كيمياء حياتية / النظري
جامعة العميد/ كلية طب الاسنان
مدرس المادة : **م.د عامر موسى علي**

Enzymes are biocatalysts – the catalysts of life system. A **catalyst** is defined as a **substance that increases the velocity** or rate of a chemical reaction without itself undergoing any change in the overall process. **Enzymes** may be defined as **biocatalysts synthesized by living cells. They are protein in nature (exception – RNA acting as ribozyme),colloidal and thermolabile in character, and specific in their action.**

In the laboratory, hydrolysis of proteins by a strong acid at 100°C takes at least a couple of days. The same protein is fully digested by the enzymes in gastrointestinal tract at body temperature (37°C) within a couple of hours. This remarkable difference in the chemical reactions taking place in the living system is exclusively due to enzymes. The very existence of life is unimaginable without the presence of enzymes.

NOMENCLATURE AND CLASSIFICATION

In the early days, the enzymes were given names by their discoverers in an arbitrary manner. For example, the names pepsin, trypsin and chymotrypsin convey no information about the function of the enzyme or the nature of the substrate on which they act. Sometimes, the suffix-ase was added to the substrate for naming the enzymes e.g. lipase acts on lipids; nuclease on nucleic acids; lactase on lactose. These are known as trivial names of the enzymes which, however, fail to give complete information of enzyme reaction (type of reaction, cofactor requirement etc.) Enzymes are sometimes considered under two broad categories :

(a) Intracellular enzymes –They are functional within cells where they are synthesized.

(b) Extracellular enzymes – These enzymes are active outside the cell; all the digestive enzymes belong to this group.

Classification of enzymes

1. **Oxidoreductases :** Enzymes involved in oxidation-reduction reactions.

2. **Transferases** : Enzymes that catalyse the transfer of functional groups.

3. **Hydrolases :** Enzymes that bring about hydrolysis of various compounds.

4. **Lyases :** Enzymes specialised in the addition or removal of water, ammonia, CO2 etc.

5. **Isomerases :** Enzymes involved in all the isomerization reactions.

6. **Ligases :** Enzymes catalysing the synthetic reactions (Greek : ligate—to bind) where two molecules are joined together and ATP is used.

TABLE 66.1 Classification of enzymes

*Enzyme class with examples**	*Reaction catalysed*
1. Oxidoreductases	
Alcohol dehydrogenase (alcohol : NAD^+ oxidoreductase E. C. 1.1.1.1.), cytochrome oxidase, L- and D-amino acid oxidases	Oxidation ⟶ Reduction $AH_2 + B \longrightarrow A + BH_2$
2. Transferases	
Hexokinase (ATP : D-hexose 6-phosphotransferase, E. C. 2.7.1.1.), transaminases, transmethylases, phosphorylase	Group transfer $A - X + B \longrightarrow A + B - X$
3. Hydrolases	
Lipase (triacylglycerol acyl hydrolase E. C. 3.1.1.3), choline esterase, acid and alkaline phosphatases, pepsin, urease	Hydrolysis $A - B + H_2O \longrightarrow AH + BOH$
4. Lyases	
Aldolase (ketose 1-phosphate aldehyde lyase, E. C. 4.1.2.7), fumarase, histidase	Addition ⟶ Elimination $A - B + X - Y \longrightarrow AX - BY$
5. Isomerases	
Triose phosphate isomerase (D-glyceraldehyde 3-phosphate ketoisomerase, E.C. 5.3.1.1), retinol isomerase, phosphohexose isomerase	Interconversion of isomers $A \longrightarrow A'$
6. Ligases	
Glutamine synthetase (L-glutamate ammonia ligase, E. C. 6.3.1.2), acetyl CoA carboxylase, succinate thiokinase	Condensation (usually dependent on ATP) $A + B \xrightarrow[ATP \quad ADP + Pi]{} A - B$