CO-ENZYMES

Coenzymes are organic non-protein molecules that bind with the protein molecule (apoenzyme) to form the active enzyme (holoenzyme).

» Coenzymes are small molecules.

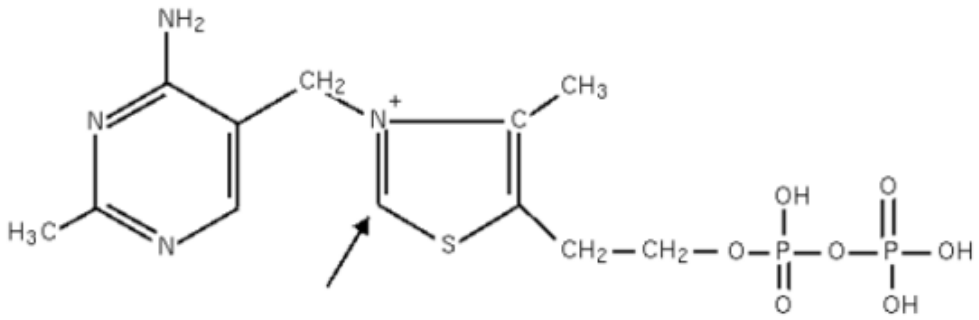
» They cannot catalyze a reaction by themselves but they can help enzymes to do so.

Example: Thiamine pyrophosphate, FAD, pantothenic acid etc.

Salient features of coenzyme:

- Coenzymes are heat stable.
- They are low-molecular weight substances.
- The coenzymes combine loosely with the enzyme molecules and so, the coenzyme can be separated easily by dialysis.
- When the reaction is completed, the coenzyme is released from the apo-enzyme, and goes to some other reaction site.

Thiamine pyrophosphate:



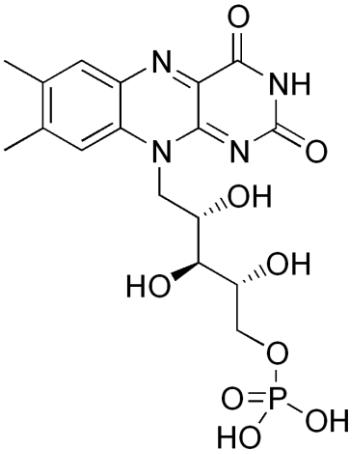
Thiamine pyrophosphate (TPP), or thiamine diphosphate (ThDP), is a thiamine derivative, is also known as vitamin B1.

Biological Function of Thiamine pyrophosphate:

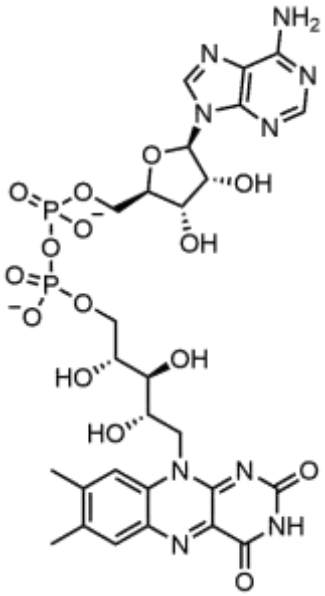
It maintains:

- ✓ The normal function of the heart;
- ✓ Normal carbohydrate and energy-yielding metabolism;
- ✓ The normal function of the nervous system;
- ✓ Normal neurological development and function;
- ✓ Normal psychological functions.

Flavin Coenzymes:



Flavin mono nucleotide (FMN)



Flavin adenine di nucleotide (FMD)

Flavin is the common name for a group of organic compounds based on pteridine,. The biochemical source is the riboflavin.

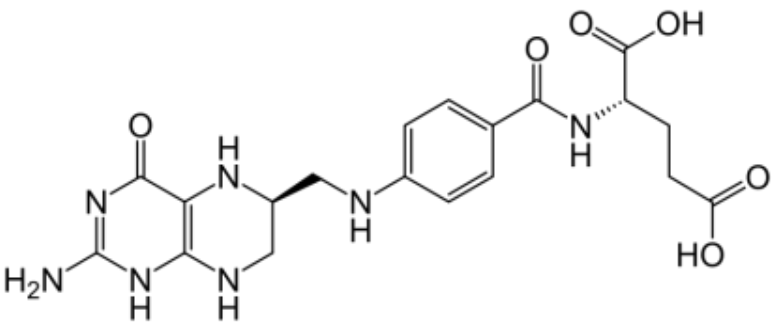
It is commonly know as Vitamin B2. The flavin often attached with an adenosine diphosphate to form flavin adenine dinucleotide (FAD),and, in other circumstances, is found as flavin mononucleotide (FMN).

Biological Functions and Importance:

- Normal energy-yielding metabolism;
- Normal metabolism of iron in the body;
- The maintenance of normal skin and mucous membranes;
- The maintenance of normal red blood cells;
- The maintenance of normal vision;
- The maintenance of the normal function of the nervous system.

TH4 or Tetrahydrofolic acid:

Tetrahydrofolic acid, or tetrahydrofolate, is a folic acid derivative.



Biological Functions:

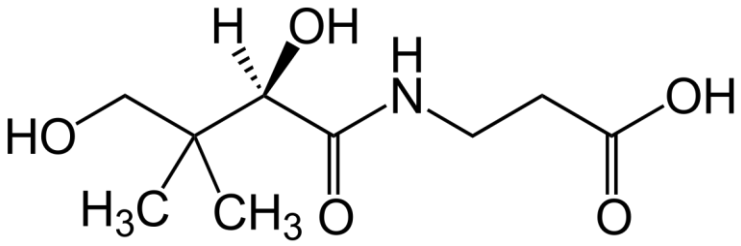
- It is a co factor in many reactions-
- In the metabolism of amino acids and nucleic acids. A shortage in THF can cause megaloblastic anemia.
- Tetrahydrofolic acid is involved in the conversion of formiminoglutamic acid to glutamic acid
- Reduce the amount of histidine available for decarboxylation and protein synthesis
- It can decrease the urinary histamine and formiminoglutamic acid.

Pantothenic acid:

Pantothenic acid or vitamin B5 is a water-soluble vitamin.

Pantothenic acid are found in nearly every food, with high amounts in avocado, whole-grain cereals, legumes, eggs, meat, royal jelly, and yogurt.

For many animals, pantothenic acid is an essential nutrient.Animals require pantothenic acid to synthesize coenzyme-A(CoA), as well as to synthesize and metabolize proteins,carbohydrates, and fats.



An adequate supply of pantothenic acid is important as it helps the body to:

- Convert food into glucose, that used to produce energy.
- Break down fats, carbohydrates, and proteins for energy generation.
- Form red blood cells, as well as sex and stress-related hormones.
- Normal mental performance.
- Normal synthesis and metabolism of steroid hormones, vitamin D and some neurotransmitters.
- The reduction of tiredness and fatigue.

NAD+

Nicotinamide adenine dinucleotide (NAD) is a coenzyme found in all living cells. NAD+ was first discovered by the British biochemists Arthur Harden and William John Young in 1906. It is consists of two nucleotides joined through their phosphate groups. Nicotinamide adenine dinucleotide exists in two forms:

An oxidized form (NAD+)

Reduced form (NADH)

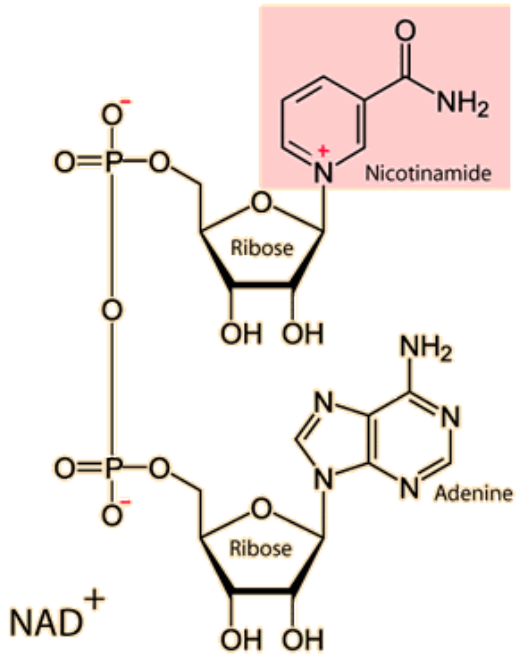
Pharmacological uses of NAD+:

» Drug design and drug development exploits NAD+

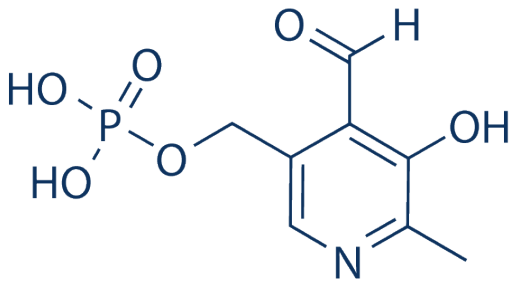
» It is being studied for its potential use in the therapy of neurodegenerative diseases such as Alzheimer's and Parkinson disease.

» NAD+ is also a direct target of the drug isoniazid, which is used in the treatment of tuberculosis.

» It is also used for the development of new antibiotics.



Pyridoxal pyrophosphate:



Pyridoxal pyrophosphate (pyridoxal 5'-phosphate), is the active form of vitamin B6, is a coenzyme in a variety of enzymatic reactions.

Vitamin B6 is a water-soluble vitamin.There are three different natural forms of vitamin B6: pyridoxine, pyridoxamine, and pyridoxal. Humans depend on external sources to cover their vitamin B6 requirements

Health Functions:

It convert food into glucose, which is used to produce energy

It make neurotransmitters,produce hormones, red blood cells, and cells of the immune system

Along with vitamin B12 and vitamin B9, it control blood levels of homocysteine, an amino acid that may be associated with heart disease

Biotin:

Biotin is a composed of a ureido ring fused with a tetrahydrothiophene ring.

Biotin is a coenzyme for carboxylase enzymes, involved in the synthesis of fatty acids, isoleucine, valine, and in gluconeogenesis.

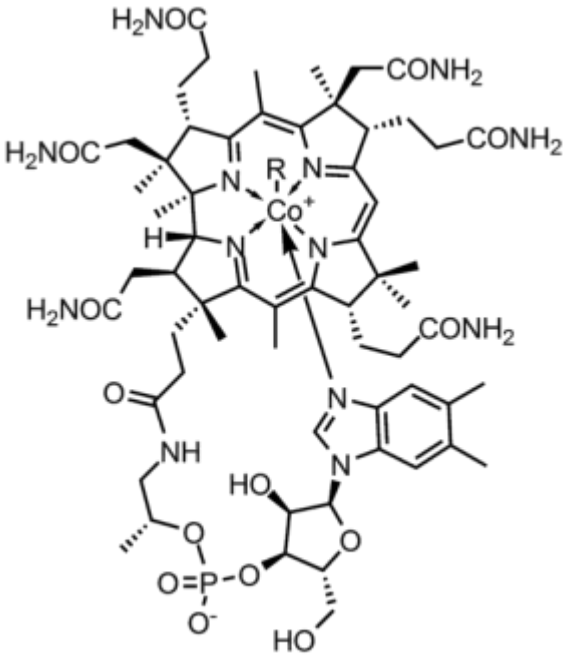
Biotin, also known as vitamin H or coenzyme R, is a water-soluble B-vitamin (vitamin B7).

Biological role of Biotin:

A sufficient intake of vitamin B7 (biotin) is important as it helps the body to:

- Convert food into glucose, which is used to produce energy.
- Produce fatty acids and amino acids (the building blocks of protein).
- Activate protein/amino acid metabolism in the hair roots and fingernail cells.
- Maintain normal macronutrient metabolism.
- The maintenance of normal. skin and mucous membranes.
- The maintenance of normal hair

Vitamin B12:



R = 5'-deoxyadenosyl, Me, OH, CN

- Vitamin B12, vitamin B-12, also called cobalamin, is a water-soluble vitamin with a key role in the normal functioning of the brain and nervous system, and for the formation of blood.
- It is one of the eight B vitamins.
- It is normally involved in the metabolism of every cell of the human body, especially affecting DNA synthesis and regulation, but also fatty acid metabolism and amino acid metabolism.
- Only bacteria and archaea have the enzymes required for its synthesis, although many foods are a natural source of B12 because of bacterial symbiosis.

Biological Role of Vitamin B12:

- It maintain healthy nerve cells
- It produce nucleic acids (e.g., DNA), the body's genetic material
- It regulate the formation of red blood cells together with vitamin B9 (folate),
- Together with vitamin B6 and vitamin B9, it control blood levels of the amino acid homocysteine, a potential marker for heart disease risk.