Occupational Health

SU Department of Public Health
Occupational health and safety in Hungary

- occupational medical service: **basic**
- centre of occupational medicine
- **secondary level:** occupational health consultations
- Hungarian Institute of Occupational Health

**SUPERVISION:** Hungarian Labour Inspectorate

**National Public Health and Medical Officer Service:**
gives **license to** the occupational medical services and **supervises the presence of minimum requirements.**
**Workload:**
any effect that at least temporarily disturbs that balance of the internal milieu, thus changing the homeostasis of the body.
(originates for work capacity, accident risk…)

**Strain:**
the sum of reactions to workload.
(increased heart rates, core body temperature…)

**Occupational disease:** a disease contracted as a result of an exposure to risk factors **arising from work activity**.

**Occupational accident:** an occurrence arising out of, or in the course of work which results in:

- fatal occupational injury; or

- non-fatal occupational injury.

**Occupational injury:** death, any personal injury or disease resulting from an occupational accident.

<table>
<thead>
<tr>
<th>Work-related diseases</th>
<th>Occupational diseases</th>
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<tbody>
<tr>
<td>Occur largely in the community</td>
<td>Occur mainly among working population</td>
</tr>
<tr>
<td>‘Multifactorial’ in origin</td>
<td>Cause is specific</td>
</tr>
<tr>
<td>Exposure to workplace may be a factor</td>
<td>Exposure to workplace is essential</td>
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<tr>
<td>May be notifiable and compensatable</td>
<td>Notifiable and compensable</td>
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</table>
Waiter’s flat feet - work-related

Silicosis – occupational disease
Work-related diseases

Occupational diseases

Partially work-related disease
- the disease has several causative factors
- work plays a partial role in the etiology, but is not the main cause
- work attributable fraction <50%

Occupational disease
- strong link to work
- attributable fraction >50%
- often only one causative factor
- delineated in legislation

Source: Finnish Institute of Occupational Health
Reported *occupational diseases* and *excessive exposure incidens* in 1985-2008 in Hungary
Occupational diseases in Hungary (2008)

Physical 9% (26)

Biological 23% (64)

Other 10% (ergonomic, psychosocial) (27)

Chemical 58% (163)
## Occupational hazards to human health

<table>
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<th>Type of hazard</th>
<th>Examples</th>
<th>Health effect</th>
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<tr>
<td>physical</td>
<td>noise</td>
<td>noise-induced hearing loss</td>
</tr>
<tr>
<td></td>
<td>local vibration</td>
<td>traumatic vasospastic diseases</td>
</tr>
<tr>
<td>chemical</td>
<td>various chemicals (e.g. solvents, heavy metals)</td>
<td>intoxications</td>
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<tr>
<td></td>
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<td>fibroses</td>
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<td></td>
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<td>cancers</td>
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<td>allergies</td>
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<tr>
<td></td>
<td></td>
<td>nervous system damage</td>
</tr>
<tr>
<td>biological</td>
<td>bacteria</td>
<td>infections</td>
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<tr>
<td></td>
<td>fungi</td>
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<tr>
<td></td>
<td>viruses</td>
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<tr>
<td>ergonomic</td>
<td>repetitive work</td>
<td>musculoskeletal injuries</td>
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<tr>
<td></td>
<td>work-rest schedules</td>
<td>mental stress</td>
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<tr>
<td></td>
<td></td>
<td>lowered productivity and work quality</td>
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<tr>
<td>psychosocial</td>
<td>organizational stress conflicts</td>
<td>work dissatisfaction</td>
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<tr>
<td></td>
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<td>burnout</td>
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<td></td>
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<td>depression</td>
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</table>
## Occupational health vs. Environmental health

<table>
<thead>
<tr>
<th>Occupational health</th>
<th>Environmental health</th>
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</thead>
<tbody>
<tr>
<td>Hazards in workplace environment</td>
<td>Hazards in community environment</td>
</tr>
<tr>
<td>Hazards largely in air</td>
<td>Hazards in air, soil, water, and food</td>
</tr>
<tr>
<td>Hazards are physical, chemical, biological, and psychosocial</td>
<td>Hazards are physical, chemical, biological, and psychosocial</td>
</tr>
<tr>
<td>Route of exposure: inhalation and dermal</td>
<td>Route of exposure: ingestion, inhalation, and dermal</td>
</tr>
<tr>
<td>Exposure period: 8 h/day for working life</td>
<td>Exposure period: lifelong</td>
</tr>
<tr>
<td>Exposed population: adults, usually healthy</td>
<td>Exposed population: children, adults, elderly, and sick persons</td>
</tr>
</tbody>
</table>
### Defining Risk

**Hazard identification**

Can the agent cause the adverse effect?

**Dose–response assessment**

What is the relationship between dose and incidence of adverse effects in humans or in animals?

**Exposure assessment**

What exposures are currently experienced or can be anticipated under various circumstances?

**Risk characterization**

What is the estimated incidence of the adverse effect in a given population or subpopulation?

What is the nature of the effect?

What is the strength of the evidence?
RISK:
expresses the probability that an adverse will appear in a person or a group.

HAZARD /occupational/:
potentially harmful effect caused by an inactive source.

RISK (R) mathematical formula:
\[ R = W \times K \]
\[ W = \text{odds of occurrence /from 0 to 1/} \]
\[ K = \text{severity of the event /from 0 to 1/} \]

POPULATION’S RISK = N \times R

POPULATION’S RISK UNIT:
1 mikrorisk = at 1 millions person 1 death in lifetime (70 years average)
Occupational health risk assessment

In HUNGARY for this is **responsible the employer**
(but it made by the occupational medical service)
Environmental monitoring at the workplace

Chemical risk factors

Volatile Organic Compounds (VOC’s) Monitor

For dust particles  For CO measurement
PEL – permissible exposure limits
TLV – threshold limit value
REL – recommended exposure levels

**MAC – maximum allowable concentration**
(A quantity of exposure which the human body can tolerate **without any temporary or lasting damage, or health risks to descendants**. Applies to 8-hour working days or 40 working hours per week.)

**Ceiling limits** (C values)
Time allowed: 15 minutes one-shift maximum.
**Biological monitoring**: measured as a concentration of chemical substance that is present in body or its metabolic byproducts or through the specific changes it induces.
World distribution of health workers

Biological agents:

- Viral hepatitis
  /prevention: vaccines, gloves, mask, protective eyewear etc./
- Tuberculosis
- HIV/AIDS
- Diphteria (communicable disease ward, laboratories)
Occupational diseases in the healthcare II.

Chemical agents:

• Ethylene oxide /teratogenic and carcinogenic effect, minors and pregnant women can not work in places with that/

• CYTOTOXIC DRUGS / mutagenicity, teratogenicity, carcinogenicity/

• ALLERGIC REACTION

Ergonomic matters
Safe handling of cytotoxic drugs
Risks of occupational exposure include topical irritation and necrosis, liver damage, mutagenesis, carcinogenesis, teratogenesis and risk of miscarriage.

Health Care Units should maintain records of the following:
• cytotoxic drugs prepared;
• personnel involved and their training and accreditation;
• details of equipment used, e.g. safety cabinets, including maintenance records;
• personal protective equipment issued and worn;
• monitoring and assessments performed;
• health surveillance checks implemented;
• emergency spillage and other incidents.

Cytotoxic drug cabinet
It is strongly recommended that cytotoxic drugs are prepared in cytotoxic drug safety cabinets.
Rubber glove allergy. In contact allergic eczema due to rubber gloves, the rash finishes abruptly at the wrist or mid-forearm. Latex gloves (yellowish color), for instance, are a common cause of potentially severe reactions in health workers and occasionally in their patients. Polythene (colorless) and vinyl (white) gloves are suitable alternatives.
**Occupational disease**: a **causal relationship** can be established **between exposure and disease** as a result of an exposure to risk factors arising from work activity.

**Occupational accident**: an occurrence arising out of, or in the course of work and causes **sudden or relatively sudden health damage**.

**Occupational injury**: death, any personal injury or disease resulting from an occupational accident.
Chemical exposure

Classification

Explosive (E)  Oxidising (O)  Flammable (F, F+)  Toxic (T, T+)

Corrosive (C)  Harmful (Xn), Irritant (Xi)  Dangerous for the environment (N)
**PRIMARY PREVENTION**

- Elimination
- Substitution
- Environmental monitoring
- Engineering controls
- Personal protective devices

**SECONDARY PREVENTION**

- Biological monitoring
- Health effects screening

**Exposure** → **Identification of vulnerable worker** → **Biological exposure index** → **Biological effects** → **Asymptomatic disease** → **Disease**

**Pre-employment medical examinations** → **Periodic medical examinations** → **Notification to authorities** → **Enforcement of prevention** → **Active case finding** → **Confirmation of diagnosis**
Accident - injuries:
- domestic injuries
- recreational injuries
- traffic injuries
- occupational injuries
Causes of accidents:

1. Human factors:
   - Fatigue due to long working hours or ill health
   - Insufficient training
   - Psychological, behavioral and emotional disorders
   - Unsafe act due to overconfidence or negligence
   - Drug or alcohol addiction
   - Defects in sensory organs: vision, hearing
     - Non usage of personal protective devices
   - Lack of careful supervision (of supervisors)
2. Environmental and organizational factors

- Lack of Ergonomics
- Repetitive monotonous work
- Work stress and urgency of time
- Machinery failure due to bad maintenance
- Bad housekeeping
- Bare electric wires
- Slippery floor
- Defective lightning, noise, uncomfortable hot environment
- Lack of maintenance of floors, ladders, walls …etc.
In the initial stage of the investigation, the questions asked will usually identify the immediate causes of the accident or contributed to the accident. These questions may include:

- Was the work authorized?
- Did a machine failure occur?
- Was the machinery involved properly guarded?
- Were the people involved adequately trained?
- Was there adequate lighting?

The immediate causes, however, are symptoms of a deeper problem. Determine the basic causes of the accident by asking the question “Why did the substandard practices or conditions exist? The basic causes will invariably stem from a lack of management control.
Total work accident in Hungary

Total work accident death in Hungary

(Comparing: from Traffic accident in a year about 1000 deaths)
Decompression sickness is a condition that occurs when divers or workers from the caisson come back to the surface too quickly after being in deep. It is caused by the formation of nitrogen bubbles in the bloodstream and, in the worst cases, can cause death. Treatment involves reversing the conditions under which it first occurred. A person is placed into a hyperbaric (high pressure) chamber. Pressure is increased in the chamber, causing nitrogen gas bubbles to go back.
Signs and Symptoms of The Bends
(Develop 15 min. to 12 hrs. after surfacing)

Extreme Fatigue
Pain in Joints
Muscle Pain
Dizziness
Paralysis
Rash on Skin
Staggering
Choking
Decreased Sensation
Collapse or Unconsciousness
Vibration

Frequency:
- 0 - 0.5 Hz: Kinetosis
- 0.5 – 16 Hz: Vibration
- 16 – 8000 Hz: Vibration and sound effects simultaneously
- 8000-20 000Hz
- over 20 000 Hz: Ultrasound effects

Local effects
- Headache, dizziness
- Bone cysts, osteoporotic changes (wrist, elbow, shoulder)
- Nerve lesions (plexus brachialis, n.ulnaris, n.radialis)
- Raynaud phenomenon

Global effects (5-11Hz)
- Back pain, visceral ptosis, risk for abortion
Hand-arm vibration is caused by many power tools, such as those used in road maintenance, construction, mining and forestry, and can cause disorders such as vibration-white finger.

Whole-body vibration occurs in drivers of off-road machines, passenger and freight transport, in agriculture and aircraft. The most commonly reported health effect from whole-body vibration is back-pain.
Measuring instruments for vibration
**Vibration - prevention**

- Use anti-vibration equipment
- Appropriate maintenance of vibrating tools
- Reduction of exposure time
The organ of Corti in the cochlea picks up the vibrations from the basilar membrane by means of hair cells: mechanosensor array.

A hair cell

Hair cells
With repeated exposure to excessive noise, these hair cells lose some of their resilience and may even break off resulting in sensorineural or noise induced hearing loss.

The basic mechanism of hearing involves converting sound waves hitting the ear drum to structure-borne vibrations transmitting through bones in the middle ear.

The fluid filled cochlea contains 40,000 tiny hair cells like the one shown at right (magnified) that initiate the nerve impulse which is transmitted to the brain.
The area below the curves represents sound levels that the patient could still hear. (X = left ear; O = right ear)
NOISE
individual sensation of sound

- frequency: the higher the frequency, the more disturbing the sound; this is true for sound up to 6000 cps
- sound pressure: the stronger the sound pressure, the more disturbing
- duration: the longer a sound lasts, the more disturbing it becomes
- time sequence: increasing and decreasing sounds are more disturbing than monotonous ones
- physical fitness: tired or sick persons feel more disturbed than well-rested or healthy ones
- personal attitude: those who hear involuntarily feel more disturbed than those who make the noise
- kind of activity: intellectual work is more easily disturbed than physical work
**Injuries due to noise:**

Probably the most common occupational disease.
Factors determining injury: sound pressure, frequency, exposure duration.

- 40-65 dB: irritation, annoyance, sleep disturbance
- 65-75 dB: autonomic symptoms, headaches
- over 80 dB: auditory damage

(80-100 dB - temporary, over 120 dB - permanent and/or generalised)

**In the very early stages of hearing loss, a threshold shift first manifests itself around 4000Hz (high-pitch tones).**

- **TTS** = temporary threshold shift
- **PTS** = permanent threshold shift

Prevention requires many different levels of intervention depending on specific situation - regular audiometric screening, technological noise reduction, individual protective gear (ear muffs, ear plugs...).
normal conversation

press

pain begins

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190

sound level dB (A)

quiet bedroom

weakest sound we can hear

insulated lounge

course grinding

in the vicinity of a jet plane taking off

highest sound level that can occur

manual machine

air cooled electric motor 50 kw

spray painting
Critical health effects from noise

- Hearing impairment of adult (peak noise)
- Hearing impairment of child (peak noise)
- Hearing impairment (daily noise for 1 hour)
- Hearing impairment (daily noise for 24 hrs)
- Serious annoyance (outdoor)
- Disturbance of communication
- Sleep disturbance

Source: WHO
Audiometry

Portable audiometer
Noise
Air temperature

Air humidity

Air speed

Radiant heat
Evaporation (Sweat) (Breathing)
Radiation (Infra Red)
Convection (Air)
(Wind Chill)
Conduction (Contact)

Body Core / Vital Organs

Extremities / Limbs
Dry bulb temperature

Wet bulb temperature

Air movement

Effective temperature
Heat exposure

Dry bulb = ± 0.2 C from 5-55 C
Globe = ± 0.2 C from 5-70 C
RH = ± 2% from 0-95% non condensing
Wind speed = ± 0.2 m/sec or 10%, whichever is the greater, from 0.1-8.0 m/sec
Pressure = ± 1.5 KPA from 40-115 KPA
Heat exposure threshold limit values (TLVs) in Hungary - for a work shift averages in ET (CET)

- Office work: 31 °C
- Light physical work: 31 °C
- Moderate physical work: 29 °C
- Heavy physical work: 27 °C
When the body is unable to cool itself through sweating, serious heat illnesses may occur. The most severe heat-induced illnesses are heat exhaustion and heat stroke. If left untreated, heat exhaustion could progress to heat stroke and possible death.

Source: U.S. Department of Labor, Occupational Safety and Health Administration
Heat stress - could lead to
heat collapse
heat cramps
heat exhaustion
heat stroke

**HEAT EXHAUSTION**
- Mois & clammy skin
- Pupils dilated
- Normal or subnormal temperature

**HEAT STROKE**
- Dry hot skin
- Pupils constricted
- Very high body temperature
Medical examinations
Acclimatization
Technical solutions
Short „cooling-off” breaks
Replacement of water and salt
California employers are required to take these four steps to prevent heat illness:

1. **Training**
   Train all employees and supervisors about heat illness prevention.

2. **Water**
   Provide enough fresh water so that each employee can drink at least 1 quart per hour, and encourage them to do so.

3. **Shade**
   Provide access to shade for at least 5 minutes of rest when an employee believes he or she needs a preventative recovery period. They should not wait until they feel sick to do so.

4. **Planning**
   Develop and implement written procedures for complying with the Cal/OSHA Heat Illness Prevention Standard.
When the body is unable to warm itself, serious cold-related illnesses and injuries may occur, and permanent tissue damage and death may result.

Hypothermia can occur when land temperatures are above freezing or water temperatures are below 98.6°F / 37°C. Cold-related illnesses can slowly overcome a person who has been chilled by low temperatures, brisk winds or wet clothing.

Adapted from: ACGIH Three-Tab Limit Values; Chemical Substances and Physical Agents Biohazard Indexes, 1998-1999.
Occupational respiratory diseases

Dust
- Silica dust
- Asbestos dust
- Coal dust

Toxic Gases
- SO₂
- NOₓ

Biologic reaction
Inflammatory reaction

Neoplastic changes
- Asbestos
- Nickel
- Iron

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 asbest (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 **strengthening 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)
Anthracosis

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-breeder’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.
* Chart from *The measure of man & woman* by Henry Dreyfuss Associates
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.

Conventional seating can actually worsen back problems by encouraging a slumped posture. Without a Back Support System, A Back Support System realigns the spine to a naturally healthy posture.
Top of monitor placed at eye level to allow proper head and neck position.

Copy holder placed at eye level, close to monitor, reduces eye motions and discomfort, allowing 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.
Ergonomics: the science of designing the job, equipment, and workplace to fit the worker.
An ergonomic redesign of the spade.
Physical work

- light physical work comprises types of activity with energy use of 930 kJ/h or less

- moderate physical work comprises types of activity with energy use of 936 - 1140 kJ/h

- heavy physical work comprises types of activity with energy use of 936 - 1140 kJ/h

- very heavy physical work comprises types of activity with energy use of 1146 - 1350 kJ/h

Static work

Dynamic work
Mental work
- less than 20 decision / minute: underburden
- more than 60 decision / minute overburden
Psychosocial health hazards

- sense of insecure livelihood
- shiftwork or extreme work schedules
- separation from familiar environment (e.g. family), commuting
- workplace conflicts, bulling
- information deprivation of work tasks
- lack of control over work
What is the difference between tiredness and fatigue?

Fatigue is generally described as a state of feeling tired, weary, or sleepy that results from prolonged mental or physical work, extended periods of anxiety, exposure to harsh environments, or loss of sleep. The result of fatigue is impaired performance and diminished alertness.