

## Coenzymes and cofactors

Some enzymes need assistance so that the catalytic process goes smoothly. Molecules, which can provide this assistance, are either cofactors or coenzymes.

### Function of coenzymes

Coenzymes are organic carrier molecules. They are non-protein components of an enzyme that are required for the catalytic process to occur smoothly. They bind to the active sites of enzymes when the substrate molecules bind, and although they are not substrate molecules they participate in the catalysis process.

They can be carriers of electrons or groups of atoms, which enables the catalytic reaction to occur.

Some examples include:

- NADH which is an electron carrying coenzyme
- CoA (coenzyme A) is an acyl group (-COR) carrying coenzyme

### Function of cofactors

They are either loosely or tightly bound to the enzyme, which is often denatured when the cofactor is removed. These participate directly in the catalytic process, unlike coenzymes. Cofactors stabilize the enzyme or the substrate and assist directly in the reaction process.

In summary, they are inorganic stabilisers that assist directly in the catalytic reaction.

Some examples include:

- $Mg^{2+}$  ions are cofactors in the DNA replication process that stabilize the negatively charged DNA molecules.

## Vitamins and minerals

Vitamins are often precursors to many organic coenzymes and minerals are inorganic cofactors.

Examples include:

- Vitamins – some are coenzymes
  - B<sub>3</sub> – ‘niacin’ is a precursor of NAD
  - B<sub>5</sub> – is a precursor of CoA
- Minerals – some are cofactors
  - $Mg^{2+}$  - cofactor involved in DNA replication
  - $Ca^{2+}$  - not a cofactor because it is actually involved in the structure of teeth and bones

Vitamins are organic molecules that are needed in small amounts in the diets of some higher animals.

Vitamins can be grouped according to whether they are soluble in water or in nonpolar solvents.

### Water-soluble vitamins

Examples include ascorbic acid (vitamin C) and a series known as the vitamin B complex.

- Ascorbate, the ionized form of ascorbic acid, serves as a reducing agent (an antioxidant).
- The vitamin B series consists of parts of coenzymes. It is worth noting that except for Vit C, all vitamins must be modified before they can serve their function.

### Fat-soluble vitamins

Not all vitamins function as coenzymes. Fat-soluble vitamins have a variety of functions. Examples include:

- Vit K is needed in the blood clotting process
- Vitamin D is a hormone that regulates the metabolism of calcium and phosphorus. A deficiency in vitamin D impairs bone formation in growing animals.
- Vitamin E reacts with and neutralizes reactive oxygen species before they can oxidize unsaturated membrane lipids, damaging cell structures.