Enzyme:

An enzyme is a biocatalyst that increases the rate of chemical reaction without itself being changed in the overall process.

Virtually all cellular reactions or processes are mediated by enzymes. Enzymes have several properties that make them unique-

1. Most of the enzymes are proteins. With the exception of a small group of catalytic RNA molecules, all enzymes are proteins. Their catalytic activities depend on integrity of their native protein conformation. If an enzyme is denature or dissociated into its subunits catalytic activity is usually lost.
2. Enzymes are highly specific. They are highly specialized proteins and have a high degree of specificity for their substrates.
3. Enzymes exhibit enormous catalytic power. It increases the rate of a reaction by lowering the activation energy. It changes only the rate at which equilibrium is achieved; it has no effect on the position of the equilibrium.

Enzymes can be divided into two general classes-

1. **Simple enzyme**- which consist entirely of amino acids.
2. **Conjugated enzymes**- contain a non-protein group called a cofactor, which is required for biological activity.

   Removal of cofactor from a conjugated enzyme leaves only protein component, called an **apoenzyme**, which generally is biologically inactive. The complete biologically active conjugated enzyme (***simple enzyme + cofactor***) is called a **holoenzyme.** A cofactor can be linked to the protein of the enzyme either covalently or non-covalently. Some cofactors are simple metal ions and other cofactors are complex organic groups which also called coenzymes. Cofactors which are tightly associated with the protein covalently or non-covalently are called **prosthetic group**.

   Naming and Classification:

   The Enzyme Commission (EC) has developed a rule for naming enzymes. According to this rule, each enzyme is classified and named according to the type of chemical reaction it catalyzes. The Enzyme Commission (EC) has given each enzyme a number with four parts EC 2.7.1.2 (Hexokinase).

The first 3 numbers define major class, subclass, and sub-subclass respectively. The last number is serial number in the sub-subclass, indicating the order in which each enzyme is added to the list.

Most of enzymes name end with "**ase**".

Classification:

EC1. Oxidoreductase:

These enzymes are catalyzing oxidation/reduction reactions.

$A_{red} + B_{ox} \longrightarrow A_{ox} + B_{red}$

Examples:

Oxidases	Use oxygen as an electron acceptor but do not incorporate it into the substrate.
Dehydrogenases	Use molecules other than oxygen as an electron acceptor.
Oxygenases	Directly incorporate oxygen into the substrate.
Peroxidases	Use H_2O_2 as an electro acceptor.

EC2. Transferase:

Transferases catalyze reactions that involve the transfer of groups from one molecule to another. Examples of such groups include amino, carboxyl, methyl and phosphoryl. Common trivial names for the transferases often include the prefix *trans*.

$A – B + C \longrightarrow A + B – C$

Examples:

Transcarboxylases	Transfers a carboxylate group to a substrate.
Transaminases	Transfer amino group from amino acids to keto acids.
Kinases	Transfer phosphate from ATP to a substrate.
Phosphorylases	Transfer inorganic phosphate to a substrate.

EC3. Hydrolase:

$A – B + H_2O \longrightarrow A – H + B – OH$

Examples:

Phosphodiesterases	Cleave phosphodiester bonds.

EC4. Lyase:

Lyases are enzyme that catalyzes the breaking of C-C, C-O, C-N C-S and other bonds by means other than hydrolysis or oxidation. These bonds are cleaved by the process

of elimination and the result in the formation of a double bond or a new ring, or conversely adding groups to double bonds.

A = B + HX ⟶ A – X + B - H

EC5. Isomerase:

These enzymes catalyze geometric or structural changes within one molecule and are named according to the type of isomerism as epimerase, cycloisomerase, mutase etc

AB ⟶ BA

EC6. Ligase:

Ligases catalyze the formation of C-C, C-S, C-O and C-N bonds. This energy for these reactions is always supplied by ATP hydrolysis. Other common names for ligases include ***synthetases***, because they are used to synthesize new molecules

A + B + ATP ⟶ A – B + ADP

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