Magnesium

- An essential mineral and a cofactor for hundreds of enzymes.
- Involved in many physiologic pathways (including energy production, nucleic acid and protein synthesis, ion transport, cell signaling, and also has structural functions.)
- Deficiency has been associated with increased risk of
  - Cardiovascular disease
  - Osteoporosis
  - and metabolic disorders, including hypertension and type 2 diabetes mellitus.

Magnesium

- Preliminary studies have shown that magnesium improved insulin sensitivity in individuals at risk for diabetes.
- in obstetric care for the prevention of seizures in pregnant women with preeclampsia or eclampsia, and in preventing brain damage in premature infants.
- Uses:
  - Pregnancy complications (Preeclampsia and eclampsia)
  - Perinatal neuroprotection

Non Essential Ions

- Fluoride, Lead, Aluminum, Gold, Mercury, Lithium, Silver

Fluoride

- Fluoride anion increases the structural stability of teeth and bones through interactions with calcium phosphates, prevent dental caries.
- Dental fluorosis (also termed mottled enamel) is an extremely common disorder, characterized by hypomineralization of tooth enamel caused by ingestion of excessive fluoride during enamel formation.
- H_2SiF_6, Na_2SiF_6, NaF, Na_2FPO_3

Lead

- Its salts were used topically as astringent.
- Inorganic lead can not pass through intact skin but it will absorbed through abraded skin, thus Lead solution used as astringent could be absorbed systemically while organic Lead such as tetraethyl Lead can penetrate skin rapidly.
- Once absorbed , the Lead can be found initially in the erythrocyte and soft tissue. Later the kidneys contain the most Lead with the liver.

Lead poisoning

- Chronic Lead poisoning manifests itself by inhibition of heme synthesis.
- The most serious Lead poisoning symptoms is encephalopathy which is more common in children.
- Renal damage.

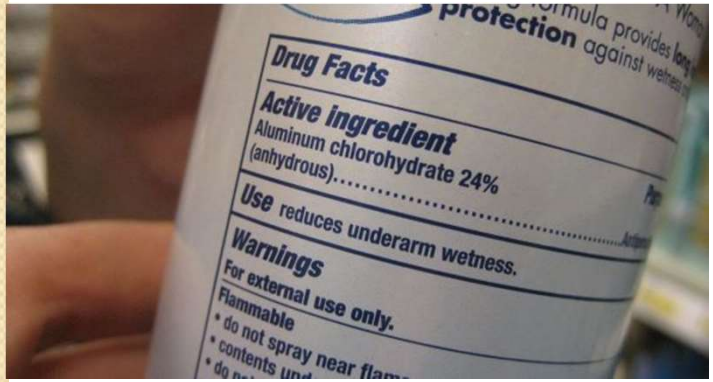
Lead poisoning

Treatment of lead poisoning

- Treatment is based on the use of chelating agents to remove the accumulated Lead from erythrocyte and soft tissue.
- Dimercaprol and calcium disodium edetate are used initially followed by pencillamine for follow up treatment.
- Acute poisoning from oral ingestion can be treated by administrating Na or Mg sulphate to precipitate the Lead followed by gastric lavage.

Aluminum

- Soluble aluminum compounds are astringent and antiseptic.
- Soluble aluminum salts are used by the cosmetic industry as deodorants because of their mild astringent action, and function as pigments and thickening agents.
- The insoluble aluminum compounds are mostly used as non systemic antacid.



"Because estrogen has the ability to promote the growth of breast cancer cells, some scientists have suggested that the **aluminum-based compounds in antiperspirants** may contribute to the development of breast cancer."
-NIH National Cancer Institute

Gold

- Used in the rheumatoid arthritis, and therapeutic gold compounds are administered i.m.
- Orally is poorly absorb and irritant.
- Gold injections can be effective for some people, their use has declined dramatically in the last 20 years due to the severe side affect.

Mercury

- Metallic mercury is relatively non toxic as such (the mercurous Hg^{+} and the mercuric Hg^{+2} cations are toxic, in addition that mercury vapour is toxic.)
- Poisoning by soluble inorganic mercury salts can be avoided while organic mercurial compounds are very toxic and are the cause of most reports of mercury poisoning.

Mercury

- Toxic effects of mercury similar to that of Lead due to its combining with protein sulfhydryl groups.
- Once absorbed , the mercuric cation concentrates mostly in kidney, with less concentration in liver, blood, bone marrow, and other tissues.
- It is excreted by kidney and colon.
- Acute poisoning usually occurs by ingestion of soluble mercuric salts, vomiting and diarrhea may result with diuresis (suppression of tubular reabsorption) and kidney damage.

Mercury

Mercurial salts are used as :

- Diuretics
- Antiseptics
- Parasiticides
- Fungicides

Mercury

Treatment of acute poisoning

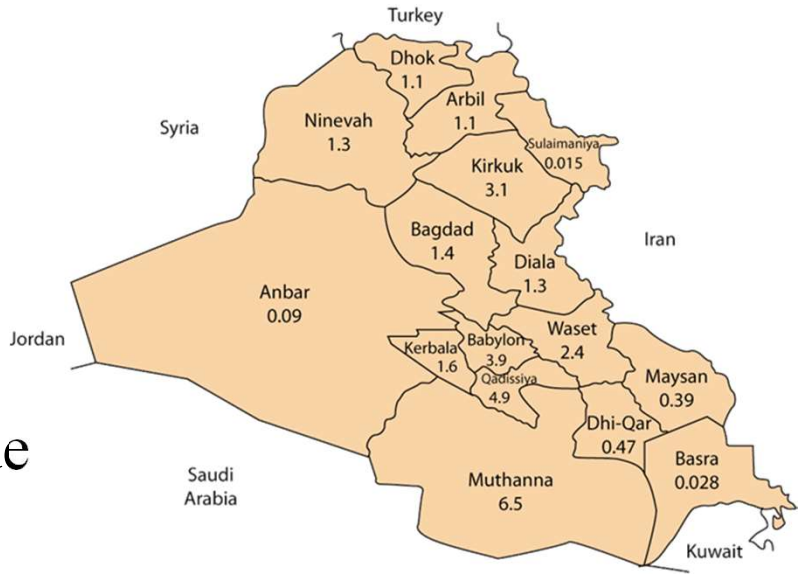
- gastric lavage.
- using of reducing agent such as sodium formaldehyde sulfoxylate (to reduce the mercuric cation forming less soluble mercurous salt)
- using of chelating agents such as dimercaprol or pencillamine.

Mercury/Laboratory Accidents

- Chemist Karen E. Wetterhahn was accidentally poisoned in her own lab.
- A drop of mercury spilled on her glove.
- She immediately cleaned up the spill, but she began experiencing symptoms 3 months later.
- Finally, she was diagnosed with mercury poisoning and treated with chelation and transfusion.
- Treatment was unsuccessful, and Dr. Wetterhahn eventually died from the incident.

Mercury/Acute Mercury Toxicity

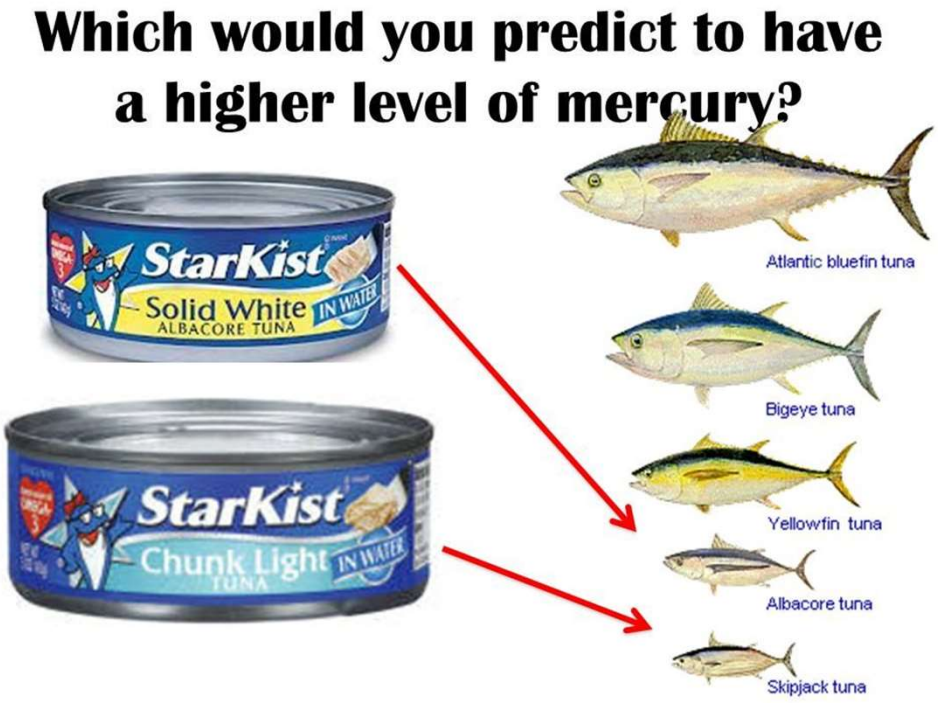
- Iraq Acute Mercury Toxicity Incident
- Fall 1971: Shipment of grain treated with alkyl fungicide to Iraq
- Winter 1971: 6200 cases, 500 deaths
- Source of exposure: homemade breads



Mercury

Case Studies in Mercury Toxicity: Modern Day Concerns

- Mercury in fish?
- Solid white tuna has three times the Hg levels of light tuna



Lithium

- It is readily absorbed from intestine , accumulates in the body.
- the extent of its accumulation depends on sodium intake (decrease sodium intake accelerate lithium accumulation and potentiate toxicity)
- Lithium intoxication is treated by withhold lithium and provide sodium intake.

Lithium

- Lithium carbonate is administered orally in manic depressive disorder (used as a psychiatric medication).
- Lithium carbonate can affect thyroid function causing myxedema(deficient thyroid function) and decrease protein bound iodine levels and increase iodine intake.

Silver

- Silver generally has low toxicity, and minimal risk is expected when silver is used in approved medical applications
- The medical uses of silver include its use in wound dressings, creams, and as an antibiotic coating on medical devices
- Wound dressings containing silver sulfadiazine may be used on external infections

Silver is added to some bandages for its antimicrobial effect.