Non essential ions

- **1-Fluoride:**
- **Fluorides are widely used today:**

1. For their anticariogenic action (inhibition of dental cavity development),
2. Required for bones.

- About 95% of orally taken fluoride is absorbed, and the balance is excreted in the feces.
- About 50% of the ingested fluoride is excreted in the urine.
- Sodium fluoride has a wide range of therapeutic index.

- Many reports indicated that fluoride reduces the prevalence of osteoporosis.
- Visible aortic calcification were actually higher in low fluoride area because fluoride facilitate calcium deposition in hard tissues (teeth and bones) rather than soft tissues.

- 2- Bromide :
- Bromides were introduced into medicine in 1853 for their antiepileptic effect.
- Administration of small doses (0.5-2 gm) of bromide serve to cause depression to CNS,
- while large doses (4-8 gm) may depress all reflexes and cause narcotic type effect.
- Bromides usefulness in epilepsy depend on their ability to depress the motor areas of the brain, an effect brought about by large doses.

- Bromides are rapidly absorbed and are excreted mainly in urine, and repeated doses tend to cause accumulation with a consequent replacement of chloride ion by accumulated bromide ion.
- The use of bromide is stopped because of the possibility of bromism (bromide poisoning).
- Treatment of bromism by administration of sodium chloride (6 gm. daily in divided doses) or ammonium chloride used.

- 3- 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 is a depressant to the CNS and has a diuretic action.

- Lithium salts have been advocated at different times as central nervous system depressants.
- Lithium urate (very water soluble) is used to determine whether uric acid enhanced urea toxicity in guinea pigs.
- Lithium carbonate is administered orally in manic depressive disorder.

- The manic depressive reaction is characterized by extremes in emotion and behaviour
- The patient becomes hyperactive , paranoid, then the danger of suicide increases.
- The treatment with lithium carbonate included phenothiazine tranquilizers and electroshock therapy
- Lithium carbonate is administered orally in doses of 300 to 600 mg three times a day to manic patients and should be discontinued if a satisfactory response is not obtained in 14 days.

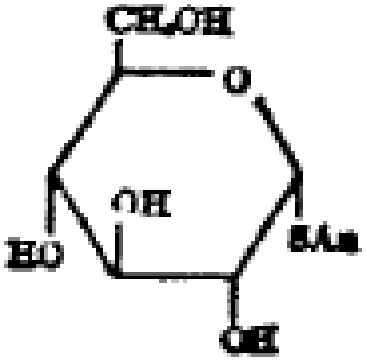
- Lithium carbonate is contraindicated with patient with impaired renal function
- Lithium can cause diabetes insipidus (increase urination without glucosuria). Interfere with action of vasopressin.
- Also, since lithium toxicity increases with a decrease in sodium intake, patients on salt-restricted diets or those who are receiving diuretics should be monitored carefully.

- Mechanism of action in manic episode
- its effect Na, K, Mg and Ca balance . Actions involve alteration in the metabolism of the neurotransmitters, norepinephrine and serotonin.
- Lithium carbonate can affect thyroid function causing myxoedema(deficient thyroid function), decreased protein bound iodine level and increased iodine uptake.
- Lithium reduces atherosclerotic heart disease.

- 4- Gold:
- It is used in the rheumatoid arthritis, and therapeutic gold compounds are administered by I.M.
- Orally is poorly absorb and irritant.
- The gold is rapidly enters the plasma where it remains bound to albumin for several days so it is usually administered weekly.
- Gold toxicity involves the skin, mucous membrane, joints, blood, kidney, liver and nervous system.
- Treatment of toxicity involve cessation of administration, supportive treatment and dimercaprol can be used.

- R.A. Is the disease in which some factor triggers the continual release of enzymes , causing the breakdown of normal synovial membranes, cartilage, muscle, and bone.
- In advanced cases the cartilage may completely destroyed and fibrous tissue may grow out of the exposed bone ends.
- Eventually the fibrous tissue may become calcified, resulting in the fusion of the joint.
- Gold is used primarily in the treatment of rheumatoid arthritis.
- it acts by stabilizing the lysosomal membranes, thereby reducing the enzymatic breakdown of the joint tissues.
- They think that gold may give symptomatic relief only.

- Gold is used for non disseminated lupus erythematous but is contraindicated in disseminated lupus.
- It should not be given in individuals with renal disease, a history of infectious hepatitis, skin or blood disorder, diabetes, pregnancy, hypertension, or congestive heart failure.
- Official gold compounds
- Aurothioglucose injection
- Usual dosage range: 10 to 50 mg weekly



- 5- Aluminum:
- Soluble aluminum compounds are astringent and antiseptic.
- Several of soluble aluminum salts are used by the cosmetic industry as deodorants because of their mild astringent action.
- The insoluble aluminum compounds are mostly used as non systemic antacid.

- 6- silver:
- Silver is protein precipitant.
- The action of silver ion on tissue ranges from antiseptic, astringent, and irritant to corrosive as the conc. of free silver ion increases.
- Silver products are used topically

- When silver preparations are used for long period of time, they can cause discoloration, called argyria.
- The color ranges from gray to cyanosis, part of the pigment may be silver sulfide(Ag2S) or Ag ion metallic resulting from the reduction of silver in the tissues.
- Since this reduction is facilitated by light as in photographic emulsion, to the skin to become more discolored.
- The treatment is by 6% sodium thiosulfate and 1% potassium ferricyanide subcutaneously will remove the color.

- 7- Barium :
- Barium cation is toxic systemically due to its muscle stimulating action.
- Stimulating gastrointestinal musculature causes vomiting, severe colic, diarrhea and hemorrhage.
- Stimulation of the cardiovascular musculature causes spasm of the arterioles, leading to hypertension and cardiac arrhythmias. also respiratory failure and convulsion, death by cardiac arrest .
- Treatment of barium poisoning consists of precipitation of insoluble barium sulfate by oral administration of sodium or magnesium sulfate, followed by gastric lavage.
- sodium sulfate may also be administered intravenously.

- Barium chloride has been used in complete heart block (heart beat stops) since it is powerful stimulant of cardiac muscle but because of its low therapeutic index, other drugs and procedures are preferred.
- Barium sulfate (water insoluble salt) used as a radiopaque in X-ray studies of GIT.
- Sometimes ECG is required for elderly patient and those who have heart disease undergoing barium enemas .

- 8- Lead:
- Nowadays industrial and automobile fumes are the sources for lead poisoning,
- Its salts were used topically as astringent.
- Oral lead generally absorbed slowly and excreted reasonably well.
- 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 , Lead can be found initially in the erythrocyte and soft tissue, later the kidneys contain the most Lead with the liver ,then over time redistribution occur to be found in bone, teeth and hair.
- Once deposited in the bone, lead is considered nontoxic until it is mobilized again.

- **Lead poisoning**
- While Lead may be considered a protein precipitant by combining with the cysteine sulfhydryl groups of protein, chronic Lead poisoning manifests itself by inhibition of heme synthesis.
- This interference in heme synthesis in the immature red cell can lead to a reversible lead anemia.
- The most serious Lead poisoning symptoms is encephalopathy which is more common in children than adults. There is a brain damage with a fatality rate of about 25%, and about 40% of the survivors will have mental retardation, EEG(electroencephalogram) abnormalities, seizures, optic atrophy.
- Renal damage.

- **Treatment of lead poisoning**
- Treatment of chronic lead poisoning 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:
- 1. Administrating sodium or magnesium sulphate to precipitate the Lead
- 2. Followed by gastric lavage.

- 9- Mercury:
- Metallic mercury is relatively non toxic as such since its 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 by adhering to a strict dosage schedule.
- while organic mercurial compounds (alkylated mercurials) are very toxic and are the cause of most reports of mercury poisoning.
- 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 diarrhoea may result with diuresis (suppression of tubular reabsorption) and kidney damage.
- **Treatment of acute poisoning**
- 1. Gastric lavage.
- 2. Using of reducing agent such as sodium formaldehyde sulfoxylate to reduce the mercuric cation forming less soluble mercurous salt.
- 3. Using of chelating agents such as dimercaprol or pencillamine.

- Chronic mercury poisoning can occur from industrial exposure, eating of foods contaminated with mercury, and long term exposure to topical mecurials.
- Affects the CNS causing behavioral and personality changes, tremors, insomnia and ataxia.
- It is more difficult to treat than acute mercury poisoning and consists of removing the source of mercury, administrating chelating agents, and providing symptomatic treatment .
- N-acetyl- D,L- penicillamine has recently been recommended as a superior chelating as compared with dimercaprol in chronic mercury poisoning.

- **Mercurial salts are used as :**
- 1. Diuretics is to rid the body of excess fluid caused by cardiac edema.
- 2. Antiseptics
- 3. Parasiticides
- 4. Fungicides
- It is postulated that mercurial diuretics by reacting with protein sulfhydryl groups, inactivate specific enzymes of the renal tubules, thus preventing sodium ion reabsorption in the proximal tubule and there by bringing about a sodium amd water diuresis.
- **Disadvantages of organic mercurial diuretics:**
- Poor absorption from GIT so it is given parenterally.

- Official mercury products
- Meralluride Injection
- Sodium Mercaptomerin Injection
- Chlormerodrin Tablet: is the one official mercurial diuretic administered orally.