

Heavy metal pollution

- The term heavy metal refers to any metallic chemical element that has a relatively high density and is toxic or poisonous at low concentrations.
- Heavy metals are naturally occurring elements that have a high atomic weight and a density at least 5 times greater than that of water.

- **HEAVY METALS**

- • are natural components of the Earth's crust
- • they cannot be degraded or destroyed
- • to a small extent they enter our bodies via food, drinking water and air
- • as trace elements, some heavy metals (e.g. copper, selenium, zinc) are essential to maintain the metabolism of the human body
- • however, at higher concentrations they can lead to poisoning
- • heavy metal poisoning could result, for instance, from drinking-water contamination (e.g. lead pipes), high ambient air concentrations near emission sources, or intake via the food chain.

- Heavy metals are dangerous because they tend to **bioaccumulate**.
- • **Bioaccumulation** means an increase in the concentration of a chemical in a biological organism over time, compared to the chemical's concentration in the environment.
- • Compounds accumulate in living things any time they are taken up and stored faster than they are broken down (metabolized) or excreted.

- Heavy Metal • Heavy metal toxicity can result in
 - damaged or reduced mental and central nervous function,
- ▫ lower energy levels,
- ▫ Damage
- blood composition,
- lungs, kidneys, liver, and other vital organs.
- ▫ Long-term exposure may result in slowly progressing physical, muscular, and neurological degenerative processes that mimic Alzheimer's disease, **Parkinson's disease**, muscular dystrophy, and multiple sclerosis.
- Allergies are not uncommon and repeated long-term contact with some metals or their compounds may even cause cancer.

Lead

- • Exposure to inorganic lead occurs in mines and smelters as well as welding of lead painted metal, and in battery plants. • Low or moderate exposure may take place in the glass industry. • Lead is present in fuels, on burning it will enter the air • Airborne lead can be deposited on soil and water, thus reaching humans via the food chain.
- • In adults, inorganic lead does not penetrate the blood–brain barrier, whereas this barrier is less developed in children. The high gastrointestinal uptake and the permeable blood–brain barrier make children especially susceptible to lead exposure and subsequent brain damage.

- Arsenic • Arsenic is a widely distributed metalloid, occurring in rock, soil, water and air. • Inorganic arsenic is present in groundwater used for drinking in several countries all over the world (e.g. Bangladesh, Chile and China), • Organic arsenic compounds (such as arsenobetaine) are primarily found in fish, which thus may give rise to human exposure.
- Arsenic • Uncertainties in the estimation of past exposures are important when assessing the exposure– response relationships, but it would seem that drinking water arsenic concentrations of approximately 100 µg/l have led to cancer at these sites, and that precursors of skin cancer have been associated with levels of 50–100 µg/l.

Element	Acute exposure <i>usually a day or less</i>	Chronic exposure <i>months or years</i>
Lead	Encephalopathy (brain dysfunction) Nausea Vomiting	Anemia Encephalopathy Foot drop/wrist drop (palsy) Nephropathy (kidney disease)
Cadmium	Pneumonitis (lung inflammation)	Lung cancer Osteomalacia (softening of bones) Proteinuria (excess protein in urine; possible kidney damage)
Mercury	Diarrhea Fever Vomiting	Stomatitis (inflammation of gums) Nausea, tremor Nephrotic syndrome (kidney disorder) Neurasthenia (neurotic disorder) Parageusia (metallic taste) Pink Disease (pain and pink discoloration of hands and feet)
Arsenic	Nausea, vomiting, diarrhea Encephalopathy Multi-organ effects Arrhythmia Painful neuropathy	Diabetes Hypopigmentation/Hyperkeratosis Cancer

ITAI-ITAI DISEASE: DUE TO CADMIUM POISONING

Itai-tai disease is caused by cadmium poisoning due to mining in Toyama Prefecture of Japan. Cd^{2+} goes in through rice and cereals!



This is a multi-factorial disease but cadmium is a necessary agent to result in severe kidney damage and osteomalacia (Osteomalacia is derived from Greek: *osteo-* which means "bone", and *malacia* which means "softness".).

Cause of Minamata Disease

Methyl mercury is a by-product of the manufacture of acetaldehyde. It is discharged with factory drainage, polluted fishes and shellfishes. People ate them in large quantities. Then, Minamata Disease broke out.

