Course -M.Sc. Botany Part-II, Paper-IX

(Group-"B")

Topic- Co-enzyme (Bio-Chemistry)

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Co –Enzyme

Non-protein organic cofactors are called coenzymes. Coenzymes assist enzymes in turning substrates into products. They can be used by multiple types of enzymes and change forms. Specifically, coenzymes function by activating enzymes, or acting as carriers of electrons or molecular groups.

Enzymes may or may not have a non protein molecule attached to them .Some enzymes contain covalently bound carbohydrate groups, which do not affect the catalytic activity but may influence enzyme stability or solubility. Many enzymes have metal ions, while some others possess low weight organic molecules, these are called co-factors, and are essential for enzyme activity. An organic cofactor is commonly known as coenzyme.

While enzymes are proteins, coenzymes are small, nonprotein molecules. Coenzymes hold an atom or group of atoms, allowing an enzyme to work. Examples of coenzymes include the B vitamins and S-adenosyl methionine.

Coenzymes are mostly derived from vitamins and other organic essential nutrients in small amounts. (Note that some scientists limit the use of the term "cofactor" to inorganic substances; both types are included here.) Coenzymes are further divided into two types.

Type of co-Enzymes: coenzymes

There are different type of Co- Enzymes. It make up a part of the active site, since without the coenzyme, the enzyme will not function.

- Flavin Adenine Dinucleotide (FAD) ...
- Nicotinamide Adenine Dinucleotide (NAD) ...
- Vitamin A: β-Carotene. ...
- Vitamin B_{12}: Cobalamin.

Water-soluble vitamins, which include all B complex vitamins and vitamin C, lead to the production of coenzymes. Two of the most important and widespread

vitamin-derived coenzymes are nicotinamide adenine dinucleotide (NAD) and coenzyme A. ... NADH, often called coenzyme 1, has numerous functions.

Function of Co- Enzymes:

Coenzymes work by binding to the active side of the enzymes, the side that works in the reaction. Since enzymes and coenzymes are non metal organic molecules, they bind together by forming covalent bonds. The coenzymes share electrons with the enzymes, rather than lose or gain electrons. When they form this bond, they only help the reaction to occur by carrying and transferring electrons through the reaction. Coenzymes do not become integral parts of the enzymatic reaction. Instead, the covalent bonds are broken at the end of the reaction, and the coenzyme returns back to free circulation within the cell until it is used again.

Vitamins and Coenzymes

Taking vitamins, whether from eating foods or in supplement form, increases the amount of coenzymes in the body. Some vitamins help the body produce coenzymes, such as folic acid and some of the B vitamins, while other vitamins directly act as coenzymes, such as vitamin C. Without vitamins, the body would be unable to produce coenzymes.

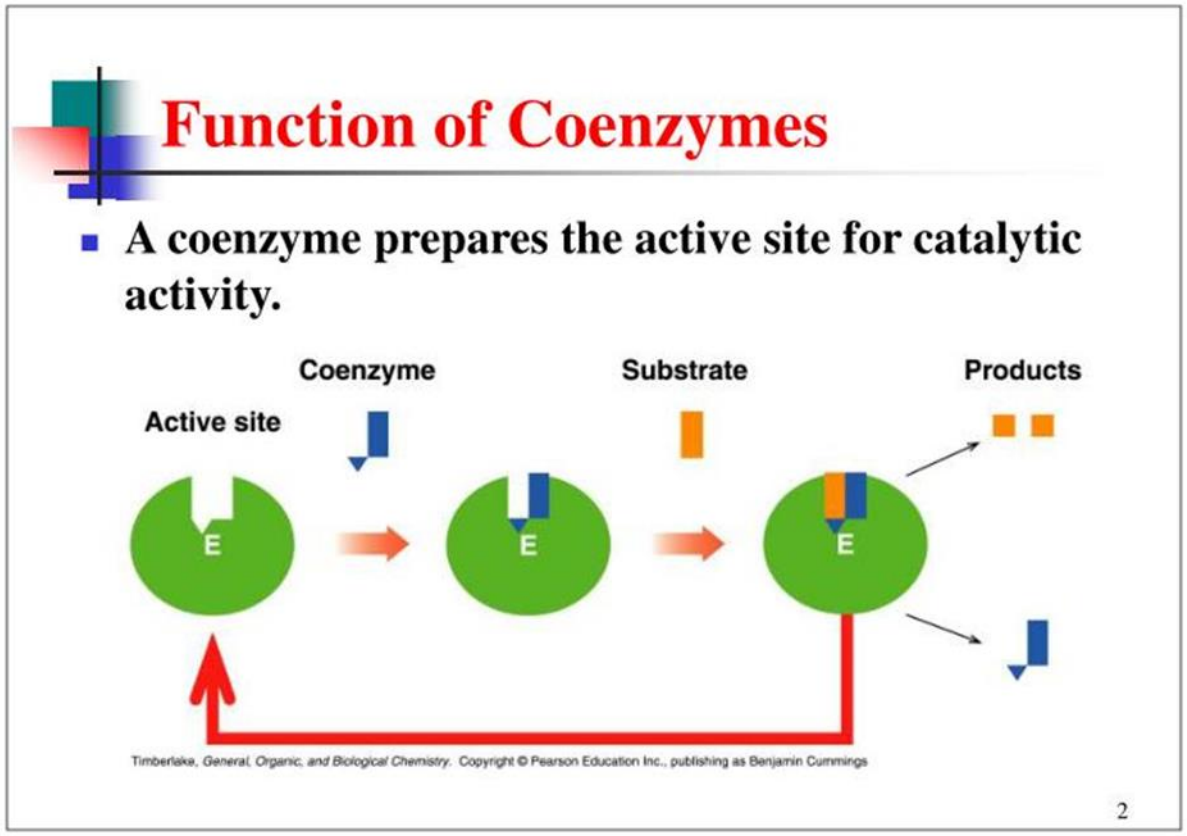
The NAD Cycle

NAD---nicotinamide adenine dinucleotide---is a coenzyme that is formed from vitamin B3. It works in several metabolic processes that goes through oxidation---the removal of a hydrogen ion---and reduction, or the gaining of a hydrogen ion. It works as a carrier of hydrogen atoms and transfers them to the end molecules in the enzyme reaction. The NAD coenzyme can be reused by the cell, over and over again.

Other Coenzymes

Other coenzymes include ATP, or adenosine triphosphate, the source of energy flow in cells. FAD, or flavin adenine dinucleotide, also functions in oxidation and

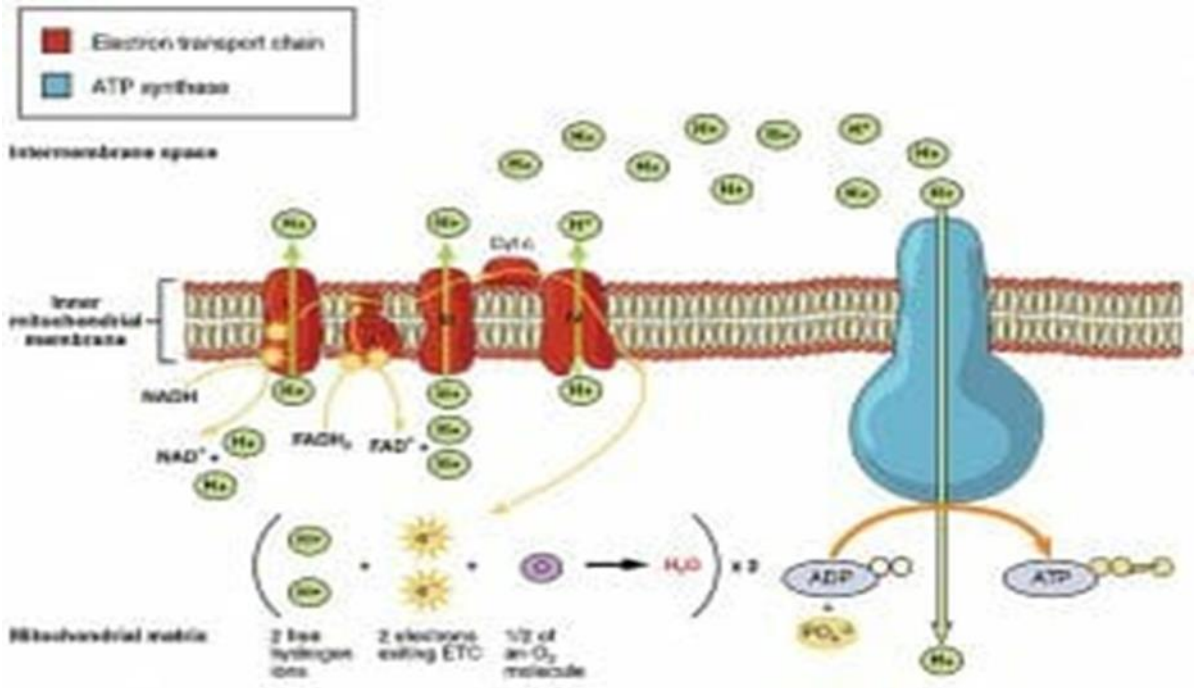
reduction reactions, while PLP---pyridoxal-phosphate---plays many roles, including in amino acid reactions.



NAD is derived from vitamin B3 and functions as one of the most important coenzymes in a cell when turned into its two alternate forms. When NAD loses an electron, the low energy coenzyme called NAD+ is formed. When NAD gains an electron, a high-energy coenzyme called NADH is formed.

NAD+ primarily transfers electrons needed for redox reactions, especially those involved in parts of the citric acid cycle (TAC). TAC results in other coenzymes, such as ATP. If an organism has a NAD+ deficiency, then mitochondria become less functional and provide less energy for cell functions.

When NAD+ gains electrons through a redox reaction, NADH is formed. NADH, often called coenzyme 1, has numerous functions. In fact, it is considered the number one coenzyme in the human body because it is necessary for so many different things. This coenzyme primarily carries electrons for reactions and produces energy from food. For example, the electron transport chain can only begin with the delivery of electrons from NADH. A lack of NADH causes energy deficits in cells, resulting in widespread fatigue. Additionally, this coenzyme is recognized as the most powerful biological antioxidant for protecting cells against harmful or damaging substances.



Thanks and Regards

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