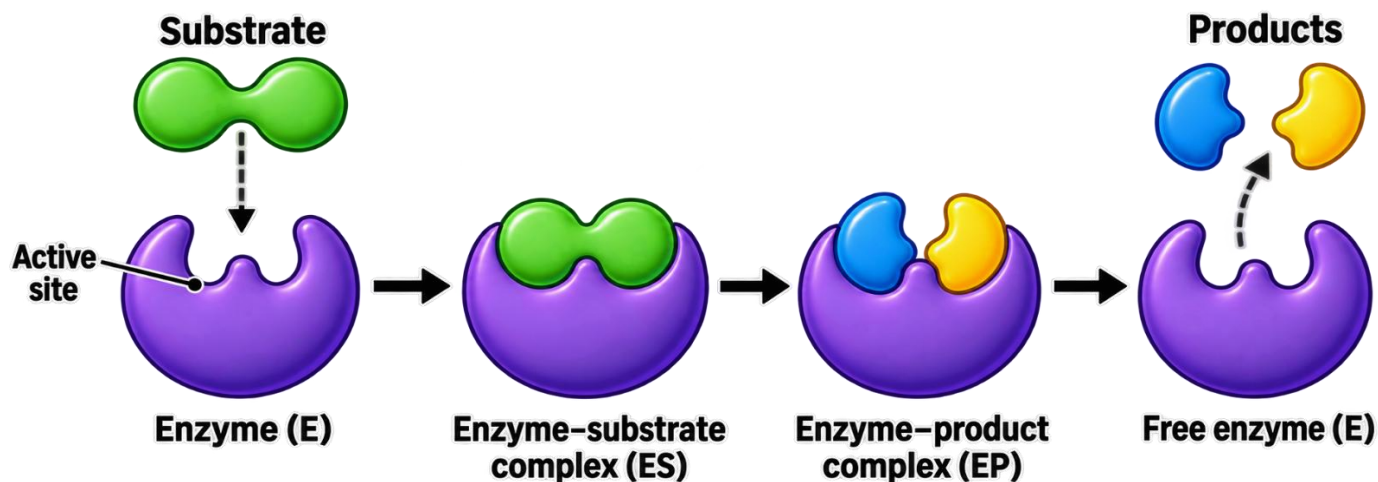


Enzyme Technology

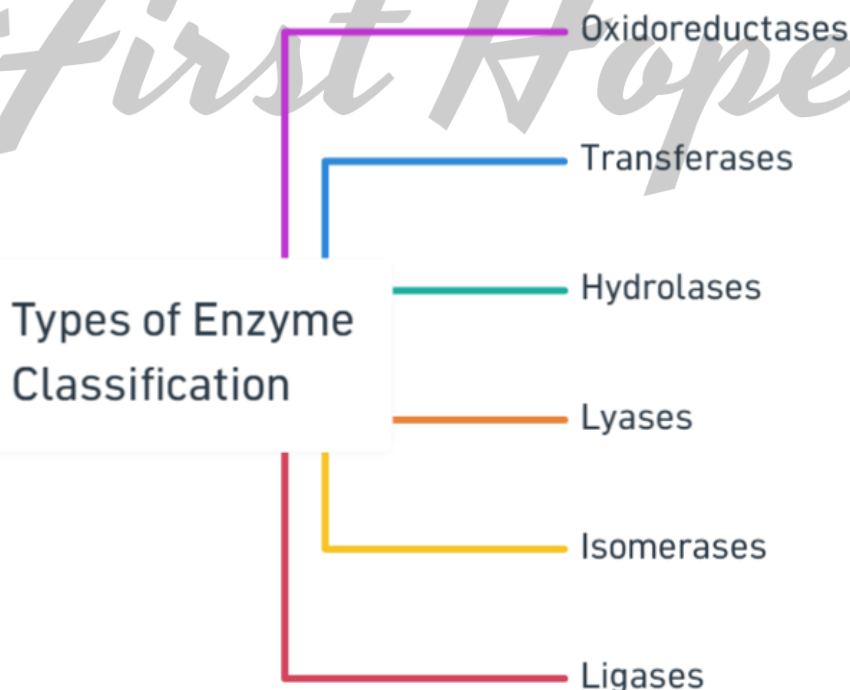
Classification of Enzymes

- **Enzymes** are biological catalysts that speed up chemical reactions in living organisms without being used up during the reaction.



- They are classified based on the type of reaction they catalyze.

Types of Enzyme Classification



1. Oxidoreductases

- Oxidoreductases are enzymes that catalyze oxidation and reduction reactions.
- These reactions involve the transfer of electrons or hydrogen from one molecule to another.
- One substance gets oxidized, while another gets reduced.
- These enzymes are very important in energy production and metabolism.

Examples:

- Dehydrogenase, Oxidase, Catalase

Function:

- They help in cellular respiration.
- They participate in detoxification reactions.
- They are involved in biological oxidation processes.

2. Transferases

- Transferases are enzymes that transfer a functional group from one molecule to another.
- The transferred groups may include amino groups, phosphate groups, methyl groups, or acyl groups.

Examples:

- Aminotransferase, Kinase, Transaminase

Function:

- They are involved in metabolism.
- They help in synthesis of important biomolecules.
- They play a role in energy transfer reactions.

3. Hydrolases

- Hydrolases are enzymes that break chemical bonds by adding water.
- This process is called hydrolysis.

Examples:

- Amylase, Lipase, Protease, Trypsin

Function:

- They help in digestion.
- They break down carbohydrates, fats, and proteins.
- They are used in pharmaceutical and industrial processes.

4. Lyases

- Lyases are enzymes that remove or add groups to molecules without using water or oxidation.
- They usually form or break double bonds.

Examples:

- Decarboxylase, Aldolase, Fumarase

Function:

- They participate in metabolic pathways.
- They help in synthesis and degradation reactions.

5. Isomerases

- Isomerases are enzymes that convert one isomer into another isomer.
- They rearrange atoms within the same molecule.

Examples:

- Glucose isomerase, Racemase, Mutase

Function:

- They help in carbohydrate metabolism.
- They convert molecules into useful forms.

6. Ligases

- Ligases are enzymes that join two molecules together.
- These reactions usually require energy from ATP.

Examples:

- DNA ligase, Synthetase

Function:

- They are important in DNA replication.
- They help in biosynthesis reactions.

General Properties of Enzymes

Enzymes have special features that make them effective biological catalysts.

1. Enzymes are Biological Catalysts

- They speed up chemical reactions.
- They lower activation energy.
- They remain unchanged after the reaction.

2. Enzymes are Mostly Proteins

- Most enzymes are proteins.
- **Some need cofactors (helper molecules) such as:**
 - Metal ions
 - Coenzymes
 - Prosthetic groups

3. Enzymes are Highly Specific

- Each enzyme acts on a particular substrate.
- This is due to the shape of its active site.

Types of Specificity:

- Absolute specificity
- Group specificity
- Stereospecificity

4. Enzymes Work in Small Amounts

- Even a small amount of enzyme can act on a large amount of substrate.
- They are not used up in reactions.

5. Enzymes Have Optimum Temperature

- Every enzyme works best at a certain temperature (for humans, about **37°C**).

Temperature Effects:

- Low temperature slows activity.
- High temperature can denature enzymes.

6. Enzymes Have Optimum pH

- Each enzyme works best at a specific pH.

Examples:

- Pepsin → acidic pH
- Trypsin → alkaline pH
- Extreme pH can reduce activity or denature enzymes.

7. Activity Depends on Substrate Concentration

- More substrate increases reaction rate up to a limit.
- After saturation, the rate stays constant.

8. Enzymes Can Be Inhibited

- Some substances called **inhibitors** reduce enzyme activity.

Types:

- Competitive inhibition
- Non-competitive inhibition
- Irreversible inhibition

9. Some Enzymes Need Cofactors

- Some enzymes require helper molecules to become active.
- The active enzyme with its cofactor is called a **holoenzyme**.

Dynamics of Enzymatic Activity

- Dynamics of enzymatic activity means studying how enzymes function and how different factors affect the speed of enzyme reactions.

Enzyme-Substrate Interaction

Formation of Enzyme-Substrate Complex

- The substrate binds to the active site of the enzyme.
- This forms an enzyme-substrate complex.
- The substrate is converted into product and released.

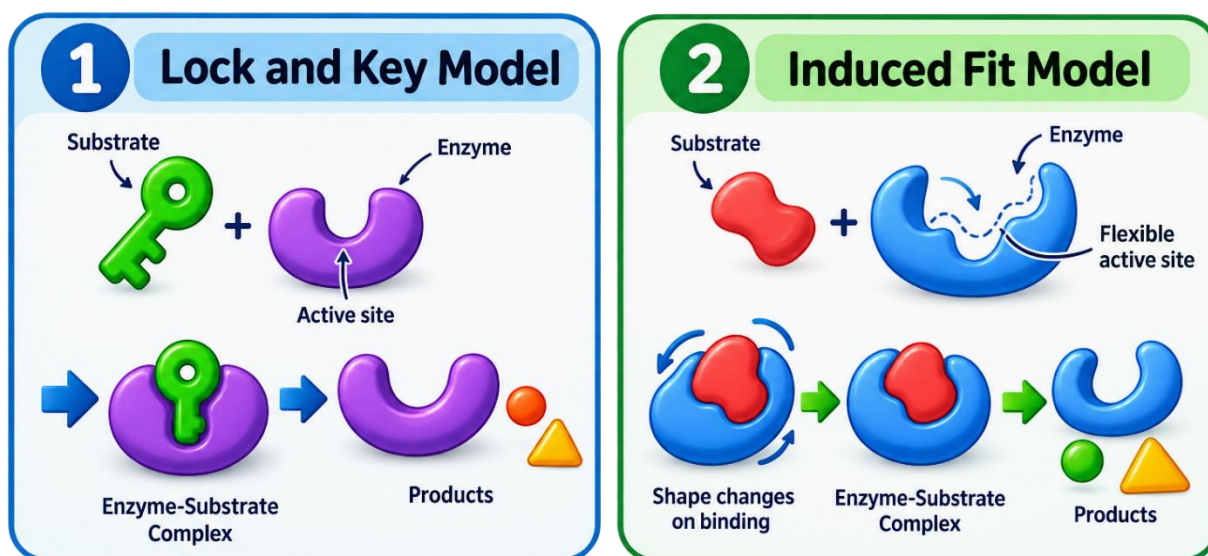
Reaction:



➤ Where:

- E means enzyme
- S means substrate
- ES means enzyme-substrate complex
- P means product

Models of Enzyme Action



1. Lock and Key Model

- The enzyme active site has a fixed shape.
- Only the correct substrate fits into it.

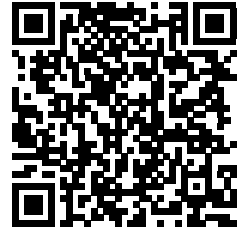


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