Enzymes

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Outline

- Introduction to Enzymes
- Important Features of Enzymes
- What is activation energy
- Role of enzymes
- Factors affecting enzyme reaction rate
- Enzyme Inhibition

Objectives

❖By the end of this lecture, students should be able to:

1. Define enzymes and explain their biological importance.

2. Describe activation energy and how enzymes lower it.

3. Differentiate between major types of enzyme inhibition.

4. Apply enzyme concepts to medical and laboratory contexts.

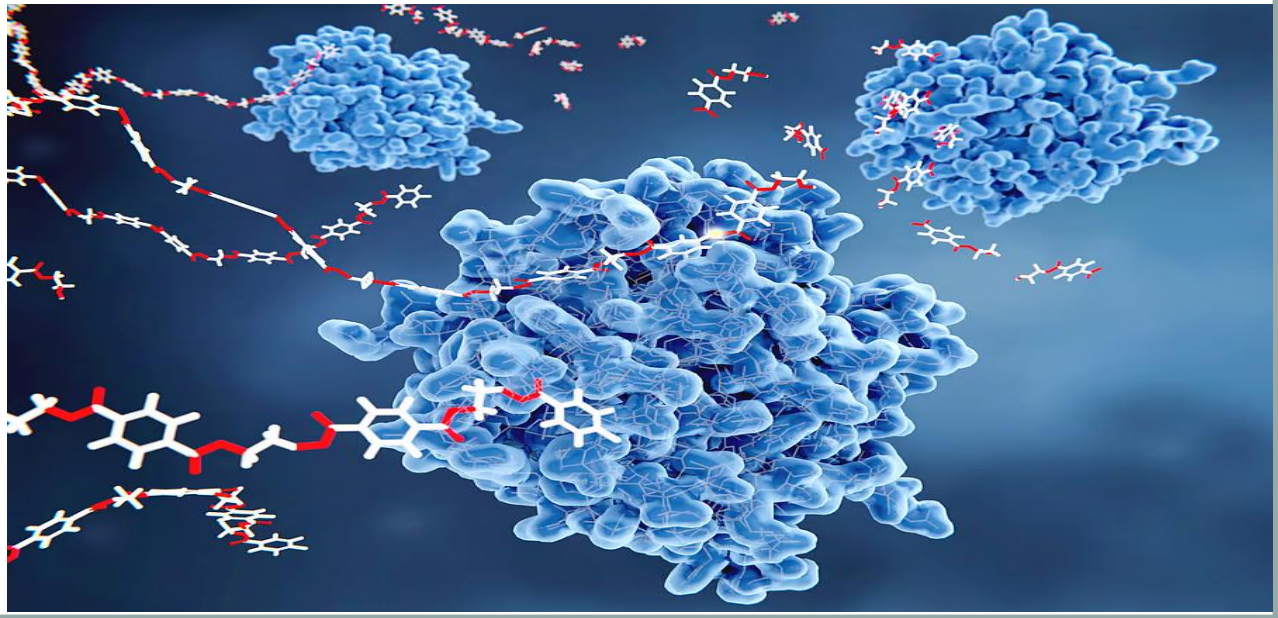
❑ Introduction to Enzymes?

➢Enzymes are **biological catalysts**, usually **proteins**, that **speed up chemical reactions** in living cells without **being consumed**.

➢Almost all **metabolic reactions** in the body depend on enzymes.

➢Examples:

- Amylase
- Catalase
- DNA polymerase



❑ Important Features of Enzymes:

1) Biological catalysts.
2) High specificity.
3) Reusable.
4) Lower activation energy.
5) Efficient and fast
6) Protein nature
7) Sensitive to temperature and pH
8) Enzyme substrate complex
9) Regulated activity

❖ What is activation energy?

- Activation energy is the **minimum energy required to start a chemical reaction**.

- Many **biochemical reactions have high activation energy** and would occur very slowly at **normal body temperature**.

- **Enzymes lower activation energy**, allowing reactions to happen quickly and efficiently inside cells.

❖ Role of enzymes:

1. Speed up biochemical reactions.
2. Enable metabolism.
3. Control cellular processes.
4. Maintain homeostasis
5. Support growth, repair, and immunity
6. Ensure specificity and efficiency

❖ Enzyme Kinetics :

➢Is the study of how **fast enzyme-catalyzed reactions** occur and the factors that influence the **reaction rate**.

➢**What is reaction rate:** The rate of an enzyme reaction is the amount of product formed per unit time.

- **Basic steps of enzyme action:** $E+S \rightleftharpoons ES \rightarrow E+P$

- **Where:** E = enzyme, S = substrate, ES = enzyme–substrate complex, P = product

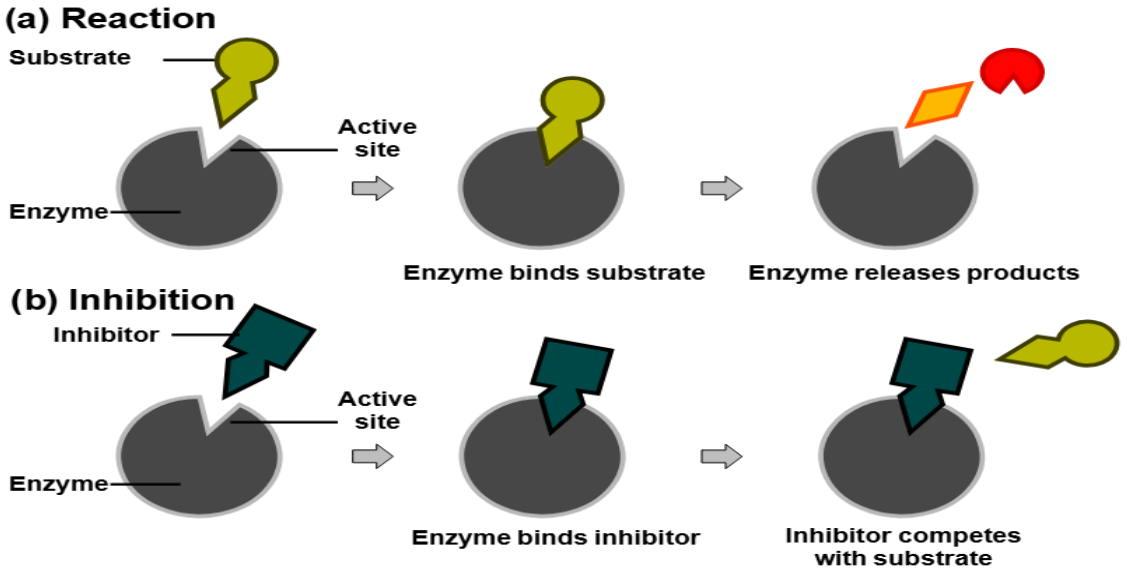
❖ Factors affecting enzyme reaction rate:

1. Substrate concentration
2. Enzyme concentration
3. Temperature
4. pH
5. Presence of inhibitors

❖ Enzyme Inhibition:

- Is the process by which a substance called an **inhibitor** **reduces** or **stops** the activity of an enzyme.

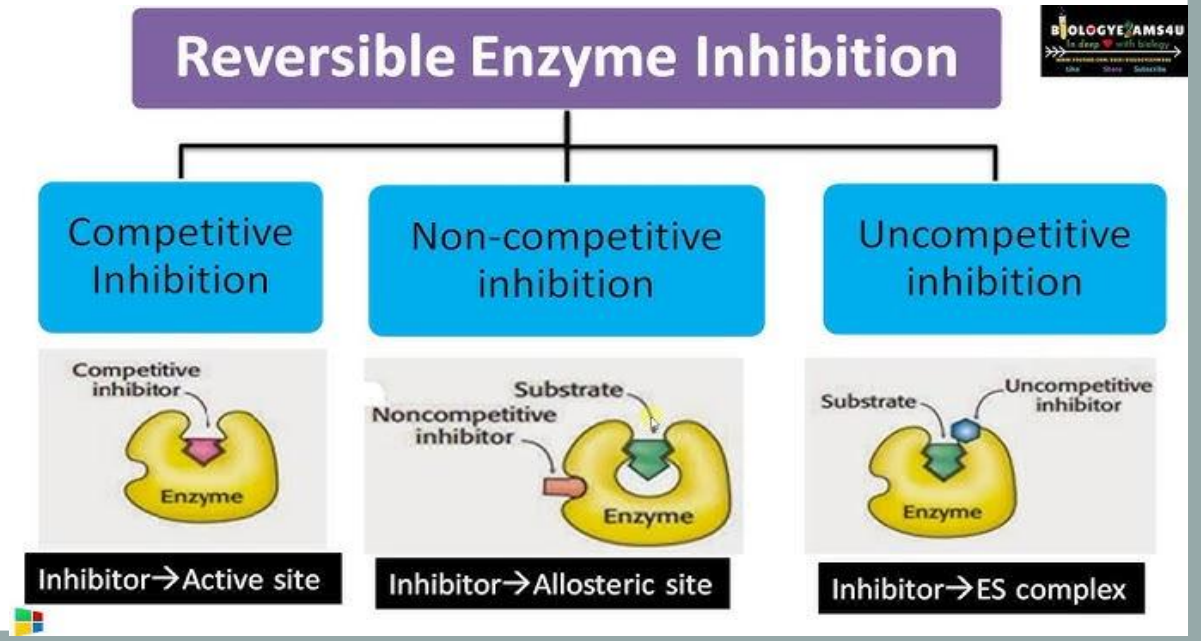
- Inhibitors work by interfering with the enzyme's ability to bind its substrate.



➢Types of Enzyme Inhibition:

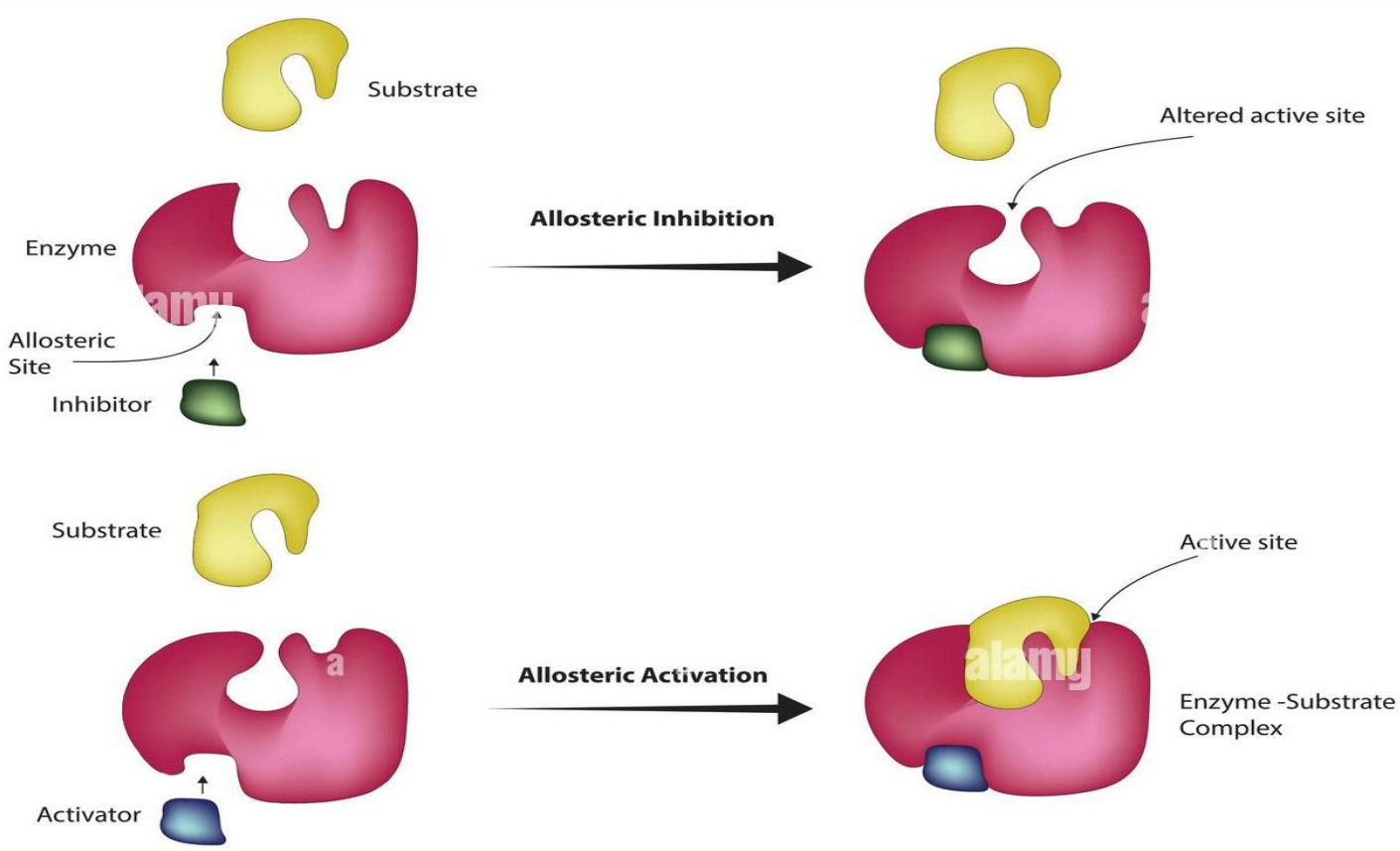
- Enzyme inhibition is broadly divided into **reversible** and **irreversible** inhibition.

- **Reversible Inhibition**: The inhibitor binds temporarily to the enzyme and can be removed.



➢Irreversible Inhibition:

- Inhibitor permanently binds to the enzyme, often by covalent bonds.



❖ Importance of Enzyme Inhibition

- Enzyme inhibition is biologically and medically important because it regulates:

I. Controls metabolic pathways.

II. Basis of many medications and antibiotics

III. Helps regulate **cellular homeostasis**

IV. Used in clinical diagnostics and cancer therapy

References

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Thanks