CHRONIC INTERSTITIAL (RESTRICTIVE, INFILTRATIVE) LUNG DISEASES, LEC 6

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SILICOSIS

- **The most prevalent chronic occupational disease in the world**

- Inhalation of crystalline silica mostly in **occupational** settings

- **quartz is the most common**

- Amorphus silica is less pathogenic

- **Workers in sandblasting and hard-rock mining are at high risk.**

PATHOGENESIS

- After **inhalation**, the particles **interact with epithelial cells and macrophages.**

- Activating the **inflammasome** and the release of **inflammatory mediators** by pulmonary macrophages

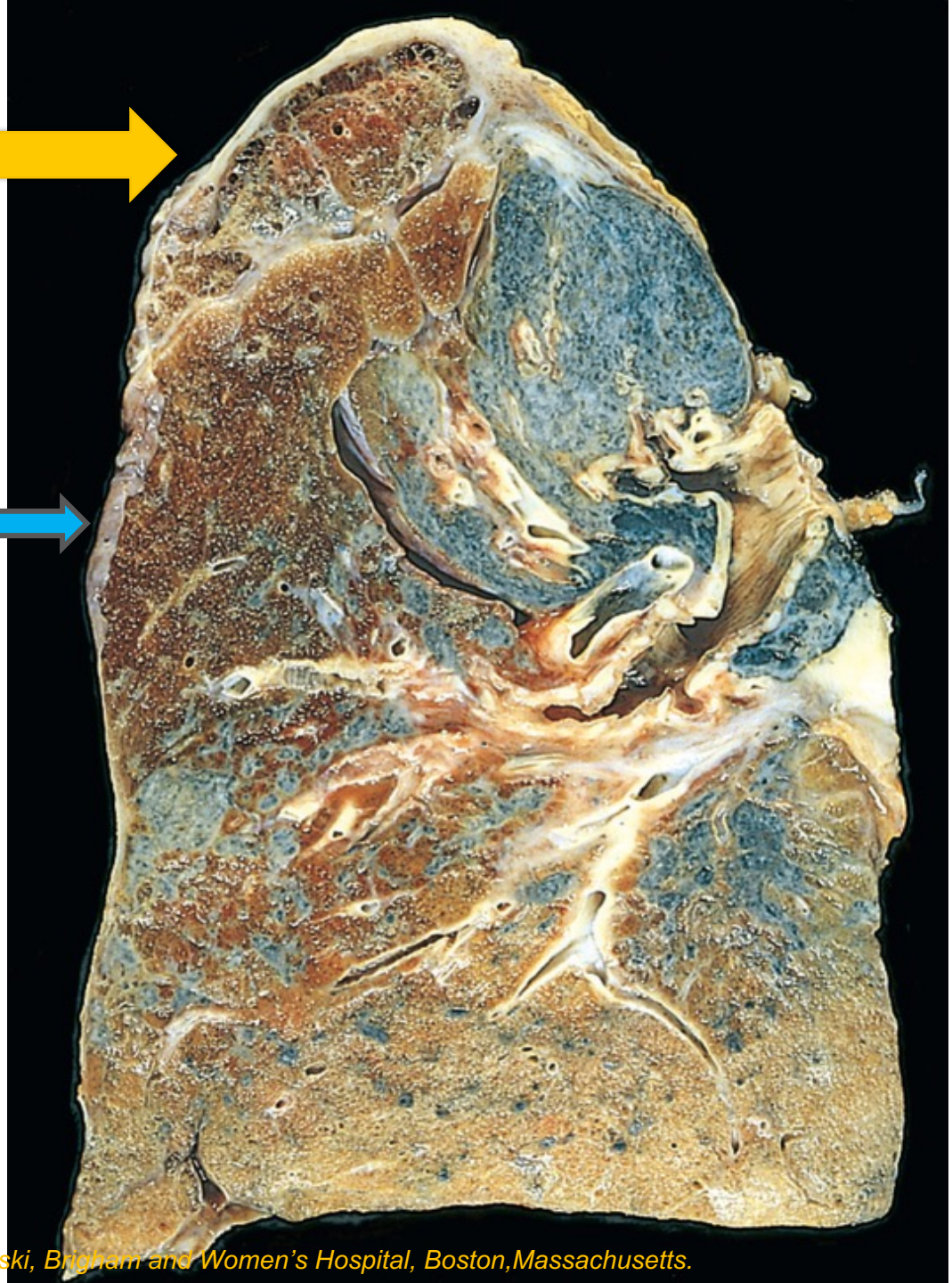
    - IL-1, TNF, fibronectin, lipid mediators, oxygen-derived free radicals, and fibrogenic cytokines.

- **When mixed with other minerals**, **the fibrogenic effect of quartz is reduced**.

- This fortuitous situation is commonplace, as **quartz** in the workplace is **rarely pure**.

MORPHOLOGY, SILICOTIC NODULES:

- **Macroscopically**:
  - early stages are tiny, barely palpable, discrete, pale-to-black (if coal dust is present) nodules
  - **Upper zones** of the lungs



Courtesy of Dr. John Godleski, Brigham and Women's Hospital, Boston,Massachusetts.

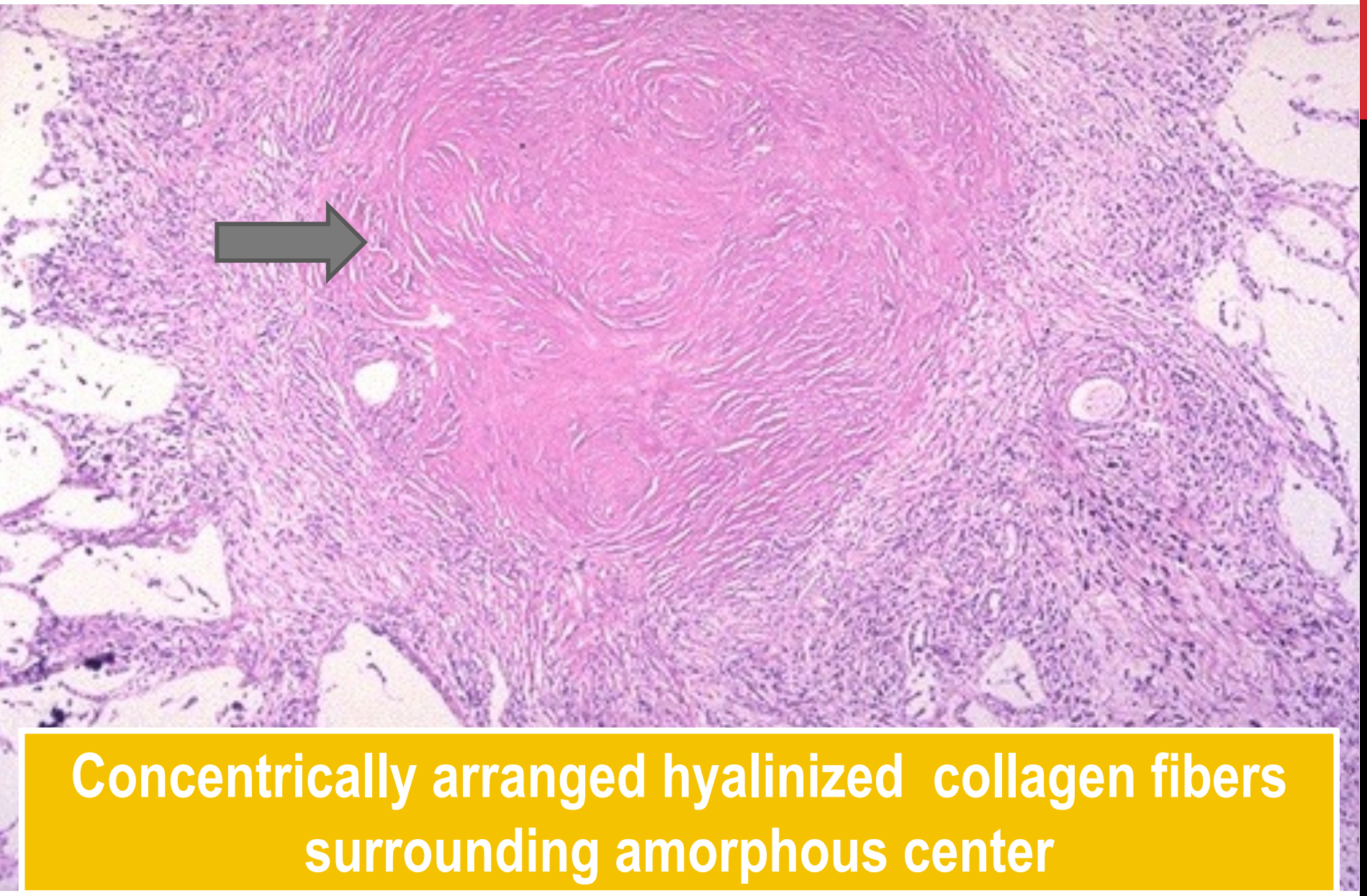
- **Microscopically:**
- **Silicotic nodules:**
    - **Concentrically arranged hyalinized collagen fibers surrounding amorphous center.**
    - With **“whorled”** collagen fibers

- **Polarized** microscopy reveals weakly birefringent silica

- Nodules may coalesce into **hard, collagenous scars**, with eventual **progression to PMF**

- **Fibrotic lesions** also may occur in **hilar lymph nodes and pleura.**

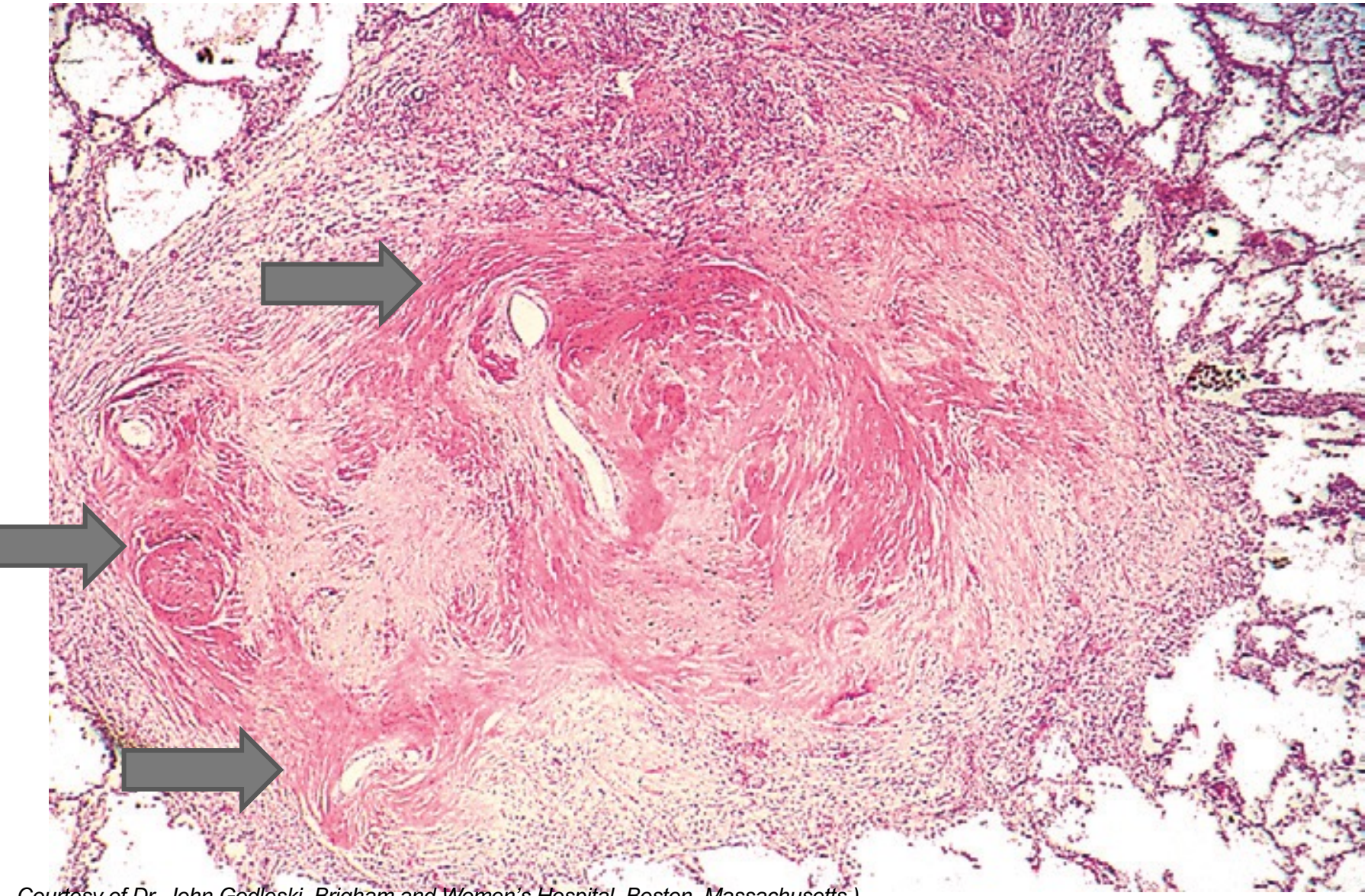
SILICOTIC NODULE



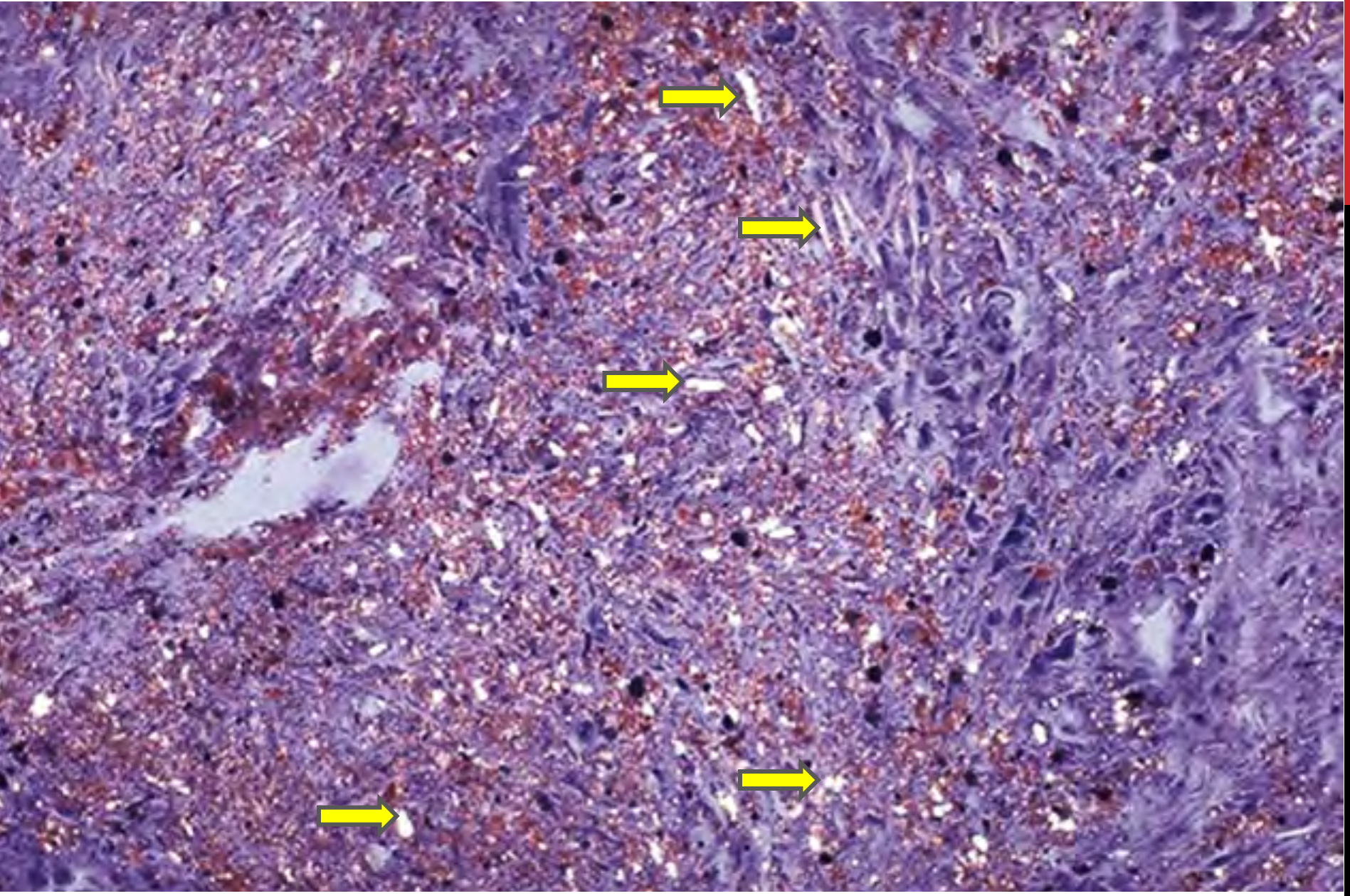
Concentrically arranged hyalinized collagen fibers surrounding amorphous center

Webpath.med.utah.edu

SEVERAL COALESCENT COLLAGENOUS SILICOTIC NODULES



Courtesy of Dr. John Godleski, Brigham and Women's Hospital, Boston, Massachusetts.)



Silica cystals

CLINICAL FEATURES:

- **Asymptomatic**: detected as fine nodularity in the upper zones of the lung on routine chest radiographs

- after **PMF**: Shortness of breath, pulmonary hypertension and cor pulmonale

- **slowly progressive**, impairing pulmonary function to a degree that limits physical activity.

- **Increased susceptibility to tuberculosis**
- **lung cancer ?**

ASBESTOSIS AND ASBESTOS-RELATED DISEASES

https://en.wikipedia.org/wiki/Asbestos

ASBESTOS

- **Family of crystalline hydrated silicates with a fibrous geometry.**

ASSOCIATED WITH:

(1) parenchymal interstitial fibrosis (asbestosis);

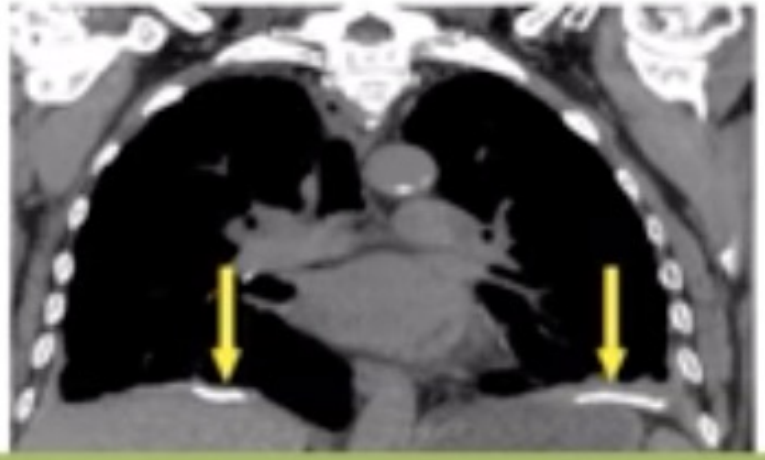
(2) localized fibrous plaques or, rarely, diffuse pleural fibrosis.

(3) pleural effusions

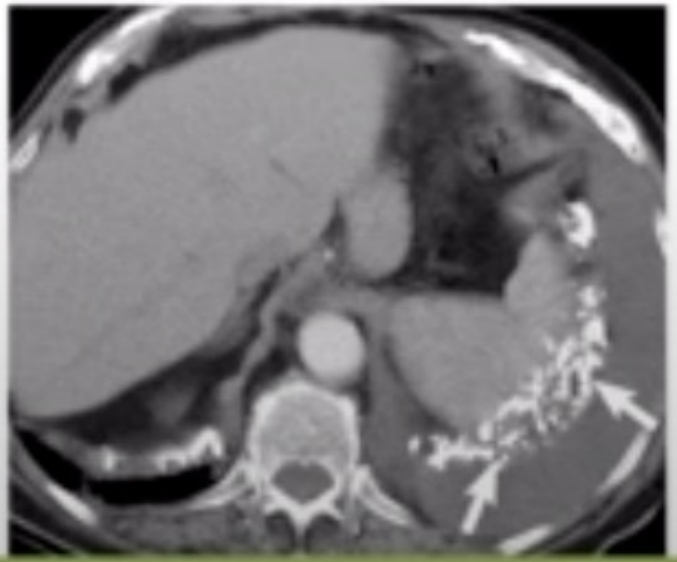
(4) Lung carcinomas

(5) malignant pleural and peritoneal mesotheliomas

(6) laryngeal carcinoma



Pleural Plaques suggest asbestos exposure and do not cause symptoms



Malignant Pleural Mesothelioma: Rare cancer of the lung lining

ASBESTOSIS:
IS SCARRING OF THE LUNG CAUSED BY ASBESTOS EXPOSURE

PATHOGENESIS:

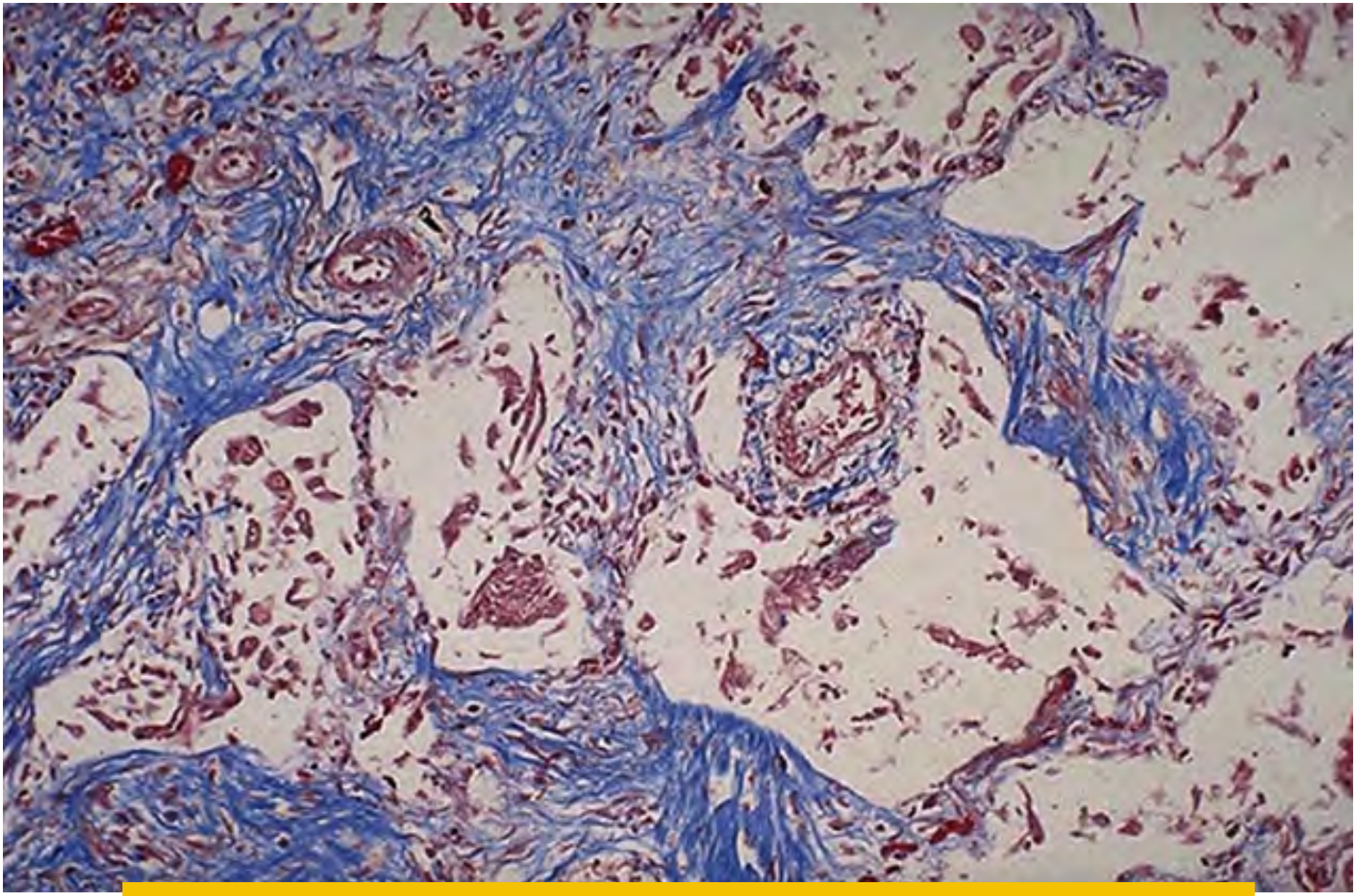
- once phagocytosed by macrophages→ asbestos fibers activate the inflammasome and damage phagolysosomal membranes → release of proinflammatory factors and fibrogenic mediators→

1. cellular and fibrotic lung reactions
2. tumor initiator and a promoter
    - mediated by the oncogenic effects of reactive free radicals generated by asbestos fibers on the mesothelium.

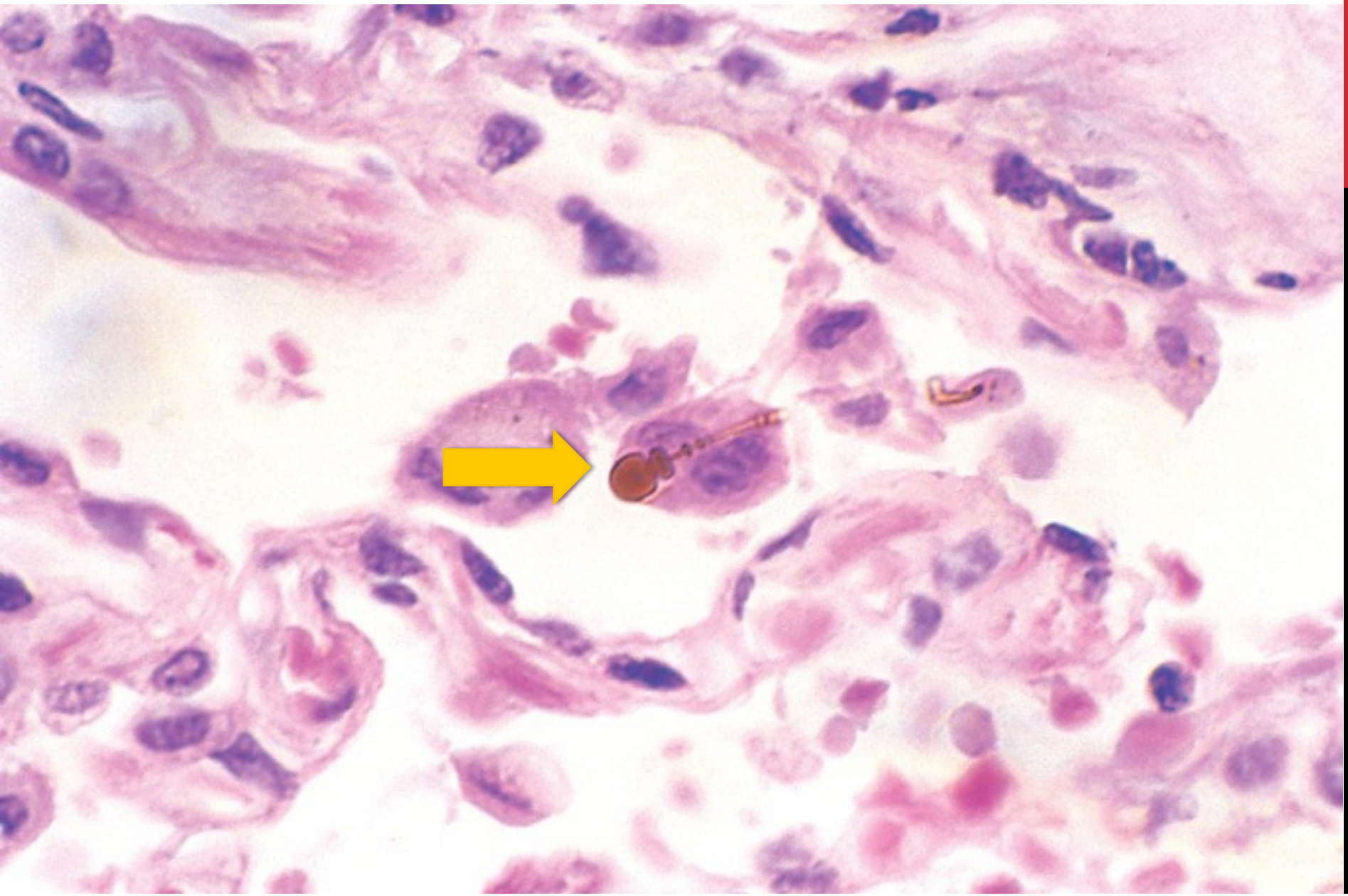
- **Asbestos and tobacco:**
  - The adsorption of carcinogens in tobacco smoke onto asbestos fibers results in remarkable **synergy** between tobacco smoking and the development of lung carcinoma in asbestos workers.

https://health.clevelandclinic.org/even-smoking-just-one-or-two-cigarettes-a-day-increases-your-risk-of-lung-disease/

MORPHOLOGY

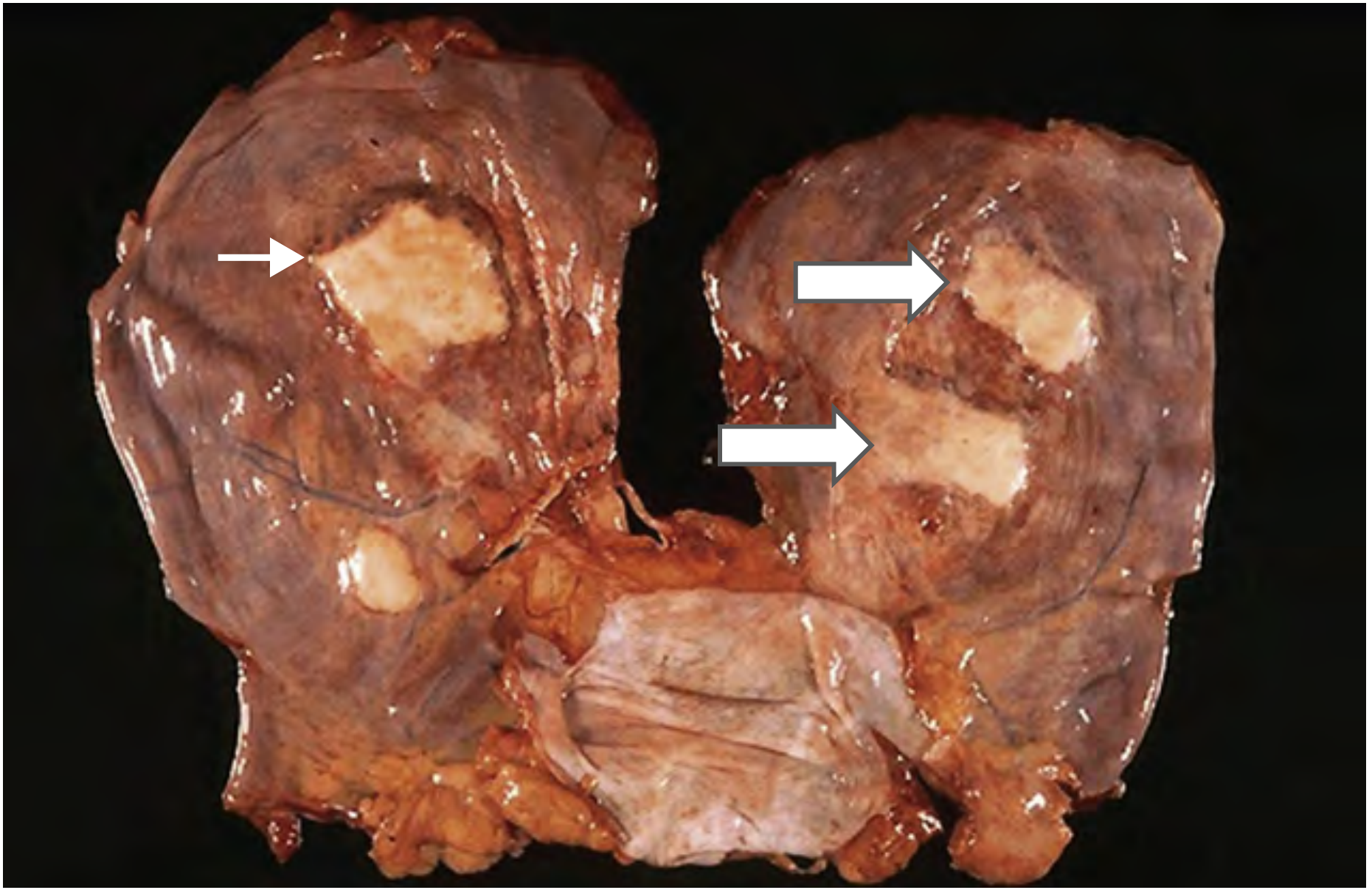


diffuse pulmonary interstitial fibrosis

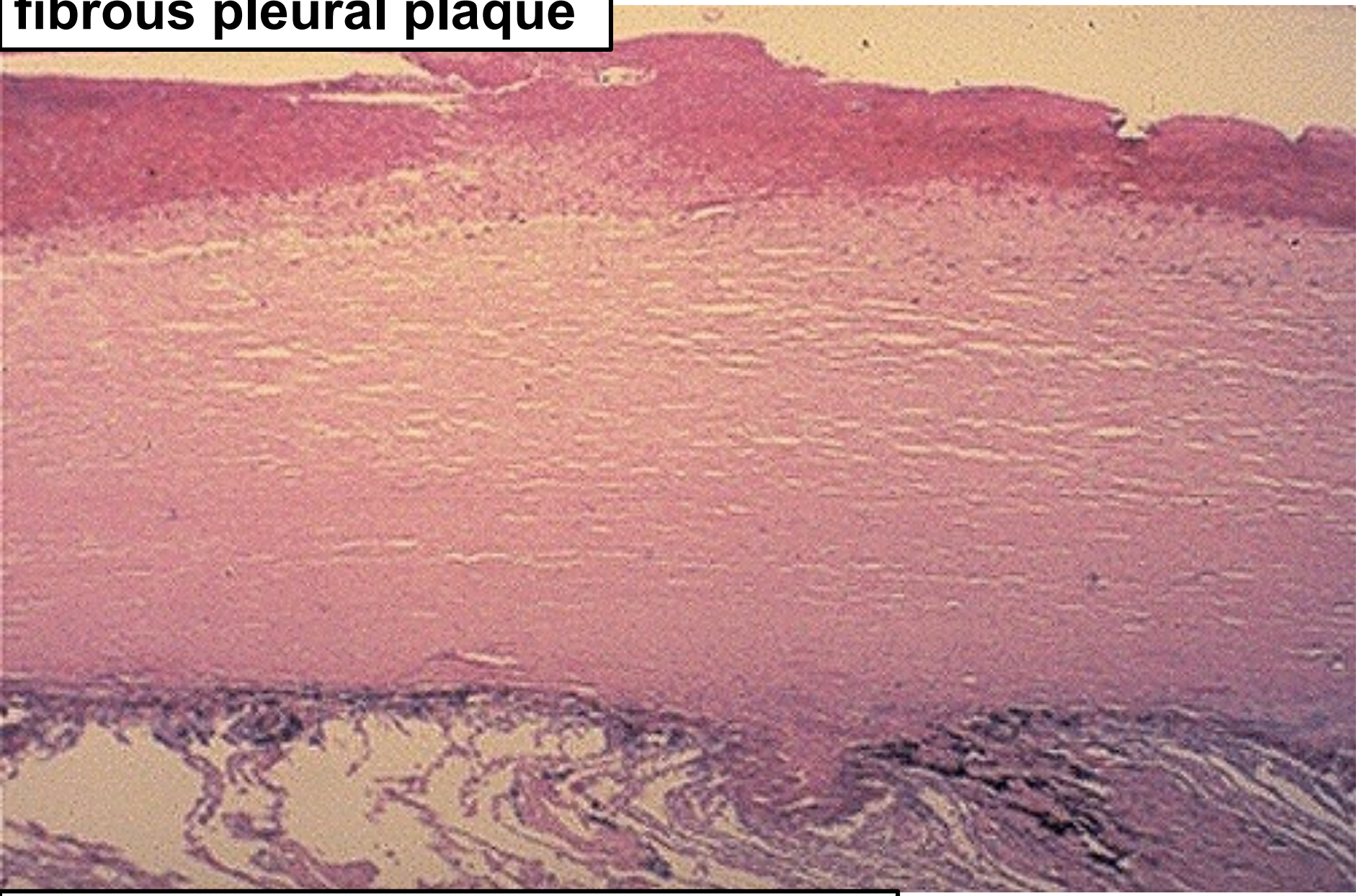


Asbestos body with beading and knobbed ends

Robbin's Basic pathology, 10 th edition

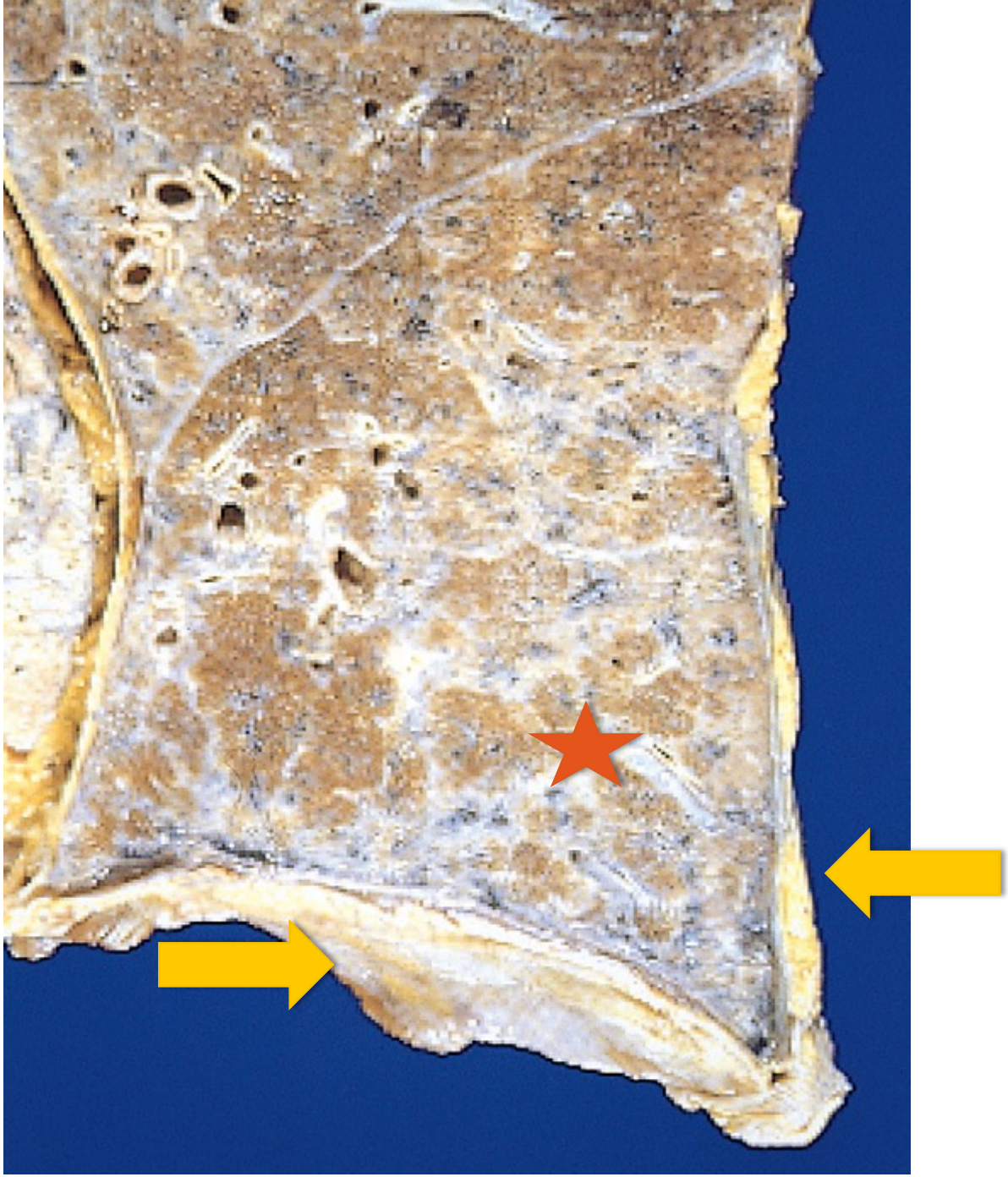


fibrous pleural plaque



dense laminated layers of collagen (pink)

Robbin's and Cotran Atlas of pathology, 3rd edition



Robbin’s Basic pathology, 10 th edition

MORPHOLOGY

- **Diffuse pulmonary interstitial fibrosis** indistinguishable from UIP.
- **Asbestos bodies:**
  - golden brown, fusiform or beaded rods with a translucent center.
  - Formed of asbestos fibers coated with an iron-containing proteinaceous material
- Begins in the **lower lobes and subpleurally**

Robbin's Basic pathology, 10 th edition

- **Pleural plaques:**
  - the most common manifestation of asbestos exposure
  - well-circumscribed plaques of dense collagen containing calcium
  - anterior and posterolateral aspects of the parietal pleura and over the domes of the diaphragm

CLINICAL FEATURES:

- Progressively worsening dyspnea **10 to 20 years after exposure**.
- cough and production of sputum.
- **static or progress** to congestive heart failure, cor pulmonale, and death.
- Pleural plaques are usually asymptomatic

OUTCOMES:

- The risk for developing **lung carcinoma** is increased **5-fold** for asbestos workers
- the relative risk for **mesothelioma** is more than **1000 times** greater than the risk for lung cancer
- Concomitant **cigarette smoking** increases the risk for lung carcinoma **but not for mesothelioma**.
- **Lung or pleural cancer** associated with asbestos exposure carries a particularly **poor prognosis**.

PULMONARY EOSINOPHILIA

PULMONARY EOSINOPHILIA

- number of disorders of immunologic origin, characterized by pulmonary infiltrates rich in eosinophils

DIVIDED INTO:

- Acute eosinophilic pneumonia with respiratory failure
- Simple pulmonary eosinophilia (Loeffler syndrome)
- Tropical eosinophilia
- Secondary eosinophilia
- Idiopathic chronic eosinophilic pneumonia

- **Acute eosinophilic pneumonia with respiratory failure:**
  - rapid onset of fever, dyspnea, hypoxia
  - respond to corticosteroids.

- **Simple pulmonary eosinophilia (Loeffler syndrome):**
  - transient pulmonary lesions
  - eosinophilia in the blood
  - benign clinical course

- **Tropical eosinophilia*:***
  - caused by infection with microfilariae and helminthic parasites

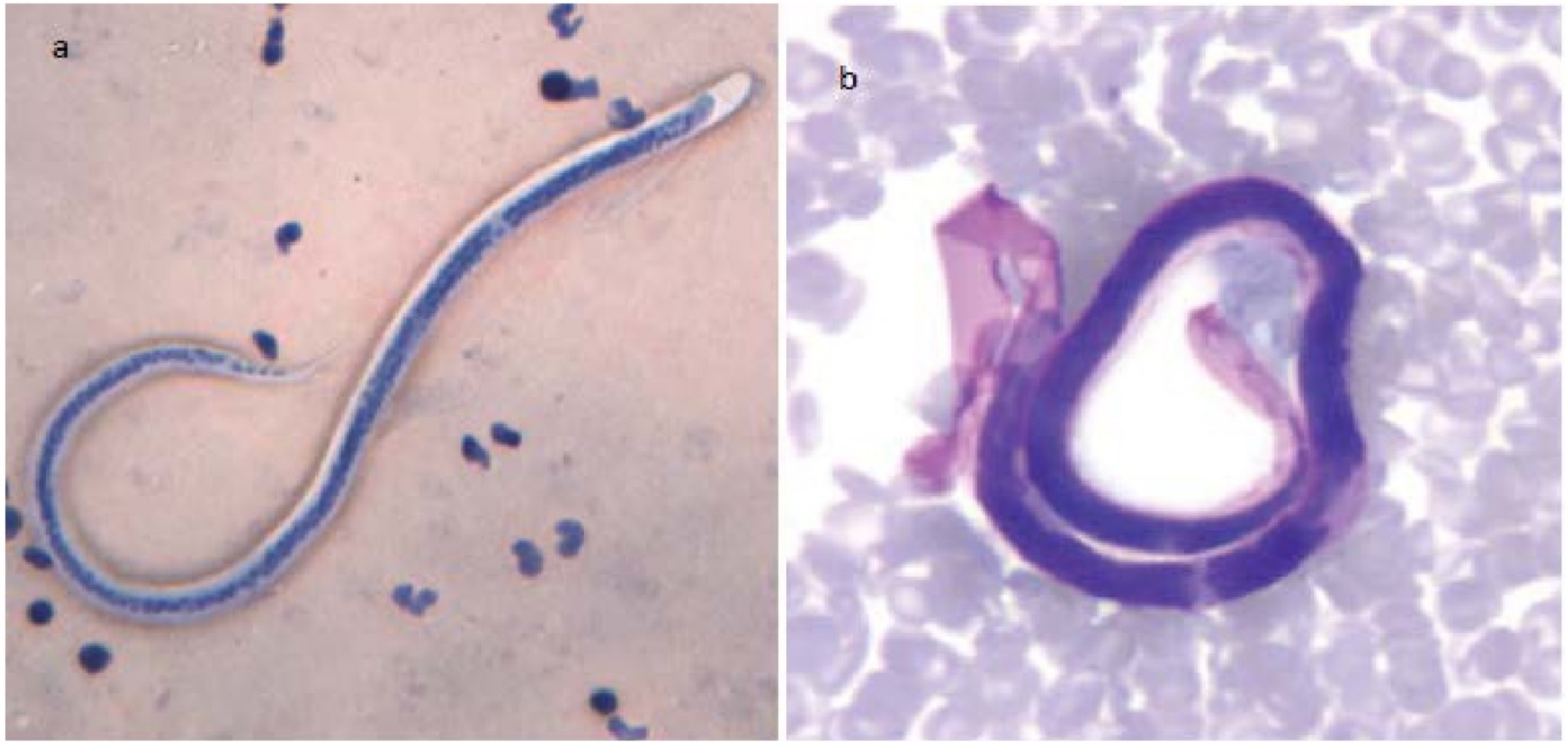


Figure 1: a) Microfilaria of *W. bancrofti* in a thick blood smear stained with Giemsa; b) Microfilaria of *B. malayi* in a thin blood

Tropical Pulmonary Eosinophilia: An Epidemiological and Clinical Review, Medicine Published 2019 DOI:10.23937/2378-3516/1410102

- **Secondary eosinophilia:**
  - in association with asthma, drug allergies, and certain forms of vasculitis

- **Idiopathic chronic eosinophilic pneumonia*:***
  - disease of exclusion, once other causes of pulmonary eosinophilia have been ruled out.

SMOKING-RELATED INTERSTITIAL DISEASES

https://health.clevelandclinic.org/even-smoking-just-one-or-two-cigarettes-a-day-increases-your-risk-of-lung-disease/

SMOKING-RELATED INTERSTITIAL DISEASES

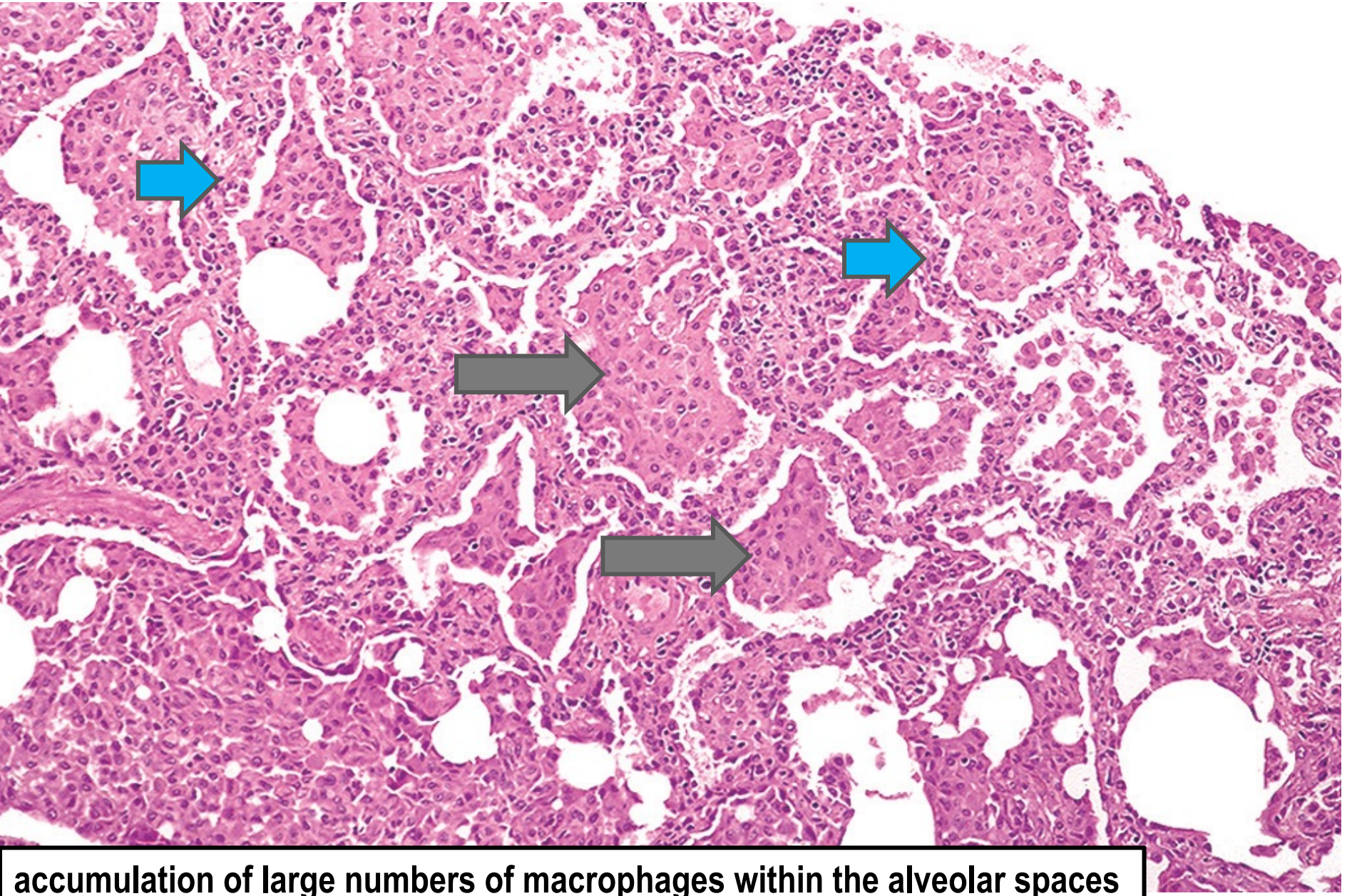
- Desquamative interstitial pneumonia (DIP)
- respiratory bronchiolitis

DESQUAMATIVE INTERSTITIAL PNEUMONIA (DIP)

- The most striking histologic feature of DIP is the accumulation of large numbers of macrophages containing dusty-brown pigment *(smoker's macrophages)* in the air spaces

- Lymphocytes in alveolar septa

- +/- mild Interstitial fibrosis



accumulation of large numbers of macrophages within the alveolar spaces

only slight fibrous thickening of the alveolar walls.

Outcome:

- good prognosis

- excellent response to steroids and smoking cessation, however, some patients progress despite therapy.

RESPIRATORY BRONCHIOLITIS

- common lesion in smokers
- presence of pigmented intraluminal macrophages akin to those in DIP, **but** in a “bronchiolocentric” distribution (first- and second-order respiratory bronchioles).
- Mild peribronchiolar fibrosis.
- As with DIP, presents with gradual onset of dyspnea and dry cough
- symptoms recede with smoking cessation.

A 60 year old gentleman had progressively worsening dyspnea over the past 12 years. He has noticed a 7-kg weight loss in the past 2 years. He has a chronic cough with minimal sputum production and no chest pain. On physical examination, he is afebrile and normotensive. A chest radiograph shows extensive interstitial disease. Pulmonary function tests show diminished lung volumes and capacities. Increased exposure to which of the following pollutants is most likely to produce these findings?

A Carbon monoxide

B Silica

C Tobacco smoke

D Wood dust

ANOTHER CASE?!

A 42 year old lady had a low-grade fever and worsening non productive cough and dyspnea for the past 2 years. On examination, she has breath sounds in all lung fields. A chest CT scan shows reticulonodular pattern of infiltrate. An arterial blood gas show mild hypoxemia and normal CO2. Pulmonary function tests show decreased lung capacities and volumes. Her pulmonary compliance is reduced. What is the most likely diagnosis?

A α1-Antitrypsin deficiency

B Diffuse alveolar damage

C Nonatopic asthma

D Sarcoidosis

FOR YOUR QUESTIONS:

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Or E-learning

THANK YOU!