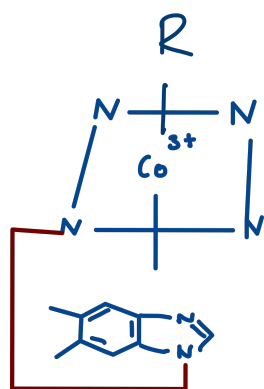


VITAMIN B12

Cyanocobalamin built from

- i) Nucleotide
- ii) Complex of tetrapyrrole ring structure (Corrin)
- iii) Cobalt ion at Centre
- iv) R-Group



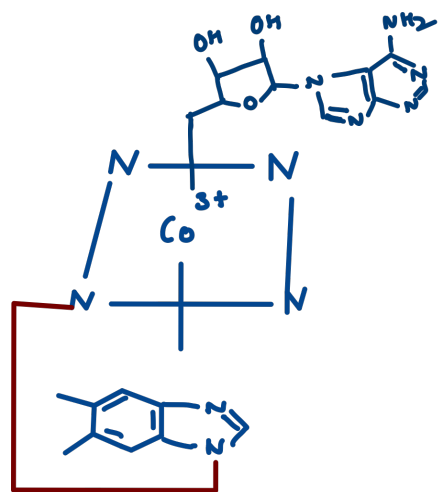
R = Adenosyl = Adenosylcobalamin

= CN = Cyanocobalamin

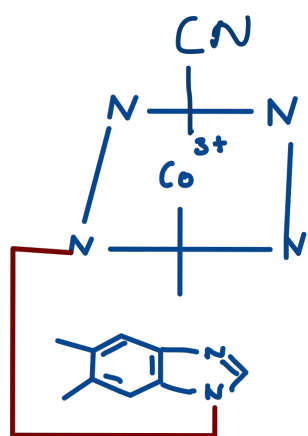
= CH₃ = Methylcobalamin

= OH = Hydroxycobalamin

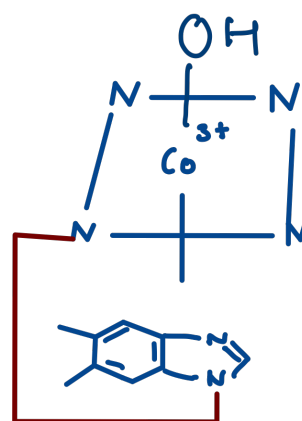
= OH₂ = Aquacobalamin



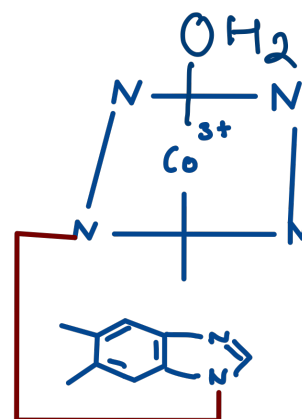
Adenosylcobalamin



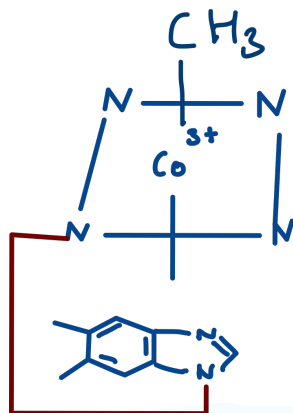
Cyanocobalamin



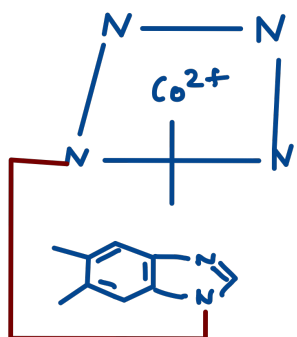
Hydroxycobalamin



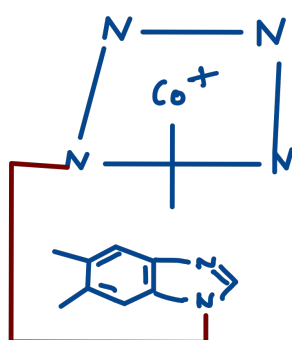
Aquacobalamin



Methylcobalamin

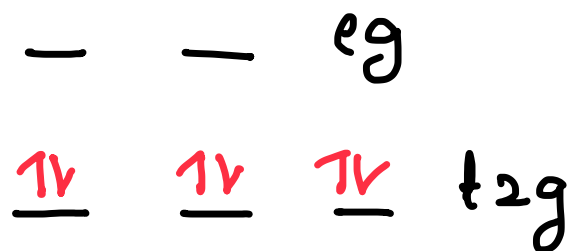


B12a
(Reduced form)



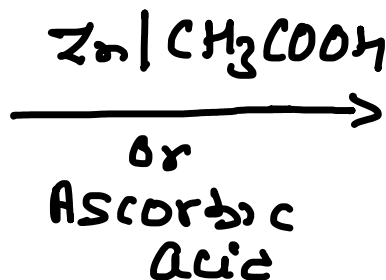
B12s
(Super reduced form)

$\text{Co}^{3+} \rightarrow 3d^6 4s^0$ Octahedral coordinated
 Crystal field splitting $t_{2g}^6 e_g^0$



NO unpaired electron, Diamagnetic in nature,
 ESR inactive.

Vitamin B₁₂
 Coenzyme
 $t_{2g}^6 e_g^0$
 Co^{3+}
 EPR inactive



Vitamin B₁₂
 $t_{2g}^6 e_g^1$
 Co^{2+}
 EPR active Zn dust

$\pi - \pi^*$ transition
 in corrin ring
 Brown in colour
 extra electron
 goes to d_{z^2}

Vitamin B₁₂
 $t_{2g}^6 e_g^2$
 Two unpaired
 electrons

paramagnetic
 EPR active
 $\pi - \pi^*$
 Blue colour

In human intestine containing bacteria synthesize
 Vitamin B₁₂.

APPLIED BIOINORGANIC CHEMISTRY

metal deficiency and treatment

Fe Recommended dietary allowance (RDA) = 8 to 10 mg/day

* Several metalloproteins and metalloenzyme contain

Fe Such as

Hemoglobin → O₂ transport

Hemerythrin → O₂ transport

Myoglobin → O₂ Storage

Ferritin → Fe Storage

Transferrin → Fe transport

Siderophores → Fe Storage and transport

Ferredoxin and Cytochromes → Electron transport

* 65 to 70% of total body iron exists in Hb in human.

* Deficiency of Fe causes Anemia and Fatigue.

* Anemic condition also occurs due to other reasons.

— Vitamin B₁₂ deficiency (Pernicious Anemia: Hb Synthesis is hampered)

— Excess Cu metabolism (Cu containing protein Ceruloplasmin controls Fe metabolism)

— Pb poisoning (Prevents Hb Synthesis) are known to cause anemia.

Treatment:

* FeSO₄ pills coated with fructose or lactose to

protect aerial oxidation

- * Ferrous fumarate, Ferrous gluconate etc are clinically recommended
- * Sometimes ascorbic acid is added with FeSO_4 to aid adsorption.
- * Fe Supplement in food (Spinach, Apple, Carrots, egg, meat, Fish etc).

Zn

RDA 8 to 13 mg/day

60% in Skeletal muscle

30% in Bone

- * Carbonic anhydrase, Alcohol dehydrogenase, Carboxypeptidases etc contain Zn.
- * Zn deficiency leads to growth retardation, dwarfism, inhibition of sexual maturation, loss of body hair, poor appetite and skin lesions.
- * Zn is important in wound healing as Zn is required in protein & collagen synthesis and cell replication.
- * About 30% of total Zn in adults is in skin and bones which are also likely to be affected in Zn deficiency.

Treatment:

- * Zn Supplements in food (Spinach, Green leaves, meat, egg and fish)
- * ZnSO_4 Capsule is clinically recommended

Important role of Zn is

- ① Storage and release of insulin
- ② maintenance of vitamin A level of serum.

Deficiency causes poor wound healing.

Cytochrome oxidase

Catalase

Ceruplasmin

Superoxide dismutase etc.

Cu

RDA (0.5 to 6mg)

- * It is stored as Cu thionein and released as Ceruplasmin or as a complex with Serum albumin.
- * It is mainly found in heart, brain, liver.
- * There are several enzymes like Superoxide dismutase, Cytochrome C oxidase contain Cu.
- * Deficiency:
 - Structural lesions of major arteries and it is fatal.
 - Bone abnormalities
 - Sometime anemic condition arises due to Ceruplasmin.
 - Excess of Zn intake may produce the symptoms of Cu deficiency.
 - Zn induced Cu deficiency arise due to the competition for absorption in gastrointestinal tract. This property allow Zn therapy in the treatment of Wilson's disease (Excess Cu deposition)
- Menke's disease: due to genetic disorder arises from the widespread defect in the intracellular copper transport.

Treatment:

- * Cu Supplements in food (like Cashew Nuts, Avocado, Mushroom, liver etc)
- * $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ may recommended.
- * CuCl_2 - L-histidine for Menke's disease.

Mn

RDA (0.4 to 3 mg)

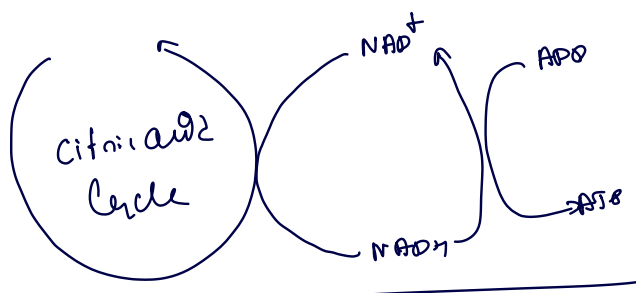
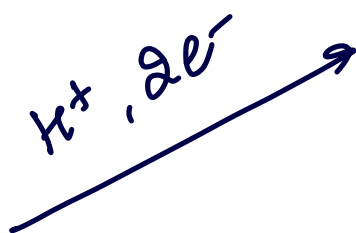
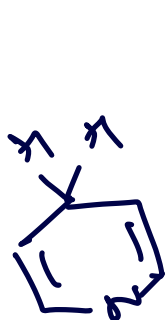
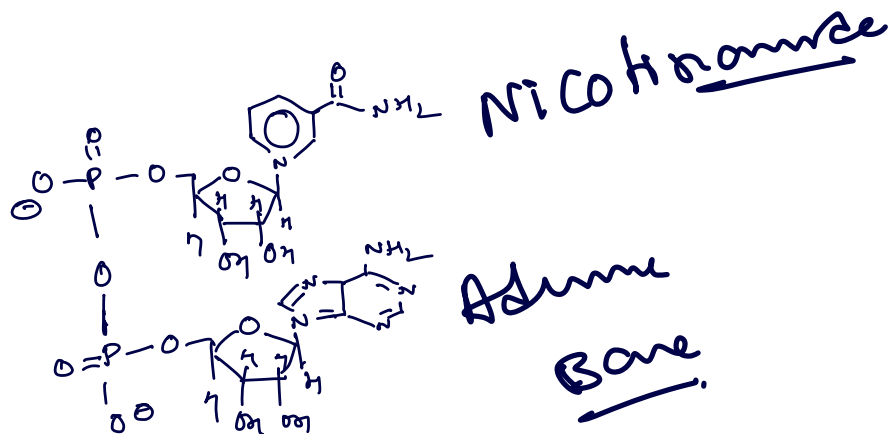
Excess Ca & or P in the diet

Deficiency causes

- * Retarded growth
- * Skeletal abnormalities
- * Transient dermatitis
- * Hypcholesterolemia
- * Ataxia in newly born offspring
- * Reproductive failure

Treatment:

- * Mn enriched foods (Grains, leafy vegetables)
- * MnSO_4 is clinically recommended



RIBTON

