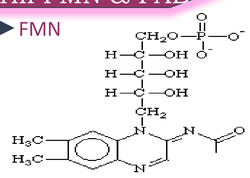
Vitamins

Prepared by: Danish

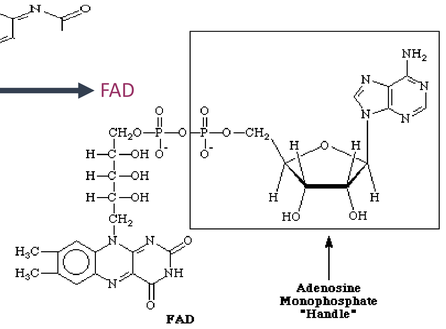
Riboflavin (Vitamin B2)

- Water soluble vitamin
- Deficiencies leads to:
  - Reproductive problems
  - Growth retardation
  - Neural degeneration
- Good sources:
  - Legumes
  - Meat
  - Dairy Products
  - Dark greens vegies
  - Grains
- Form FMN & FAD — Important for electron transfer
- FMN



FMN

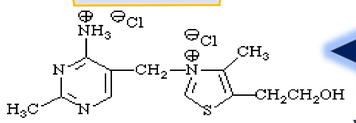
- FAD



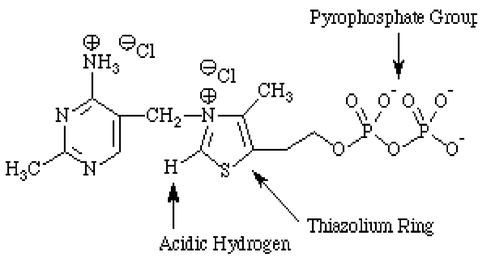
FAD

Adenosine Monophosphate "Handle"

Thiamine (Vitamin B1)

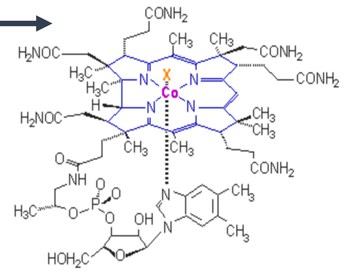


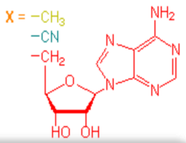
- 1st Vitamin discovered
- Deficiencies leads to:
  - Neurological disorders
  - Heart problems
  - Anorexia
  - BERI-BERI
- Thiamine reaction: Thiamin Pyrophosphate (TPP)
  - A cofactor in decarboxylation reactions of keto acids a prosthetic group in transketolasesc
  - Thiazolium ring is the chemically active part of TPP



Cobalamin (Vitamin B12)

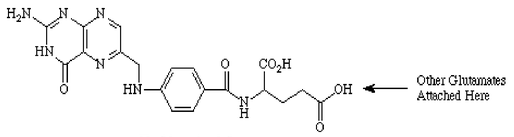
- Forms radical species.





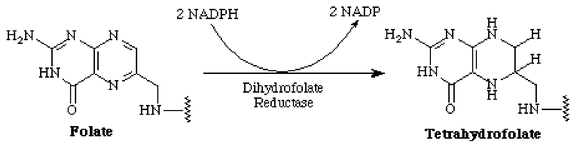
- Water soluble vitamin
- Corrin ring with Cobalt cation.
- Involved in intramolecular rearrangements, methyl group transfer, reduction of ribonucleotides to deoxyribonucleotides

Folate (Vitamin B9)



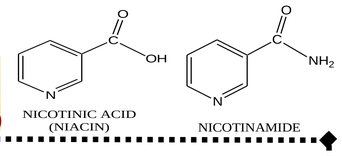
Folic Acid

- Water soluble vitamin
- Important during pregnancy to prevent neural tube defects in fetus namely spina bifida.
- Has a poly-glutamate tail formed by gamma-carboxy and alpha amino groups (unusual peptide bond).
- Pterin ring important functional
- Tetrahydrfolate (THF)
  - -Folate is converted to THF by the addition of 4 hydrogens to the pterin ring.



- Important in transfer of one-carbon units of other molecules such as methanol, formaldehyde or formic acid.

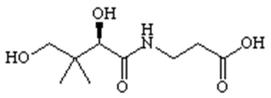
Niacin (Vitamin B3)



NICOTINIC ACID (NIACIN) — NICOTINAMIDE

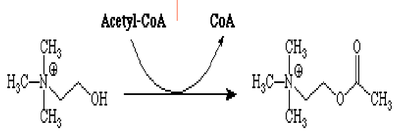
- Also known as nicotinic acid
- Deficiencies leads to:
  - PELLAGRA
    - Diarrhea
    - Dermatitis
    - Dementia
- Can be synthesized from tryptophan in the liver
- Involved in both DNA repair, and the production of steroid hormones in the adrenal gland
- A precursor to NAD^+/NADH and $NADP^+$/NADPH
  - Serves as cofactors in oxidation/reduction
  - Act as co-substrates for dehydrogenases.

Pantothenic acid (Vitamin B5)



Pantothenic Acid

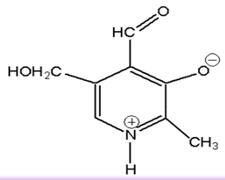
- Water soluble vitamin
- Important coenzyme to produce co-enzyme A
  - Involved in acyl group transfer.
  - Hydrophobic acyl groups (fatty acids) are made more water soluble with co-enzyme A attached.



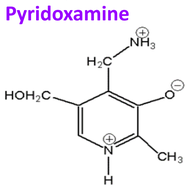
Fat soluble vitamin

- Vitamin A
  - Derived from β-carotene is important for vision, regulation of gene expression during cell differentiation and teratogenic. .
- Vitamin D
  - Important in calcium absorption, regulates intestinal absorption and deposition in bones
- Vitamin E
  - Antioxidant
- Vitamin K
  - Needed for the posttranslational modification of certain proteins required for blood coagulation and in metabolic pathways in bone and other tissue

Pyridoxal Vitamin B6

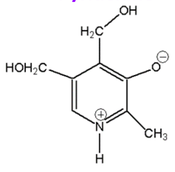


- One of the 3 natural forms of vitamins in heterocyclic compounds, alongside:
  - Pyridoxamine



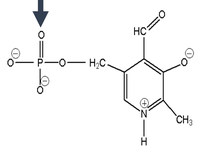
PRYIDOXAMINE

  - Pyridoxine



PYRIDOXINE

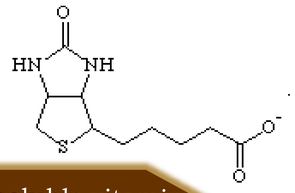
- In the body, will be converted into pyridoxal 5-phosphate (PLP).



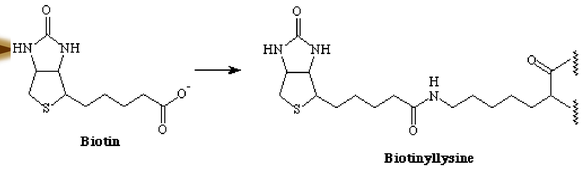
PYRIDOXAL 5' PHOSPHATE

- Important in amino acid metabolism
- Bound to enzyme through reactions with lysine

Biotin Vitamin H /B7

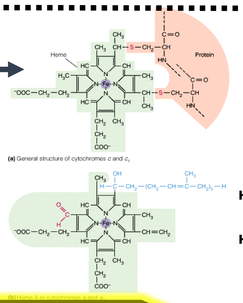


- Water soluble vitamin
- Produced by gut microflora which supplies ½ Required Daily Allowance.
- Deficiencies are rare
- Consuming 6 raw eggs a day can cause deficiencies due to the presence avidin.
- Biotin factor
  - Involved in ATP dependent carboxylation reactions.
  - Covalently bound to enzyme through amide linkage with lysine
  - Important biotin enzymes are acetyl-CoA carboxylase, pyruvate carboxylase..



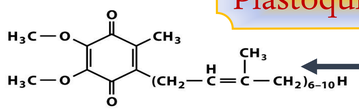
Biotin — Biotinyllysine

Chytochromes

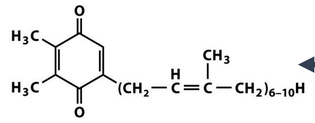


- Protein Coenzyme
- Important in redox reactions
- Fe3+ can undergo reversible one electron reduction

Ubiquinone / Plastoquinone



Ubiquinone



Plastoquinone

- Lipid soluble electron carrier
- Important in electron transport chains