VANADIUM (Vn)

General - trace mineral;

- Widely distributed in the body in low concentrations; especially concentrated in fats and oils;
- Adult body contains between 17 and 43 mg;
- History: presence of vanadium in animal tissues discovered in 1912; complete ignorance of its functions in 1940's; proof of essentiality in mammals still lacking in 1963; essentiality of vanadium for humans "established" in 1971; more recently, suggestion that role of vanadium is pharmacological, not necessarily essential;

Nutrition

- Sources: best: parsley, lobster, fish, black pepper, olives, oils, gelatine; fair: radishes, dill, lettuce, strawberries; poor: refined & processed foods;
- Supplements: salts, amino-acid chelates, multi-mineral, multi-mineral-vitamin;
- Absorption from intestine; appears to be poorly absorbed (1%), except under special conditions;
- Improved by: binding to iron-containing proteins;
- Storage: liver & bones; widely distributed throughout the body; not known to be concentrated in any specific tissue; may be stored in iron-storage molecules ferritin & transferrin;
- Excretion: mainly through kidneys; 60% of absorbed vanadium is lost within 24 hours;
- Metabolism: 10 µg/day of vanadium lost in urine; institutional diets contain 12 to 30 µg/day;
- Interactions: appear to be many, but poorly understood; tobacco decreases uptake of vanadium; drugs used to treat manic-depressive illness lower vanadium levels;

Functions of Vanadium

- In animals, vanadium plays essential roles in growth, iron & lipid metabolism, reproduction & bone development; may replace phosphorus in tooth enamel, retarding tooth decay;
- May be involved in oxidation-reduction reactions;
- May regulate activity of the Na-K pump, that pumps potassium into cells & sodium out of cells to maintain electrical charge across membranes & makes nerve conduction & muscle contraction possible;
- May regulate activity of certain membrane enzymes (ATPases);
- May regulate activity of enzymes important in phosphate metabolism;
- Vanadium can replace zinc, copper & iron in functions of certain enzymes;
- Might affect glucose metabolism by mimicking action of insulin; vanadium stimulates oxidation of glucose to energy in fat cells; stimulates glycogen formation in liver & diaphragm; appears to alter membrane function for ion transport; inhibits enzyme (G-6-P) that initiates glucose metabolism;

- Improves glucose tolerance (guinea pigs); prevents high blood sugar in low insulin diabetic rats & prevents deterioration of heart function;
- May inhibit cholesterol synthesis in humans & animals, by blocking formation of squalene in microsomes;
- Appears to have function in lipid metabolism;
- Shown to accelerate bone repair & deposit in areas of rapid tooth mineralization;

Quantities

- Measurement: microgram;
- Optimum: (SONA) averages not established; estimated requirement: 100 to 300 µg/day;
- Individual optimum needs to be determined for each individual case;
- Minimum: (DRI) not yet established; urinary loss of 10 µg/day must be replaced;
- Less than RDA: no official figures;
- Deficiency of vanadium is unlikely on normal dietary practices; not yet been induced in animals;
- Symptoms might include: elevated cholesterol & triglyceride levels; studies have yielded inconsistent results including: adverse effects on survival of new-born; growth, physical appearance, blood picture, serum cholesterol & liver lipids & phospholipids; may be involved in kidney & cardiovascular diseases;
- Impaired reproduction in 4th generation; retarded bone & abnormal tooth formation;
- Inconsistencies appear to be related to inconsistent diets used, indicating widespread interactions between vanadium & other dietary components;
- Toxicity: none observed for vanadium; excessive vanadium may be a factor in bipolar (manicdepressive) illness & is lowered by large doses of vitamin C;
- Reversed by: EDTA, vitamin C;

Therapy with Vanadium

- 100 to 125 mg/day may inhibit cholesterol synthesis by counteracting effect of manganese;
- As part of a complete program of diet & supplementation for cholesterol & triglyceride normalization;
- May be useful in treating diabetes, cancer (along with selenium), atherosclerosis;