

WHAT ARE ENZYMES ?

Enzymes are biocatalysts which are produced by all living ~~cells~~ organisms to catalyze various bio-chemical reactions essential for their survival and reproduction. Enzymes are basically proteins which increase the rate of a Bio-chemical reaction (without being changed itself) by several thousand times, eg. Urease can give a rate enhancement of 10^{14} times and work under mild reaction conditions (temp. below 100°C , atmospheric pressure and neutral pH) with great specificity, i.e. less or no byproducts are generated.

* Production of Enzymes:-

Enzymes can be obtained from plants, animals and microbial sources. However, microbial enzymes are preferred over other sources due to ease of production and great range of diversity.

The microbial enzymes (wild types and recombinants) are produced either by Submerged Fermentation (SmF) or by Solid State Fermentation (SSF). SSF is used for the production of certain food enzymes, eg. amylase (from Aspergillus oryzae). On the other hand Submerged Fermentation is a common process.

* History :— Enzymes have been in use from ancient times and presently are used in many

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industries viz. Food and feed, textile, beverages, pharmaceutical, polymersynthesis, agrochemicals, waste management and many others.

The history of enzymes began with the work of Dubrunfaut (1830) who prepared malt extract from germinating barley seeds. In modern era the study of enzymes began with Buchner (1897) who discovered that juice extracted from yeast cell brought fermentation of sugar. However, the real breakthrough in the study of enzymes was accomplished by Sumner (1926). He was the first person to isolate and crystallise the enzyme 'Urease'. He found urease enzyme to be protein and, therefore, he concluded that all enzymes are protein. The term "enzyme" was later proposed by F.W. Kuhne (1978).

* Nomenclature of Enzymes: —

Enzymes are generally named according to the substrate they attack or the type of reaction they catalyze.

- The usual practice is to add the suffix - 'ase' to the substrate attacked. eg- Sucrase, Maltase, Lactase etc.
- Some enzymes are named after the nature of reaction e.g. Oxidases, Dehydrogenases etc.
- On the certain group of compounds they attack- Example - Lipases, Proteinases, Carbohydrases, etc.
- There are some enzymes which are named in an arbitrary way such as- Pepsin, Trypsin etc.

* CLASSIFICATION OF ENZYMES

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Earlier (in older classification) enzymes were classified on the basis of reaction they catalyze. Many earlier authors have classified enzymes into two groups —

- i) Hydrolysing enzymes, and
- ii) Desmoly sing enzymes.

Others classify into 3 groups —

- i) Hydrolysing enzymes,
- ii) Transferring enzymes, and
- iii) The Desmoly sing enzymes.

In the first classification transferring enzymes were included in hydrolysing enzymes.

1) Hydrolysing Enzymes —

They catalyze reactions in which complex organic compounds are broken into simpler forms with the addition of water. They are subdivided into four groups —

- a) Carbohydrases — Eg. Sucrase, maltase, lactase etc.
- b) Esterases — Eg. Lipase, Phosphatase etc.
- c) Proteolytic Enzymes — Eg. Pepsin, Peptidases etc.
- d) Amidases — Eg. Urease, Asparaginase etc.

Desmoly Sing Enzymes : —

Most of the desmoly sing enzymes are the enzymes of respiration and those concerned in the synthesis of amino acids.

Eg. Kinases, Desmolases, Dehydrogenases, oxidases, carboxylases, Peroxidases, Transaminases, Flavoprotein etc.

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IUBMB SYSTEM OF CLASSIFICATION

Recently the International Union of Biochemistry and Molecular Biology has given more practical classification of enzymes based on reaction types and reaction mechanisms.

The major features of this classification are —

- i) Reactions/ enzymes are divided into 6 major classes with 4-13 subclasses.
- ii) The enzyme name has 2 parts — The 1st is the name of substrate while 2nd is the type of reaction catalysed.
- iii) Each enzyme has a systematic code number (E.C.)
 - The 1st digit denotes the class
 - the 2nd the sub-class
 - the 3rd the sub-sub-class, and
 - the 4th is for particular enzyme named
- iv) Additional information — If the nature of the reaction is to be further clarified, additional information may be given in parenthesis.

* MAJOR CLASSES OF ENZYMES : -

1. Oxidoreductases — Includes the enzymes formerly known either as 'dehydrogenases' or as 'oxidases'.
2. Transferases — Catalyse the transfer of one-carbon groups, aldehyde or ketone residues, and acyl, alkyl, glycosyl, phosphorus or sulphur groups.
3. Hydrolases — Catalyse hydrolysis of ester, ether, peptide, glycosyl, lipid anhydride, P-N bonds etc.
4. Lyases — Catalyse removal of groups from substrate other than hydrolysis, leaving double bonds.
5. Isomerases — Catalyse the interconversion of optical, geometric or positional isomers.
6. Ligases — Catalyse the linking together of two compounds coupled to the breaking of a pyrophosphate bond in ATP or a similar compound.