IIT Guwahati

Lecture 21

Course BT 631

Protein Structure function and Crystallography

Prof. Arun Goyal

Dept. of Biosciences and Bioengineering

Enzyme Co-factors

Enzyme Cofactors are also called coenzymes.

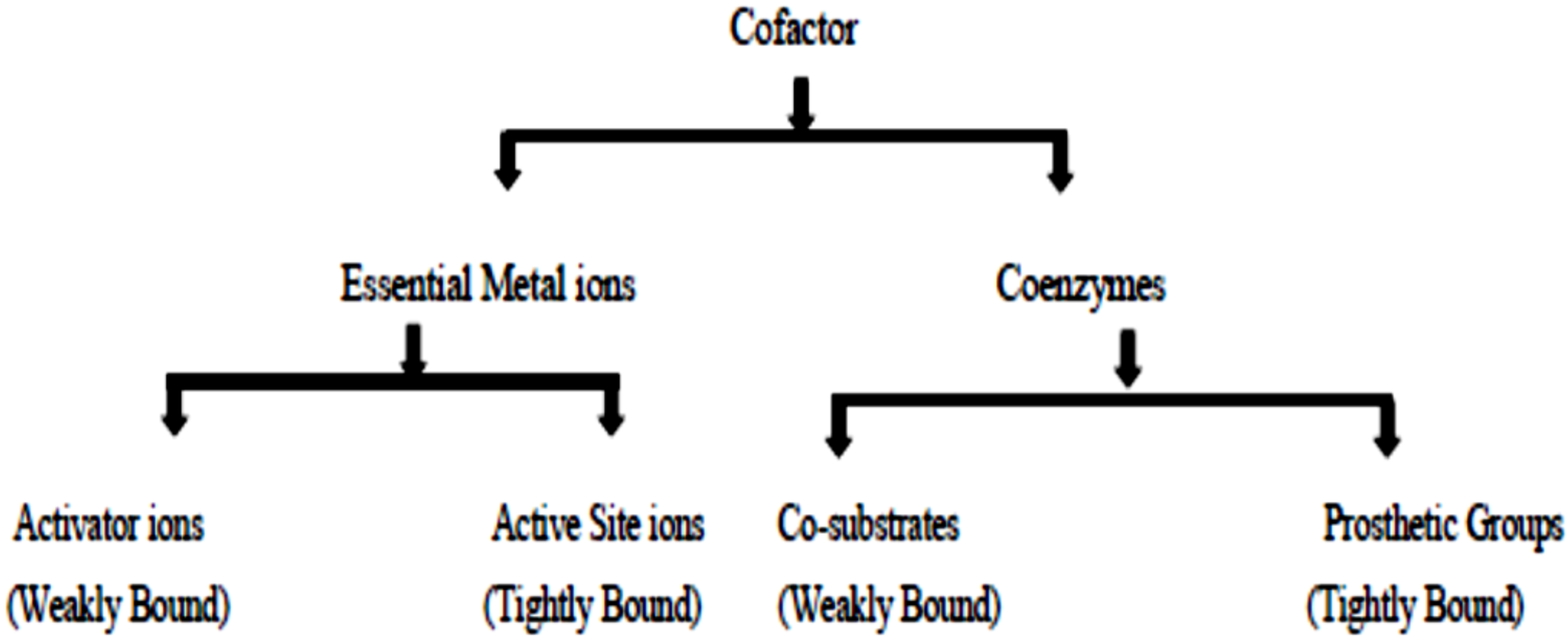
An additional non-protein molecule that is needed by some enzymes to help the reaction is called as Enzyme Cofactor.

***Tightly bound cofactors are called prosthetic groups*.**

Cofactors that are bound and released easily are called coenzymes e.g. Many vitamins are coenzymes.

The nature of interaction between cofactor and enzyme is variable with both covalent and noncovalent bonds.

Enzyme Co-factors



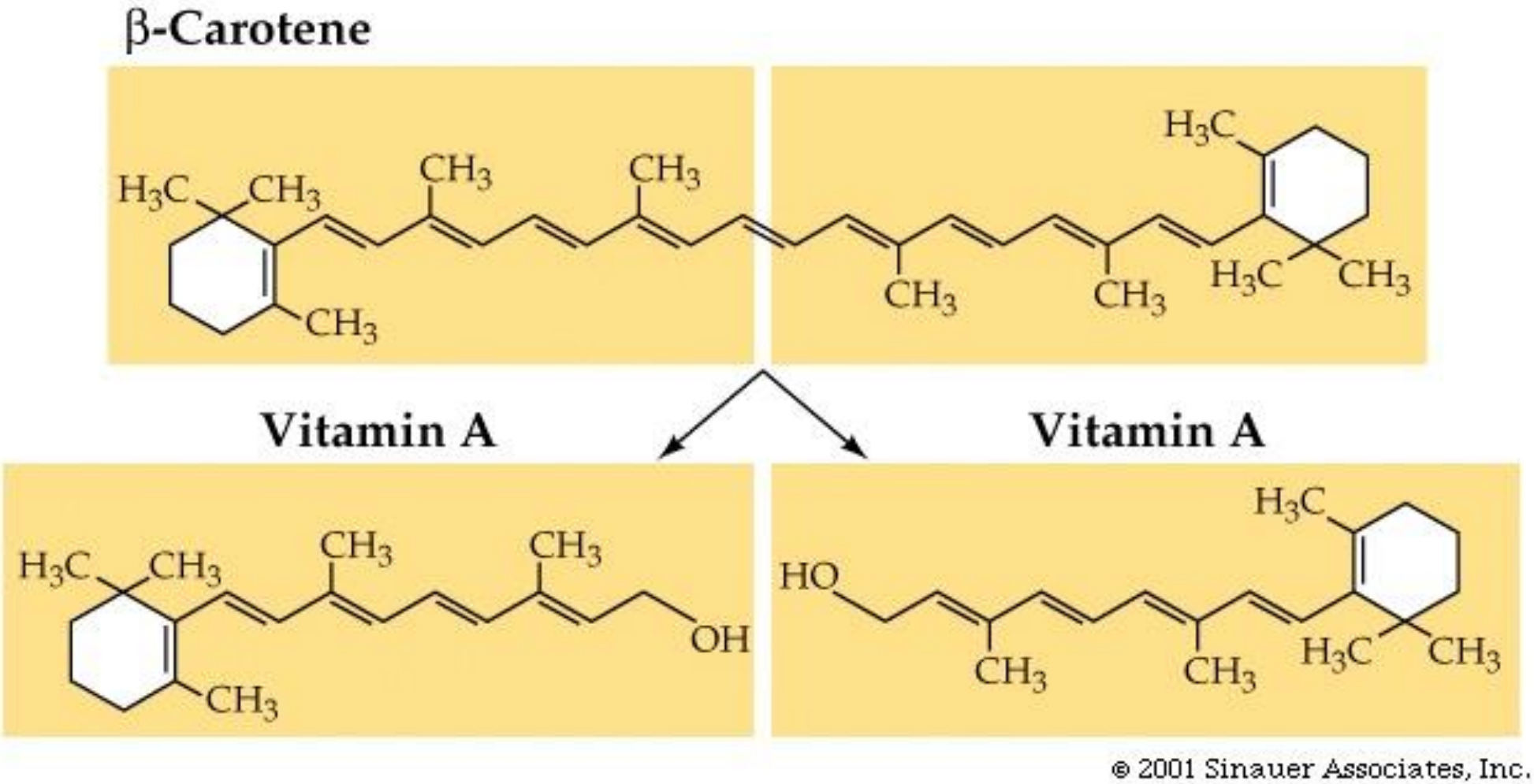
Enzyme Co-factors

Cofactors found in enzyme with their biological functions.

Component	Co-factor	Metabolic role
Vitamin A (retinol)	Retinal	Visual Cycle
Vitamin B_1 (thiamine)	Thiamine pyrophosphate	Carbohydrate metabolism
Vitamin B_2 (riboflavin)	flavin adenine dinucleotide (FAD), flavin mononucleotide (FMN)	Redox reaction in flavoenzymes
Vitamin B_3 Niacin (Nicotinic acid)	Nicotinamide adenine dinucleotide (NAD)	Redox reaction involved NAD linked dehydrogenases
Vitamin B_5 (Panthothenic acid)	Co-enzyme A	Acyl group activation and transfer
Vitamin B_6	pyridoxine	Transaminase reactions
Vitamin B_{12}	cyanocobalamin	Methyl group transfer or intramolecular rearrangement
Biotin	Biotin	ATP dependent carboxylation of substrate
Folic acid	Tetrahydrofolate	Transfer of formyl or hydroxymethyl groups
Vitamin K	Phylloquinone	Carboxylation of Glu residues
Coenzyme Q	Ubiquinone	Electron and proton transfer

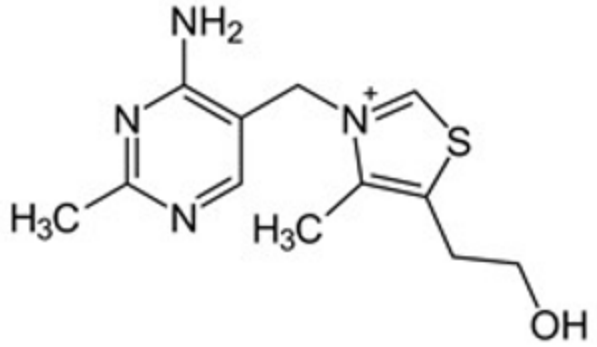
Enzyme Co-factors

Vitamin A

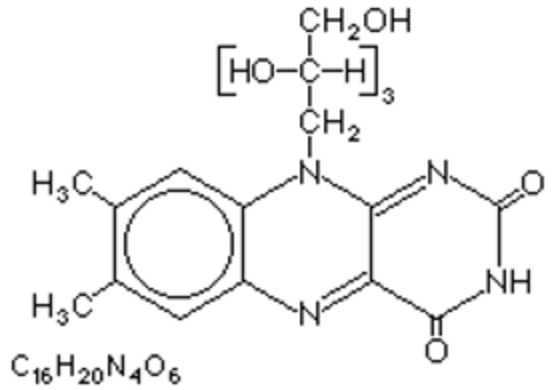


Enzyme Co-factors

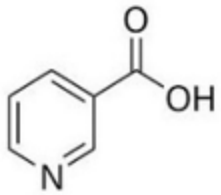
Vitamin B1, B2, B3 and B5



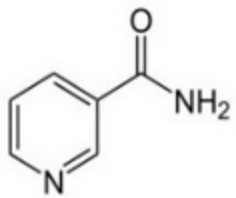
Vitamin B1 (Thiamine)



Vitamin B2 (Riboflavin)

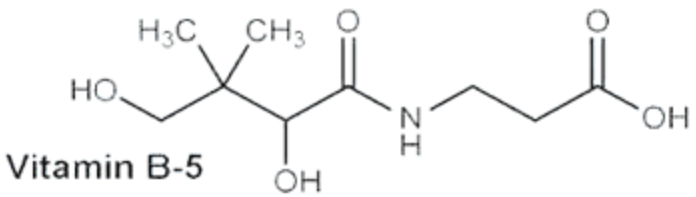


Niacin



Nicotinamide

Vitamin B3 (Nicotinic acid)

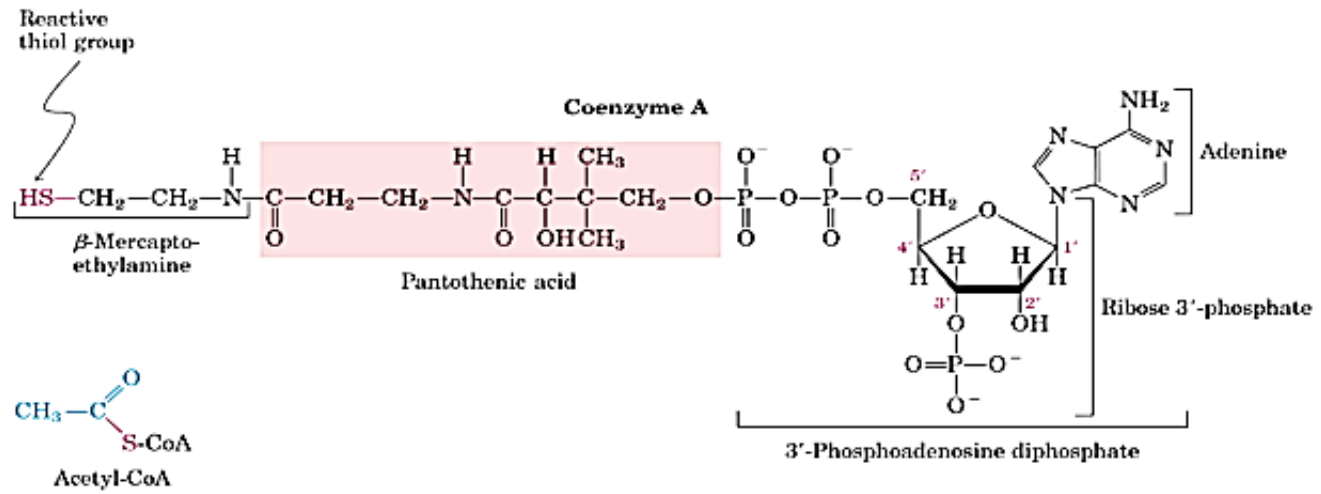


Vitamin B-5

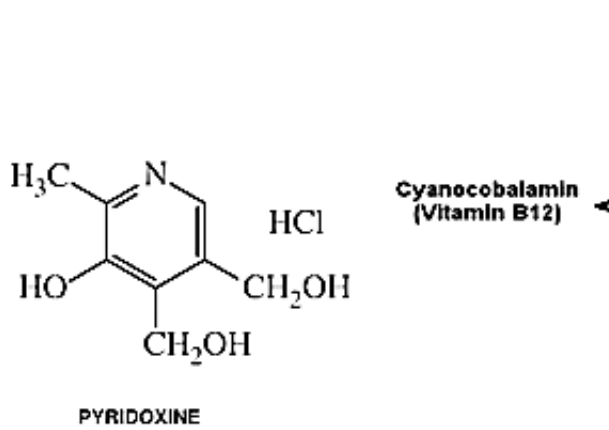
Vitamin B5 (Pantothenic acid)

Enzyme Co-factors

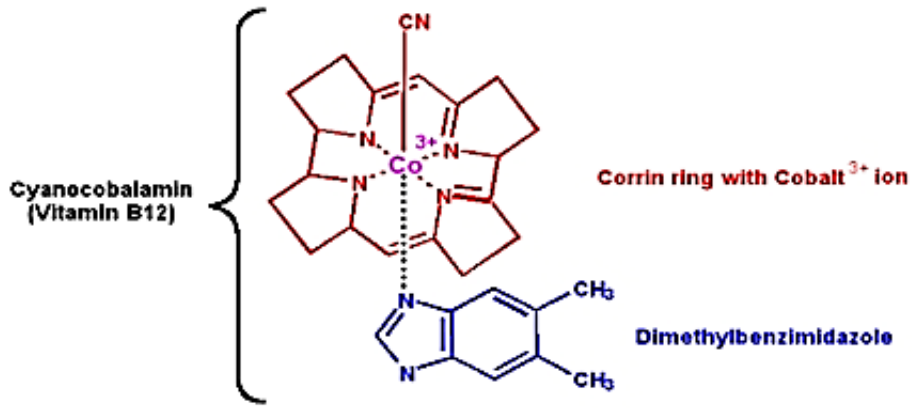
Vitamin B5, B6, B12



Vitamin B5 (Pantothenic acid) and Coenzyme A



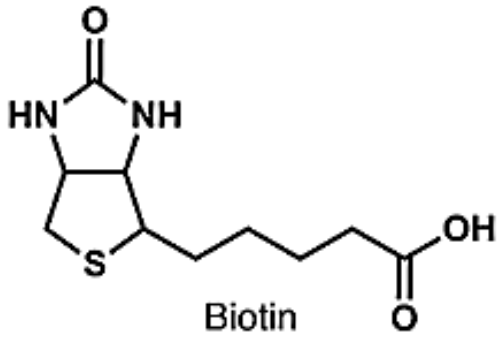
Vitamin B6 (Pyridoxine)



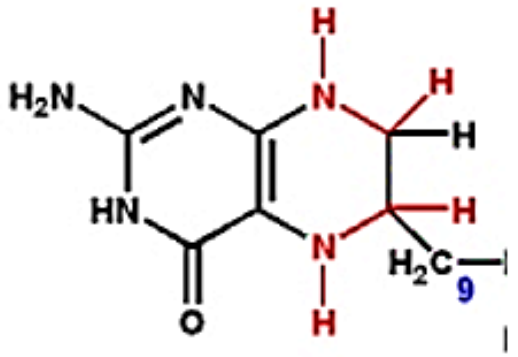
Vitamin B12 (Cyanocobalamin)

Enzyme Co-factors

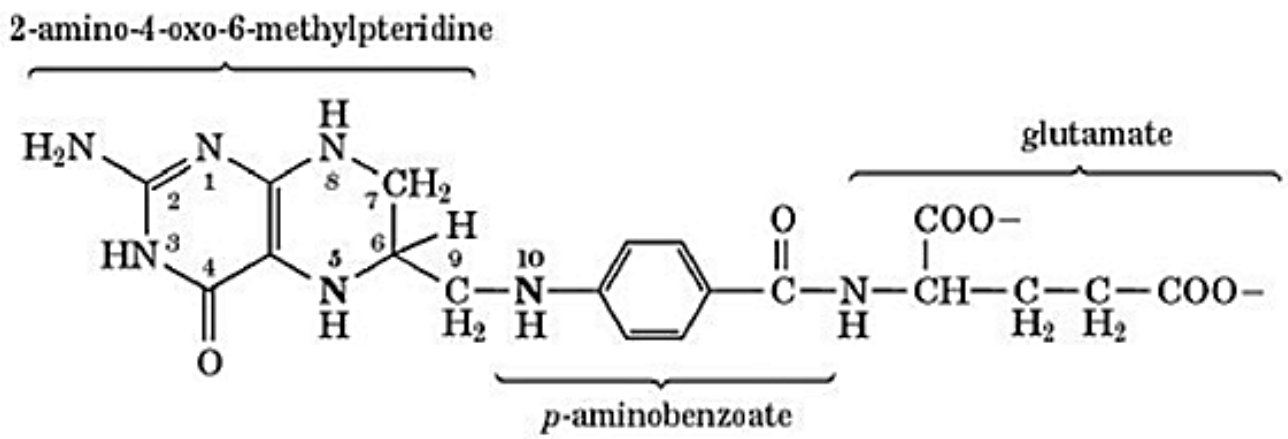
Biotin and Folic Acid



Biotin



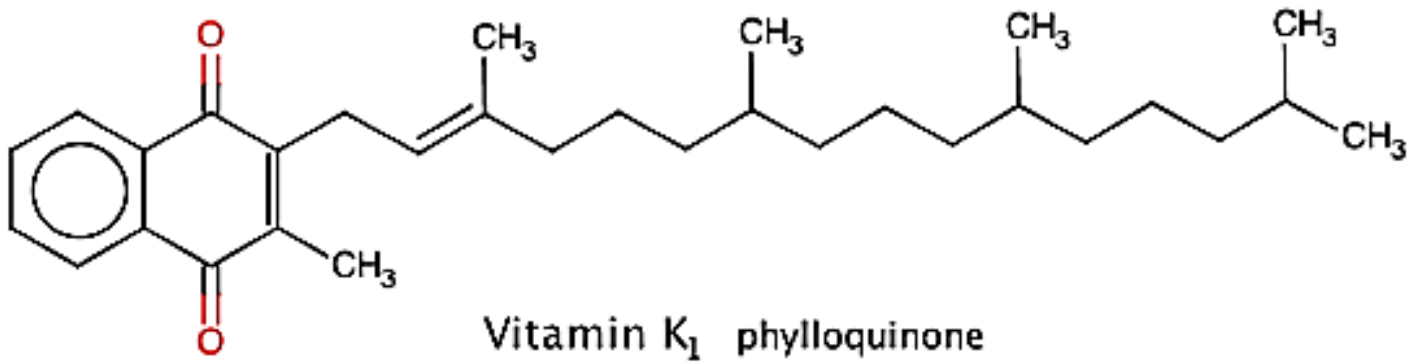
Tetrahydrofolate



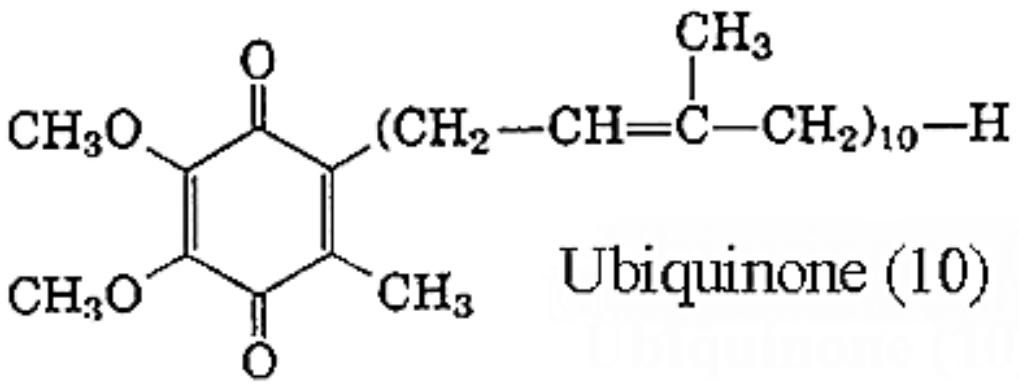
Folic acid (Tetra hydro folic acid)

Enzyme Co-factors

Vitamin K and Q



Vitamin K_1 phylloquinone



Ubiquinone (10)

Vitamin Q (Ubiquinone)

Enzyme Co-factors

Role of metal ions as cofactors in enzyme catalysis.

Metal ion	Metalloenzyme	General Reaction Catalyzed
Fe^{2+}	Cytocrome oxidase	Reduction of O_2 to H_2O
Co^{2+}	Vitamine B_{12}	Transfer of methyl group
Mo^{2+}	Sulfite oxidase	Reduction of sulfite to sulfate
Mn^{2+}	Water splitting enzyme	Photosynthetic splitting of water to oxygen
Ni^{2+}	Urease	Hydrolysis of urea to ammonia and carbamate
Cu^{2+}	Superoxide dismutase	Dismutation of superoxide into O_2 and H_2O_2
Zn^{2+}	Carboxypeptidase A	Hydrolysis of peptide bonds