Asbestosis and Berylliosis

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Asbestos

- Asbestos is a family of crystalline hydrated silicates that form fibers
- Greek word – unquenchable
- Coal is a lot of dust and little fibrosis
- Asbestos is little dust and lot of fibrosis

Asbestos

- In nature – exists as thin long fibrils which are fire resistant and can be spun into yarns
- Applications:

  Thermal insulation

  Electrical insulation

Workers at risk

- Miners

Fabrication of

- Pipes
- Tiles
- Roofs
- Textiles
- Brake lining

Manufacture of

- Textiles
- Insulating boards
- Sewer conduits
- Water conduits
- Clutch casting

Geometric forms

Serpentine

- Chrysotile

Amphibole

- Crocidolite (blue)
- Amosite (brown)
- Tremolite
- Anthophyllite
- Actinolyte

Geometric forms

Serpentine

- Curly and flexible
- Ex.,chrysotile (90%)
- Less pathogenic
- Soluble
- Get impacted in upper resp tract.
- Removed by mucocilia

Amphiboles

- Straight,stiff,brittle
- Crocidolite
- More fibrogenic
- Less soluble
- Reach deeper in lungs
- Penetrate epithelial cells, interstitium.

Asbestos –general remarks

- Amphiboles are more pathogenic
- Amphibole fibers-longer than 8 µm and thinner than 0.5 µm are more injurious than shorter and thicker ones
- High dosage – high incidence of disease
- Amphibole exposure – Mesothelioma

Asbestosis - general remarks

- Both initiators and promoters
- Oncogenic: free radical injury
- Adsorbed toxic chemicals
- *Silicosis is a nodular fibrosing disease*
- *Asbestosis is a diffuse interstitial process*
- *Diffuse fibrosis because:*
  - Asbestos reaches alveoli consistently
  - Penetrate epithelial cells

Asbestosis- pathogenesis

- Asbestos - MØ – interstitium – lymphatic - pleura
- Chemo attraction to PMN, macrophages
- Asbestos bodies - coat of glycoprotein, haemosiderin
- Induce fibrosis: MDGF, IL-1
- Induce ANA, Rhematoid factor

Asbestos induced diseases

1. Asbestosis
2. Pleural diseases
   - Pleural effusion
   - Visceral pleural fibrosis
   - Pleural plaques
3. Tumors

   Bronchogenic carcinoma

   Malignant mesothelioma

Asbestosis

- Diffuse pulmonary fibrosis
- Histologically: Asbestos bodies
- Gross: small, firm lungs
  cartilage like pleura
  subpleural fibrosis esp. @ bases
  late stages: cystic change
  honeycomb

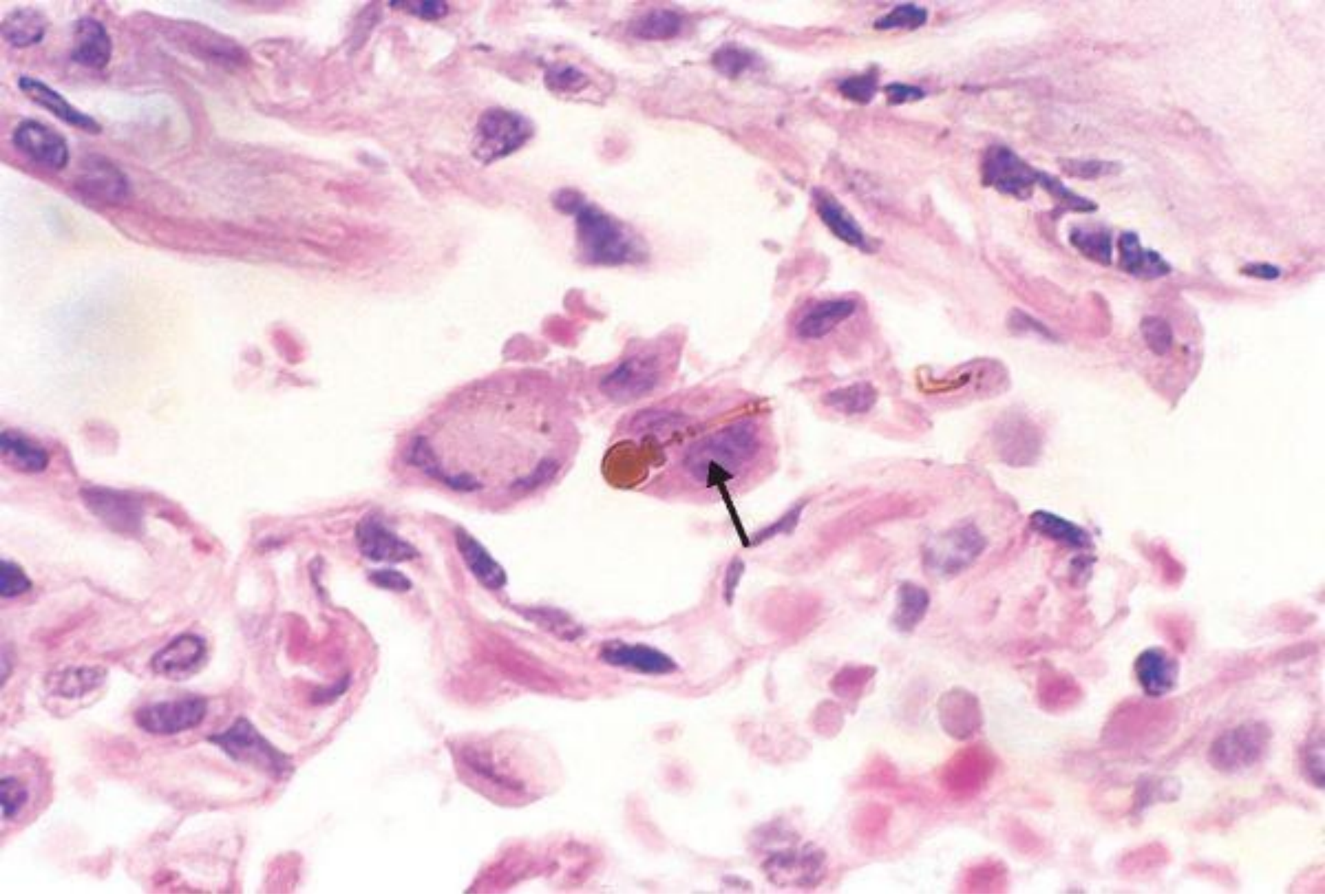
Asbestos - microscopy

1. Non specific interstitial fibrosis
2. Asbestos bodies
3. Emphysematous changes

Asbestos bodies

- Golden brown, fusiform / beaded rods with translucent center
- Consists of asbestos fibres coated with iron containing protenaceous material
- Iron derived from phagocyte ferritin
- Ferruginous bodies: inorganic particulates coated by similar iron protein complexes

This long, thin object is an asbestos fiber



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Asbestos body - Typical beading and knobbed ends (*arrow*)

Ferruginous body

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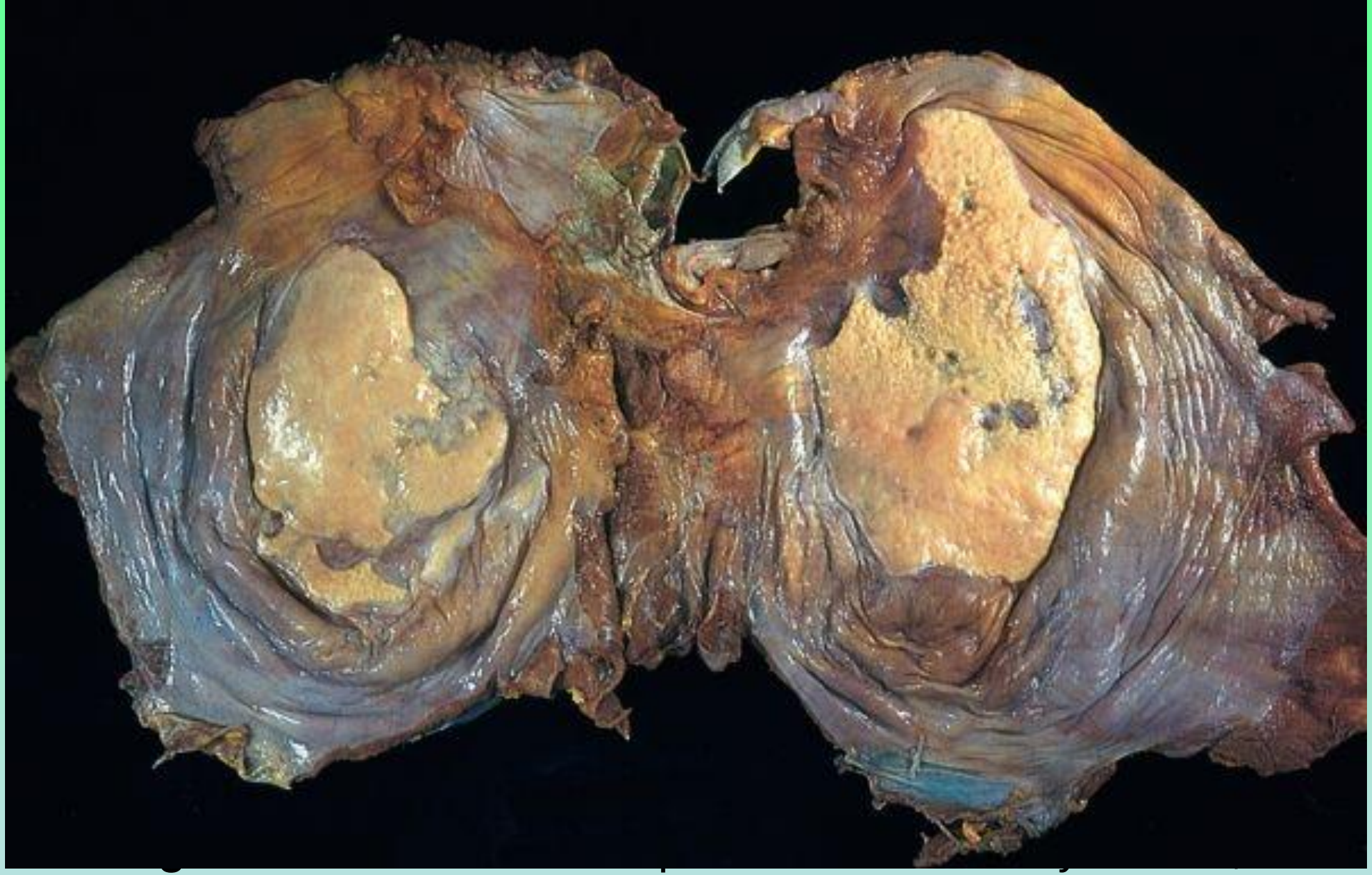
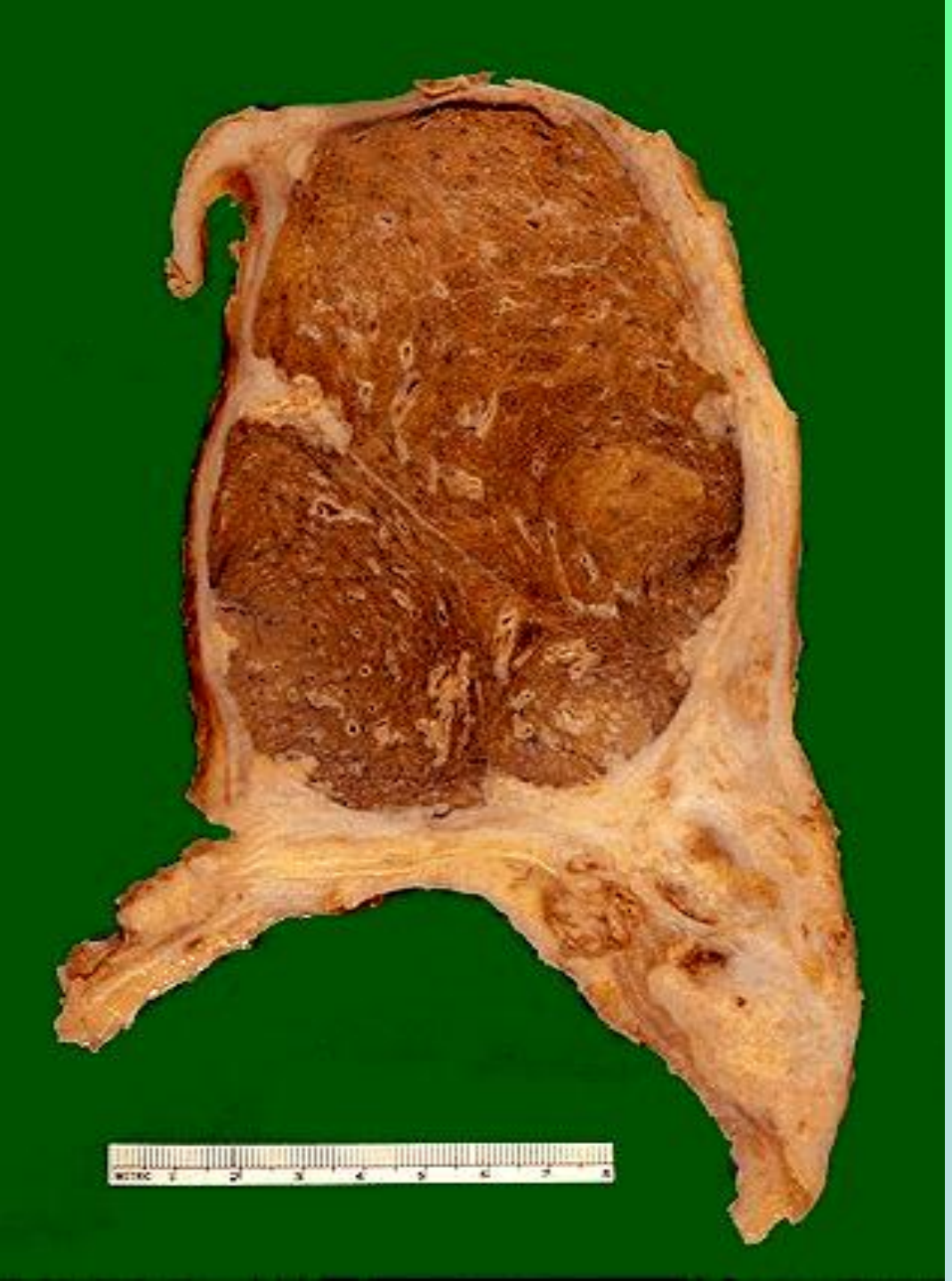
Pleural disease

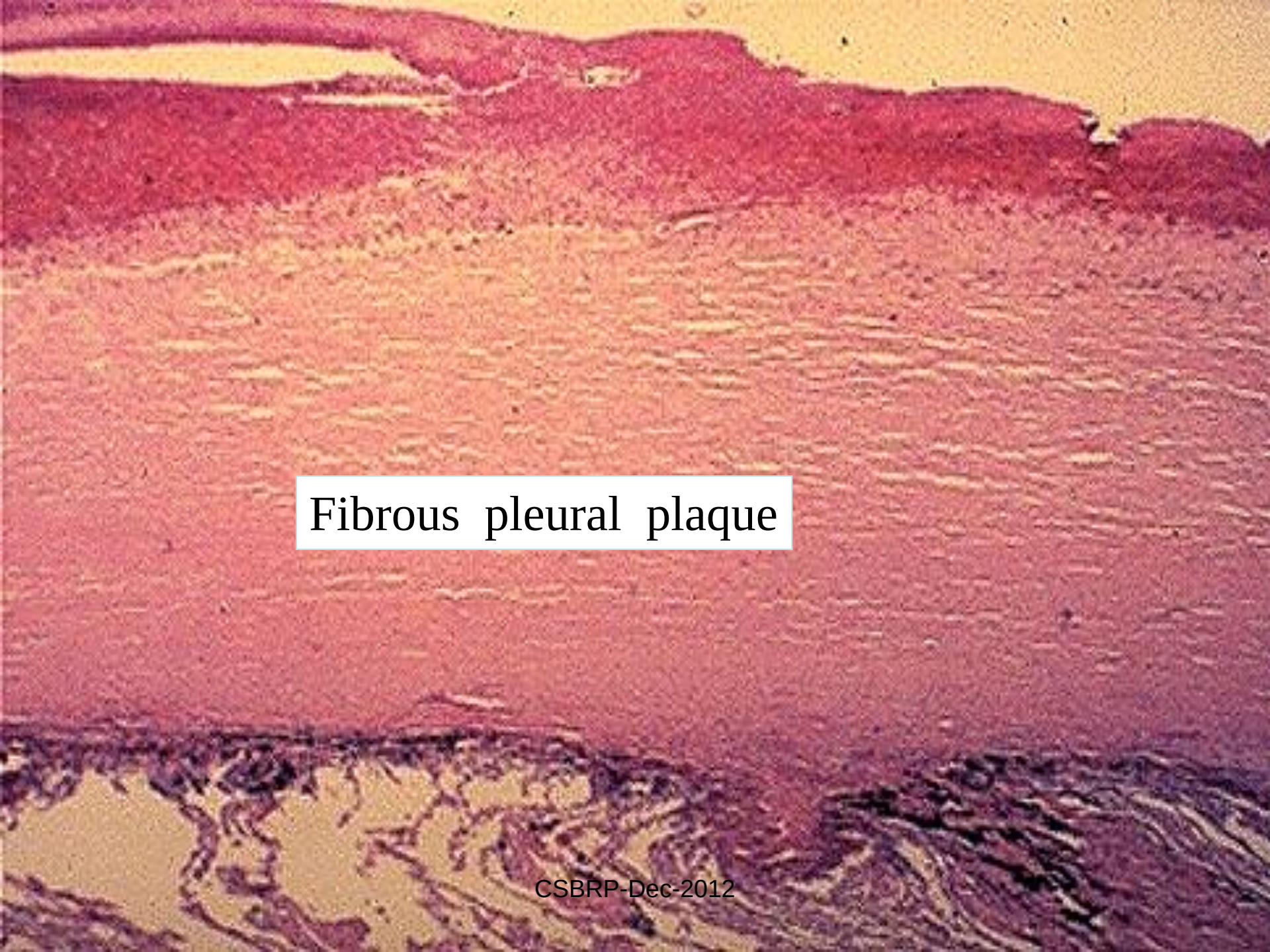
- Pleural effusion: Serous effusion
- Visceral pleural fibrosis: Encases the lung
- Pleural plaques: Fibrocalcific
- Micro:
    - Hyalinised collagenous tissue
    - Calcification
    - No asbestos bodies



discrete, characteristic **fibrocalcific plaques** on the pleural surface of the diaphragm.



Diffuse visceral Pleural fibrosis


Fibrous pleural plaque

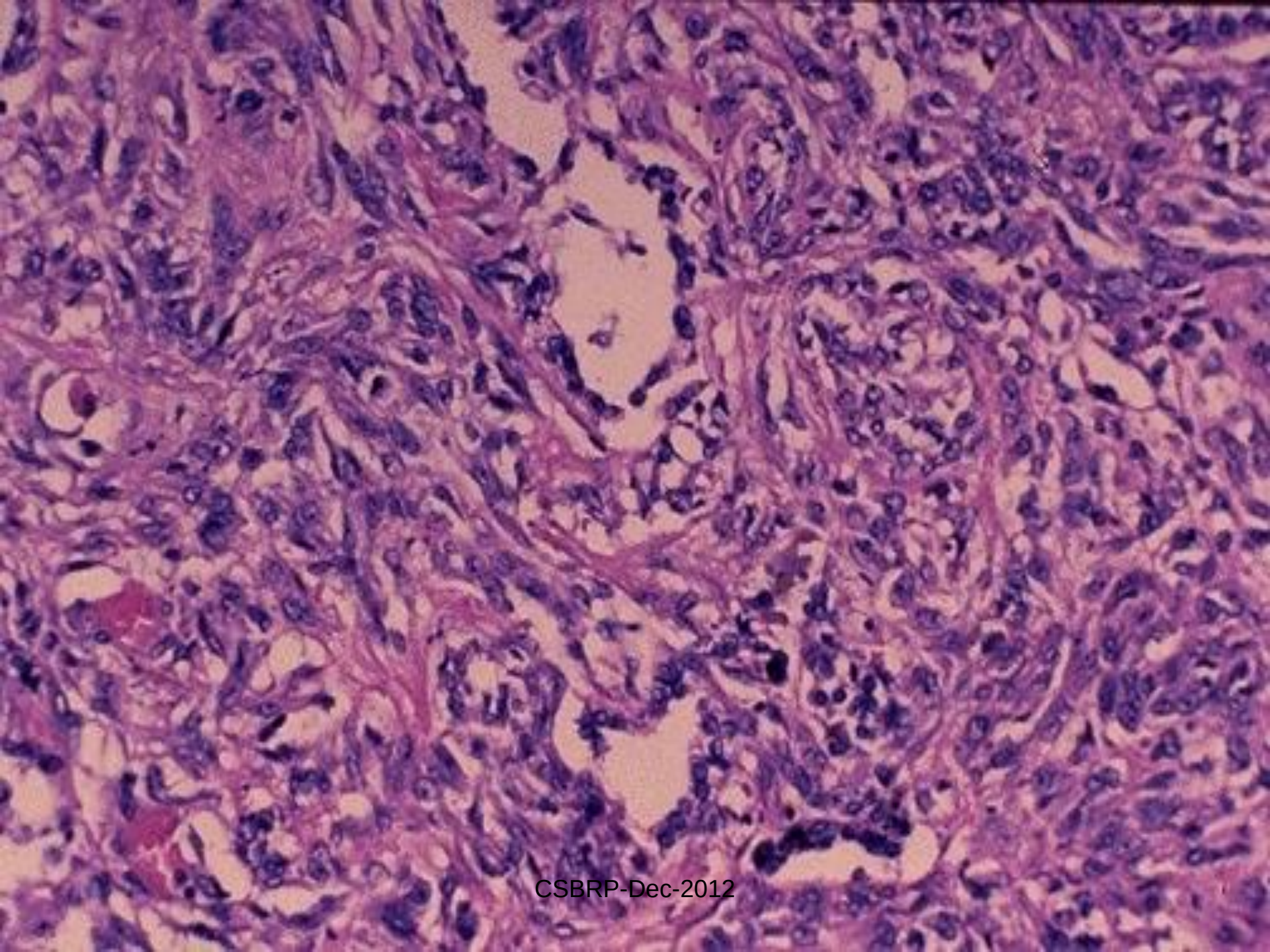
Asbestos - Tumors

- Brochogenic carcinoma 5x
- Malignant mesothelioma 1000x
- Carcinoma esophagus
- Carcinoma stomach
- Carcinoma colon
- Carcinoma kidneys
- Carcinoma larynx

Concomitant cigarette smoking greatly increases the risk of lung carcinoma but not that of mesothelioma.

Malignant Mesothelioma

- Monophasic / biphasic tumor
- Spindle cells / gland formations
- Markers:
  - Calretinin
  - CK 5/6
  - WT1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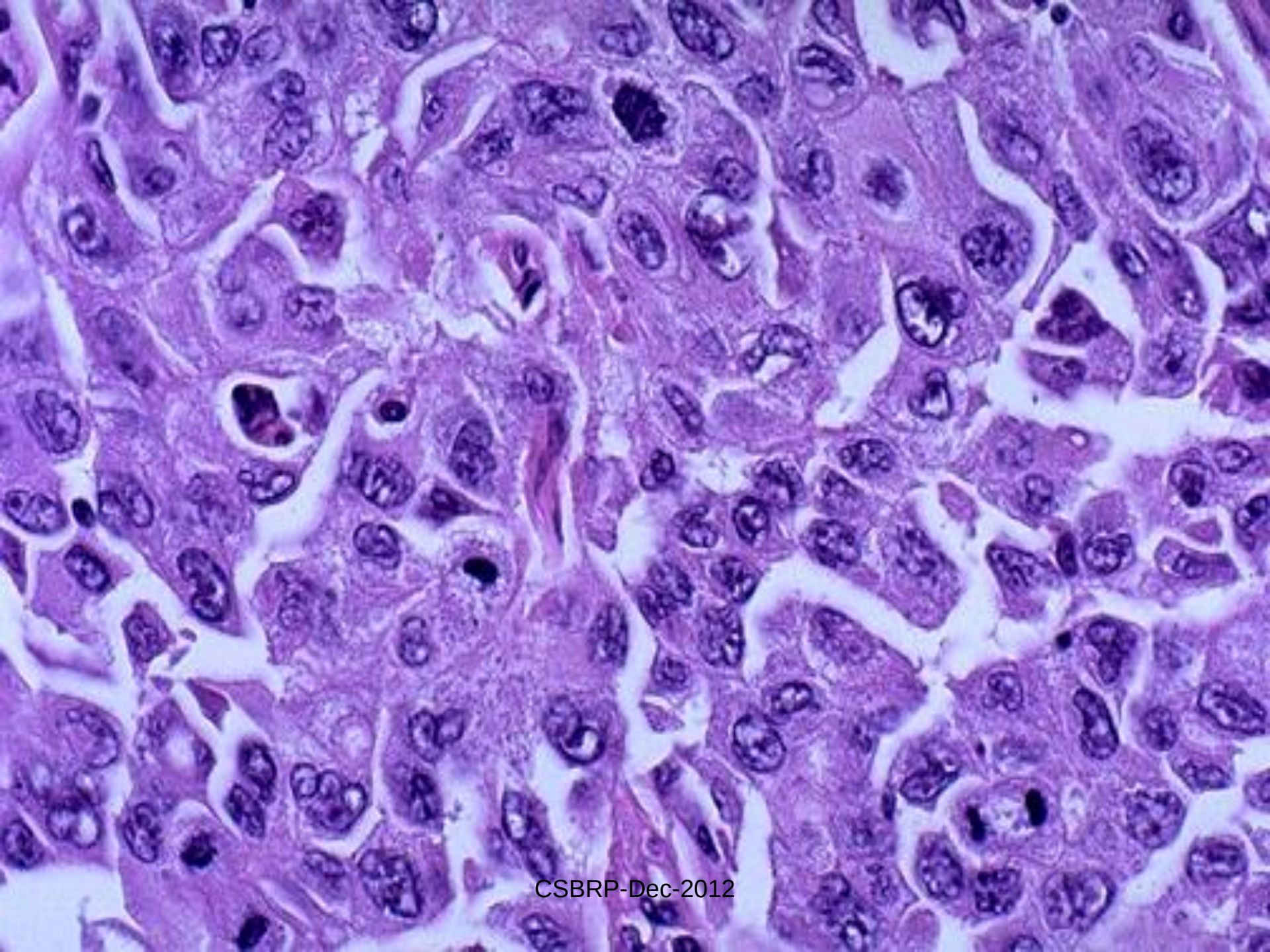
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Asbestosis - Clinical features

- Slow insidious, asymptomatic
- Dyspnoea
- Dry / productive cough
- Advanced cases:

  Caplan syndrome

  Pul. HTN
  cor pulmonale

  various Cancers

Berylliosis

Berylliosis

- Exposure to dust / fumes of metallic beryullium
- Past - Fluorescent tubes / light bulbs
- Presently –
  - Aerospace industries
  - Electrical / electronic equipments
- Two diseases – acute / chronic

Acute berylliosis

- Unusual sensitivity
- Heavy exposure over 2 to 4 wks
- Alveoli filled with protein rich fluid with formation of hyaline membrane
- C/F: sudden dyspnoea, hyperpnoea
  substernal pain
- Complete recovery

Chronic Berylliosis

- Sensitivity for over years 20 yrs or more
- CMI hypersensitivity reaction
- Metal beryllium acts as a hapten

1-Non caseating granulomas - sarcoid like

2-Birefringent crystals

3-Schaumann / conchoid bodies

4-Asteroid bodies

Immunologic Lung Disease

Immunologic lung disease

1. *Bronchial asthma*
2. Hypersensitivity (allergic) pneumonitis
3. Pulmonary eosinophilia
4. Goodpasture's disease
5. Pulmonary alveolar proteinosis

Hypersensitivity pneumonitis

- Immunologically mediated interstitial pneumonitis
- Inhaled organic antigenic material
- Acute / chronic
- Type III **or** Type IV reaction

Types of hypersensitivity pneumonitis

- Farmers lung
- Bagassosis
- Byssinosis
- Bird breeders disease
- Mushroom workers
- Malt workers lung
- Maple bark disease
- Silofillers disease

Thermophilic actinomycetes

Thermophilic actinomycetes

Cotton fiber, flex, hemp

Bired dropping, danders

Mushroom compost dust

Mouldy barley,malt dust

Mouldy maple bark (canada)

Toxic fumes of nitric oxide / nitric dioxide.

Gross and microscopy

- Early stage: alveolar wall infiltrated by
  plasma cells
  histiocytes
  granulomas
- Chronic stage:
  interstitial fibrosis
  inflammatory infiltrates
  honey combing of lung.

Pulmonary eosinophilia

- Immunologically mediated
- Two features
    1. Infiltration of lungs chest radiographs
    2. Elevated eosinophil count in blood

Pulmonary eosinophilia - causes

1. Loeffler's syndrome
2. Tropical pulmonary eosinophilia
3. Secondary chronic pulmonary eosinophilia
4. Idiopathic chronic eosinophilic pneumonia
5. Hypersensitivity syndrome

Pathology

- Gross: patchy consolidation
- Micro: thickening of alveolar membrane

  EØ, Plasma cells, Lymphocytes

  small granulomas

  lumen may show eosinophils

Goodpasture's syndrome

Necrotising haemorrhagic interstitial pneumonitis

+

Rapidly progressive glomerulnephritis

Goodpasture's syndrome
Etiopathogenesis

- Immunologic damage
- By ***anti BM antibodies*** formed against antigens common to BM of alveoli and GBM.
- *Trigger*: not clear, ?virus ?hydrocarbons ?smoking

Pathology

- Red brown areas of consolidation
- *Acute stage*: focal areas of haemorrhage, necrosis in alveolar wall
- *Chronic cases*: organisation - fibrosis

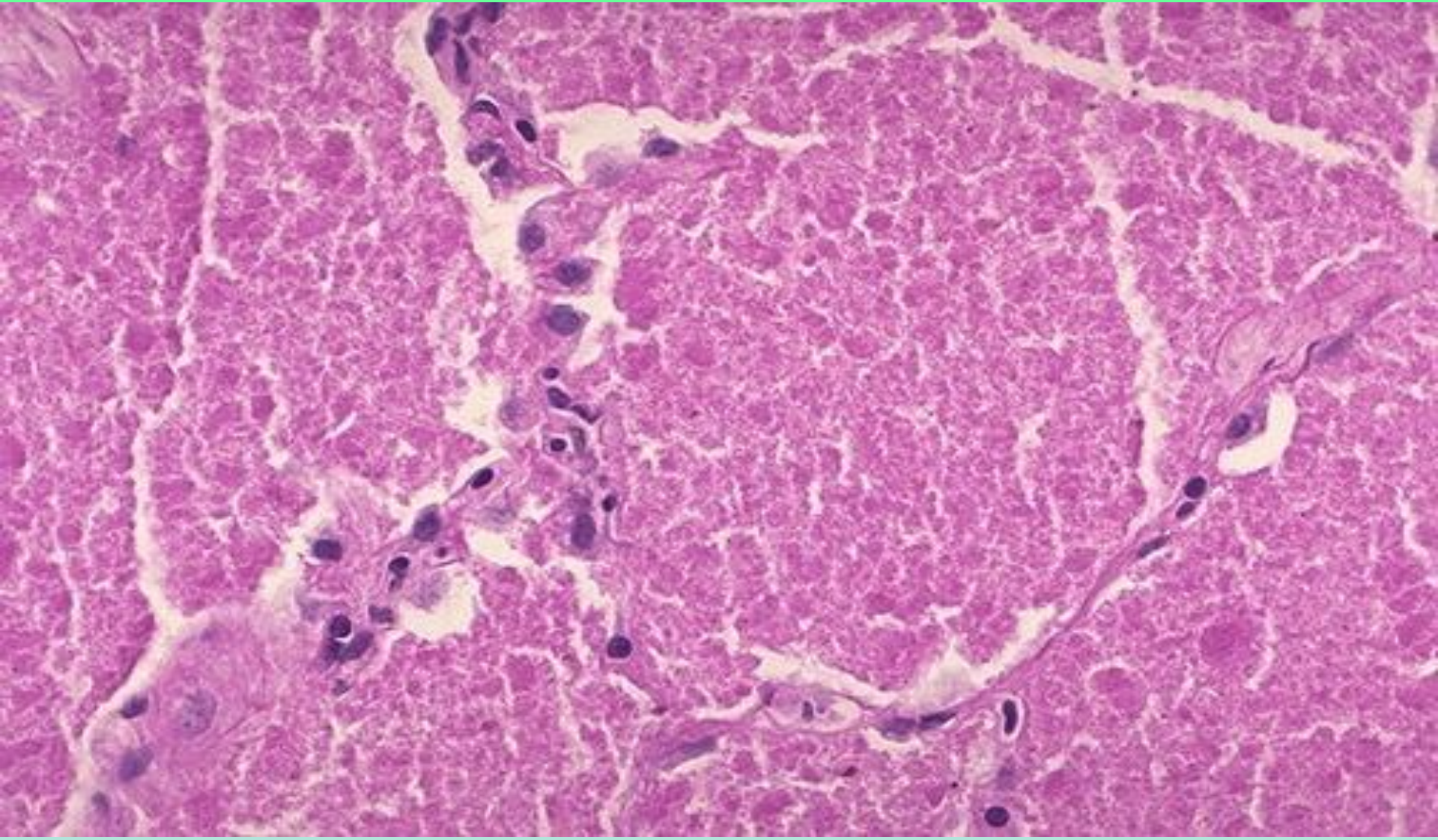
Pulmonary alveolar proteinosis (PAP)

- Chronic disease characterized by distal air spaces filled by granular eosinophilic PAS positive material with abundant lipid in it
- Material -- Surfactant
- Can occur at any age
- *Three distinct classes:*

  acquired

  congenital &

  secondary PAP



This is a rare disease known as pulmonary alveolar proteinosis. The alveolar walls are normal histologically but the alveoli become filled with a PAS postive granular exudate containing abundant lipid and lamellar bodies (by electron microscopy). Patients may cough up copious amounts of gelatinous sputum. The etiology is unknown.

E N D