Occupational Health III.

Asbestosis

SU Department of Public Health
Occupational respiratory diseases

Dust
- Silica dust
- Asbestos dust
- Coal dust

Toxic Gases
- SO₂
- NOₓ

Biologic reaction
- Neoplastic changes
  - Asbestos, nickel, iron

Inflammatory reaction

Chronic Obstructive Pulmonary Disease
- Synergism with tobacco

Allergic reaction (occupational asthma)
- Organic “dusts”
  - Cotton
  - Wood dusts
  - Flour

Particulate matter within the range of 1-5 µm-s penetrate deepest into the lung!
**Pneumoconiosis**

**Pneumoconiosis** is an occupational lung disease caused by the inhalation of dust.

**Inhalable dust**: formed of particles **smaller than 5µm**.

**Factors related to the disease:**

- Physical and chemical quality of dust
- Concentration
- Time of exposition
- Personal sensitivity
- Status of immune system
Silicosis (also known as Grinder’s disease and Potter’s rot) is a form of occupational lung disease caused by **inhalation of crystalline silica dust.** This respiratory disease was first recognized in 1705 by Ramazzini who noticed sand-like substances in the lungs of stonecutters.
Silicosis: occupational lung disease caused by inhalation of crystalline silica dust, and is marked by inflammation and scarring in forms of nodular lesions in the upper lobes of the lungs.
Silicosis

Symptoms

• Dry or severe cough
• Fatigue
• Tachypnea
• Loss of appetite
• Chest pain
• Fever

In advanced cases:
• Cyanosis
• Cor pulmonale
• Respiratory insufficiency
Silicosis
Lung tissue with crystalline silica dust

Fibrotic nodule formed of collagen due to silicosis
Silicosis - Sandblasting Hoods and Helmets

A CERTIFIED RESPIRATOR FITTED AND TESTED IS A MUST.
Asbestosis

Asbestos is a group of minerals with long, thin fibrous crystals
Most dangerous: blue asbestos (krokidolite) (banned)
Used for: brake pads, pipe insulation etc.

Induces mesothelioma and lung cancer
There are two types of asbestos fibers: amphibole (thin and straight) and serpentine (curved).
The former are primarily responsible for human disease as they are able to penetrate deeply into the lungs.

Scanning electron micrograph of asbestiform amphibole from a former vermiculite mining site
Asbestosis is the *scarring of lung tissue* (around terminal bronchioles and alveolar ducts) resulting from the inhalation of asbestos fibers. Due to the asbestos fibers' natural resistance to digestion, the **macrophage dies off**, releasing cytokines and attracting further lung macrophages and fibroelastic cells to lay down fibrous tissue, which eventually **forms a fibrous mass**.

The fibrotic scar tissue causes alveolar walls to thicken, which reduces elasticity and gas diffusion, reducing oxygen transfer to the blood as well as the removal of carbon dioxide.

Asbestosis presents as a **restrictive lung disease**. In the more severe cases, the drastic reduction in lung function due to the stiffening of the lungs and reduced total lung capacity (TLC) may induce **right-sided heart failure** (*cor pulmonale*). More than 50% of people affected with asbestosis develop plaques in the parietal pleura.
Over time, asbestos does its damage

Dangerous exposure to asbestos occurs when materials containing the fibers are disturbed. Years later, disease can take several forms.

Asbestosis
Fibers accumulate in the lungs’ narrow branches, inflaming and scarring airways. The condition causes chronic cough and chest pain.

Pleural plaques
The needle-shaped fibers may also migrate into the pleural lining. As the pleura becomes inflamed, plaque builds up and may restrict breathing.

Cancer
Risks of lung cancer or mesothelioma, cancer of the pleural lining, from asbestos is increased significantly by smoking.

Sources: National Institute of Occupational Safety and Health; USGS
Asbestos has been in use since the late 1800s but its use increased greatly during World War II. For example, the building industry used asbestos for *stiffening cement and plastics*, as well as for *insulation, fireproofing and sound absorption*.

The shipbuilding industry has used asbestos to insulate boilers, steam pipes, hot water pipes and nuclear reactors in ships.

The car manufacturing industry has used *asbestos in vehicle brake shoes and clutch pads*. 
Possible asbest exposition
Other pneumoconiosis

Fibrosis-like pneumoconiosis: personal sensitivity
Eg.: siderosis (iron), stannosis (tin), baritosis (barium), cementosis

Mild fibrosis may appear without progression: stannosis, bauxite

No reactive inflammation: inert dust (grafit, coal – coalworker’s lung)
Siderosis

Arc-welders' pneumoconiosis is caused by the deposition of iron oxide, Fe$_2$O$_3$. 
Coal miners often suffer from lung disease due to the coal dust they inhale as they work.
Diseases from organic dust

• Acute inflammation
• Inflammatory bronchoconstriction
• Chronic bronchitis
• Extrinsic allergic alveolitis

Eg.: bagassosis (molasses), byssinosis (cotton dust), farmer’s lung
Bagassosis

Byssinosis

Farmers’ lung

Sugar cane

Cotton

Hay
Farmer's Lung is an allergic disease usually caused by breathing in the dust from moldy hay (dust from any moldy crop).

The technical name for Farmer's Lung is "extrinsic allergic alveolitis", "hypersensitivity alveolitis" or more generally "hypersensitivity pneumonitis".

People can get Farmer's Lung by breathing in dust containing the spores of special, heat-tolerating bacteria or moulds often found on moldy crops.
Actinomyces israelii

"Actinomyces" is a genus of the actinobacteria class of bacteria. They are all Gram-positive and can be either anaerobic or facultatively anaerobic. They produce a number of enzymes that help degrade organic plant material, lignin and chitin. Actinomyces, a thermophilic bacteria, is usually the causative agent of farmer's lung, and bagassosis.
In extrinsic allergic alveolitis, an antigen-antibody reaction occurs in the acute phase and leads to acute hypersensitivity pneumonitis. If exposure continued, this is followed by a subacute phase, with the formation of granulomas and chronic interstitial pneumonitis.

Farmer's Lung. Caused by the molds Thermophilic actinomycetes, Saccharopolyspora rectivirgula. Exposure is generally from moldy hay but may be found elsewhere.
**Bagassosis** /exposure is from moldy bagasse (pressed sugar cane)/.
Bird-bredder’s lung

This disease is caused by the exposure to **avian proteins** present in the **dry dust of the droppings** and sometimes in the feathers of a variety of birds. It is mainly present in bird droppings.
The best way to reduce the amount of allergens in the air and possibly prevent problems in the future, is to use a high quality air purifier. HEPA (which stands for High Efficiency Particle Arresting) removes 99.97% of particles greater than .3 microns in size. Bird dust and dog and cat dander are large enough to be trapped in the HEPA material.
This mold can act as an allergen. Some people may experience hay fever, asthma, hypersensitivity pneumonitis: cheese washer's lung, woodman's lung, moldy wall hypersensitivity.
Ergonomics: aims to establish an *anthropocentric harmony* within the *human-tool-environment* system.
The **International Ergonomics Association** (IEA) divides ergonomics broadly into three domains:

1.) **Physical ergonomics**: is concerned with human anatomical, and some of the anthropometric, physiological and biomechanical characteristics as they relate to physical activity.

2.) **Cognitive ergonomics**: is concerned with mental processes, such as perception, memory, reasoning, and motor response, as they affect interactions among humans and other elements of a system.

3.) **Organizational ergonomics**: is concerned with the optimization of socio technical systems, including their organizational structures, policies, and processes.
Fundamentals for the Flexible Workplace Variability and compatibility with desk components, that flex from individual work activities to team settings. Workstations provide supportive ergonomics for task-intensive environments.
At left: the wrong position.
Top of monitor placed at eye level to allow proper head and neck position.

Copy holder placed close to monitor, reduces eye motions and discomfort—allows proper neck posture.

Padded wrist rest to reduce arm and shoulder discomfort.

Keyboard placed at elbow height with a slight incline.

A good chair with proper lumbar support.

Easily adjustable furniture table.

[Diagram of a person sitting at a desk with proper ergonomics]
Ergonomics: the science of designing the job, equipment, and workplace to fit the worker.
An ergonomic redesign of the spade.
Special work carpets