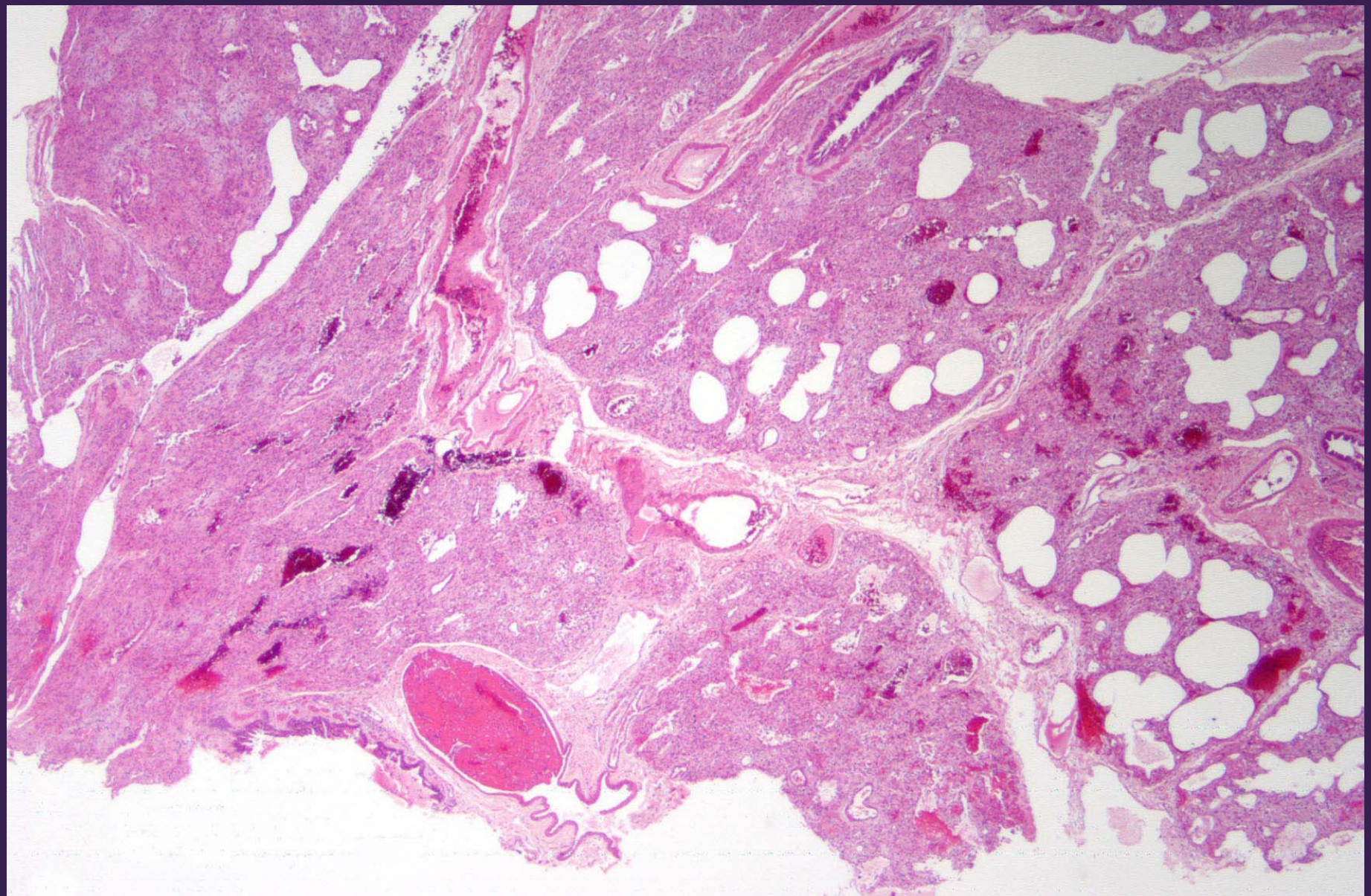


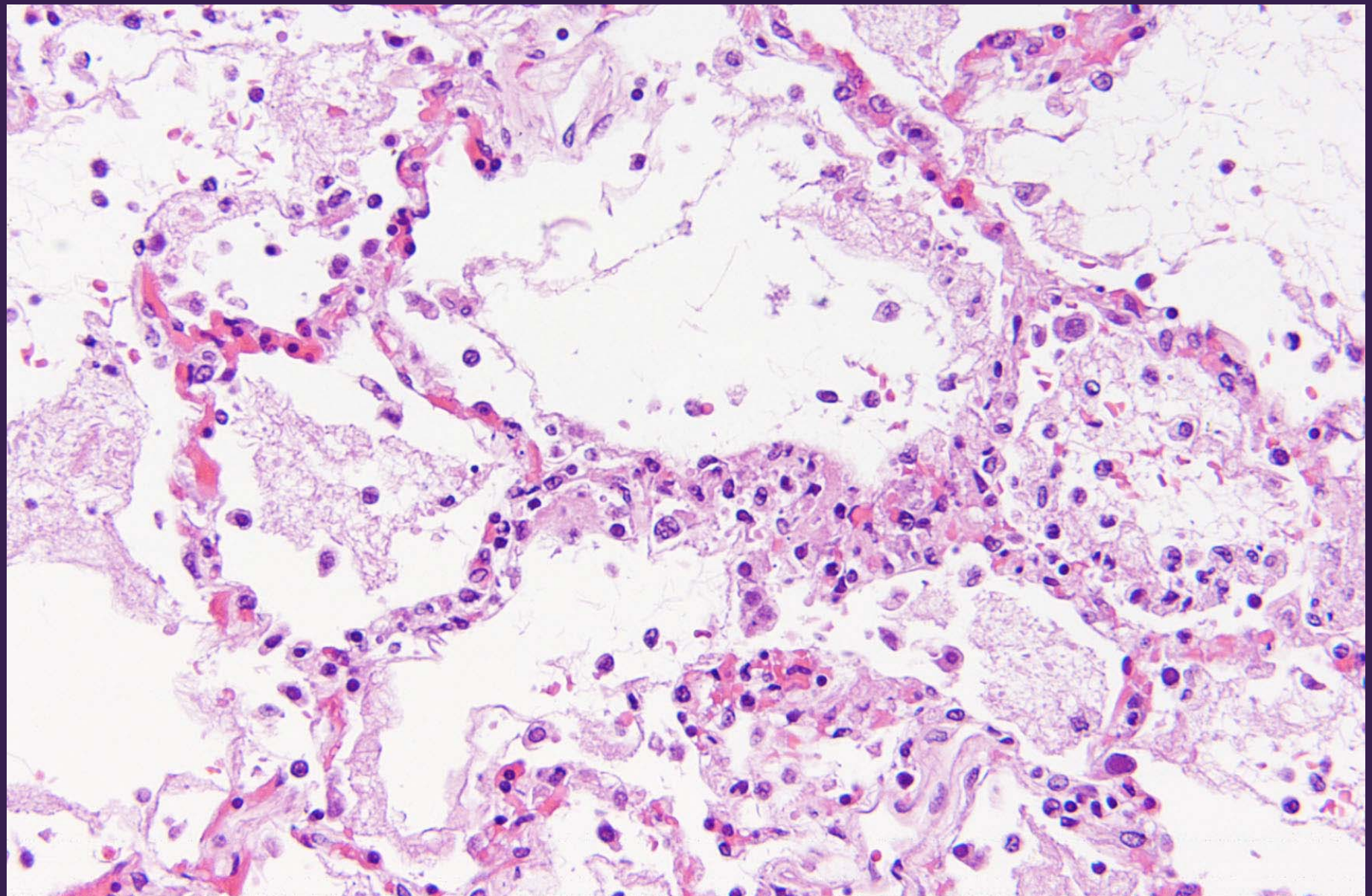
Hypersensitivity Pneumonitis

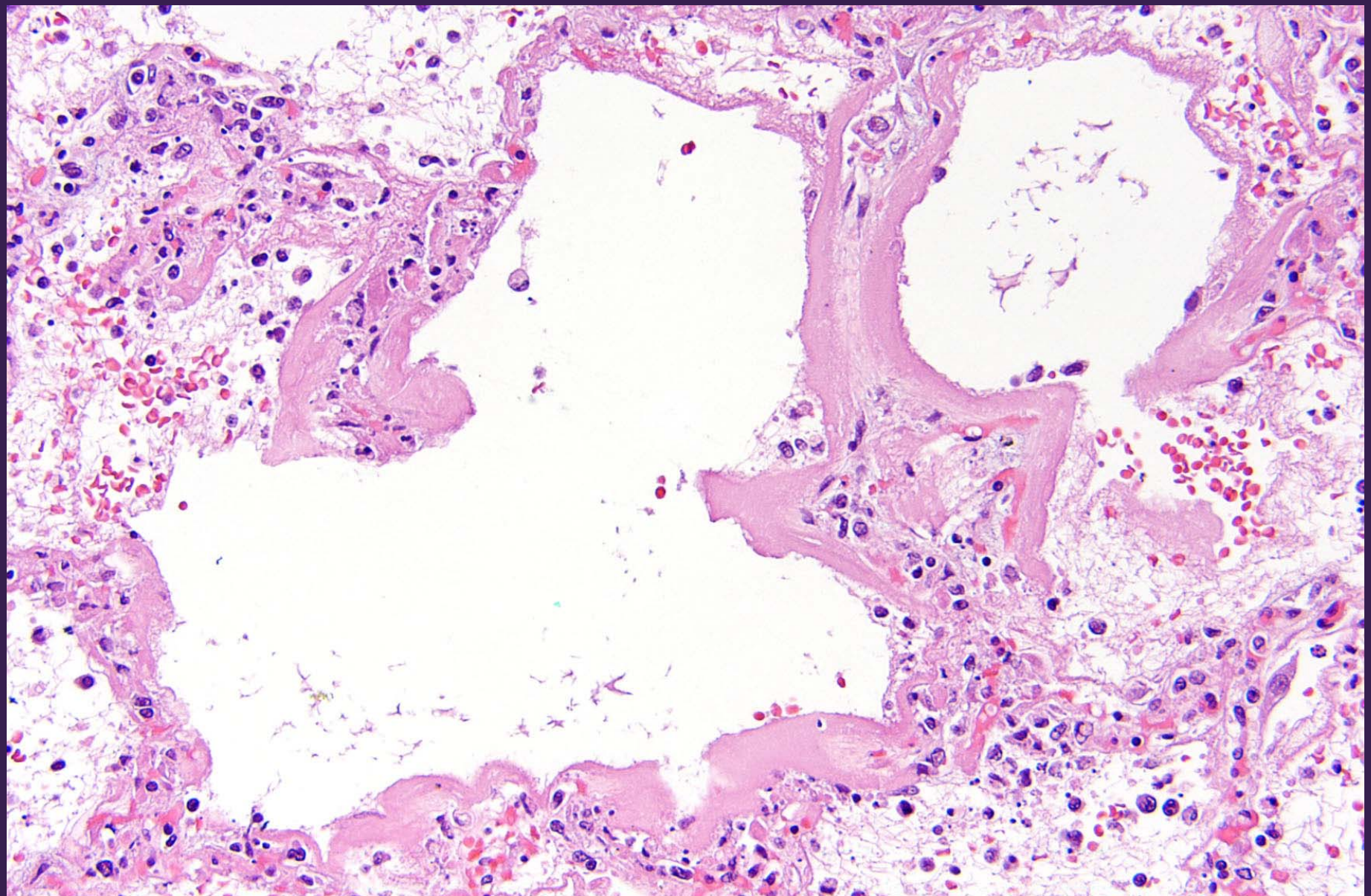


Diffuse Acute Lung Injury

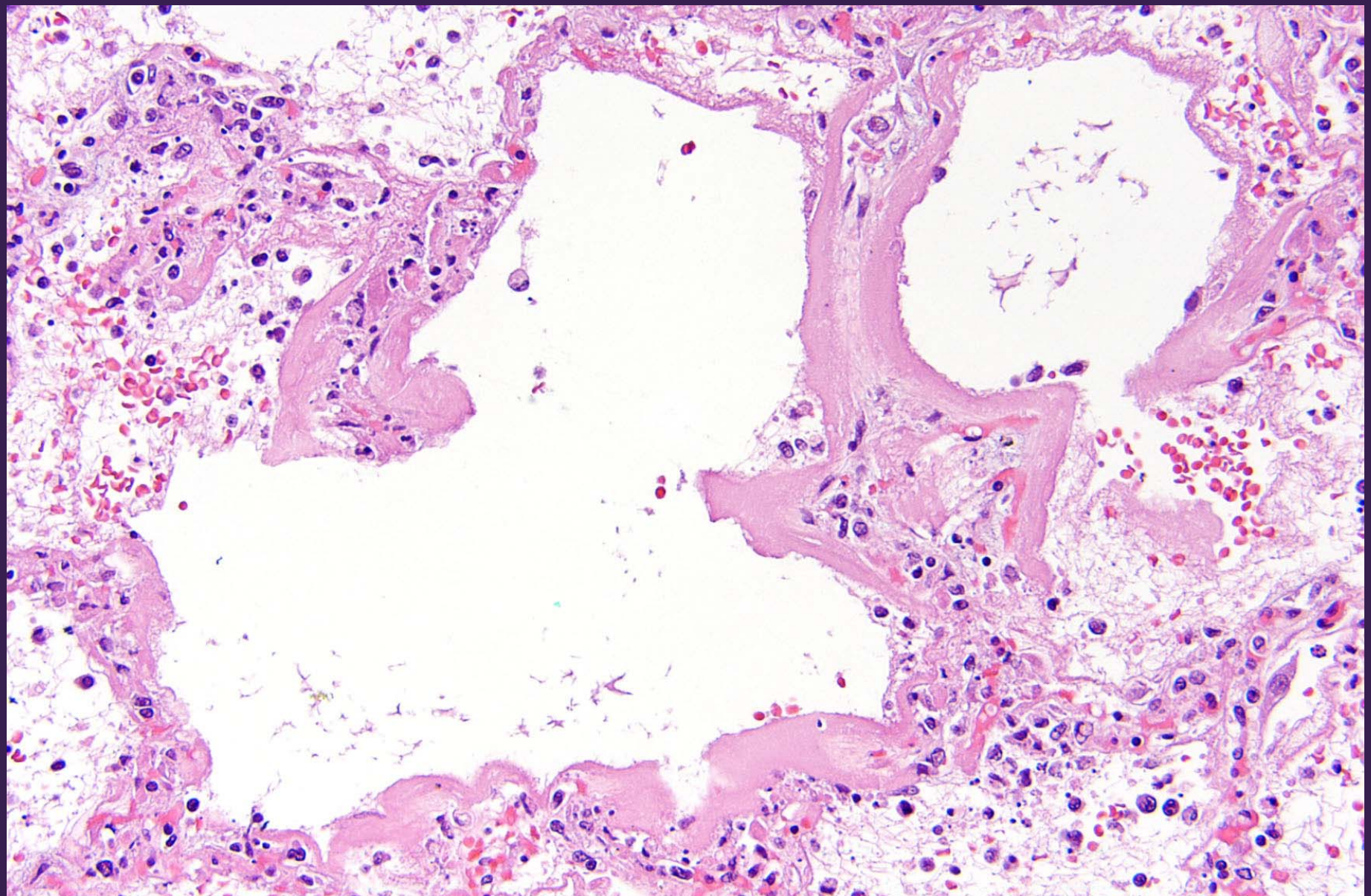








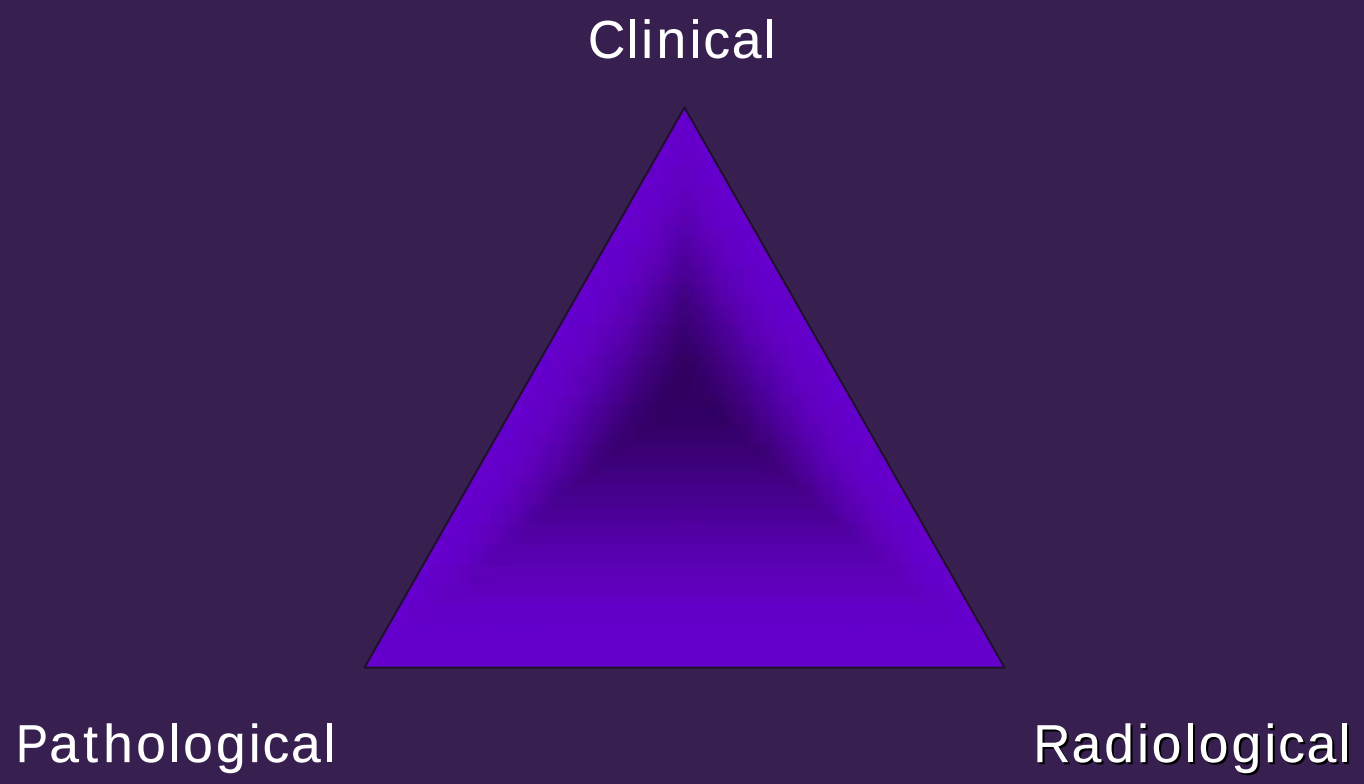
Diffuse Alveolar Damage



Diffuse Alveolar Damage

Clinical conditions associated with DAD

- Infection
- Inhalants
- Ingestants
- Drug toxicity
- Collagen vascular disease
- Uremia
- Sepsis
- Shock
- Trauma
- Miscellaneous
- Idiopathic – AIP

AskAFIP Hot Topic

Multidisciplinary information