Al-Mustaqbal University
Anesthesia Techniques Department

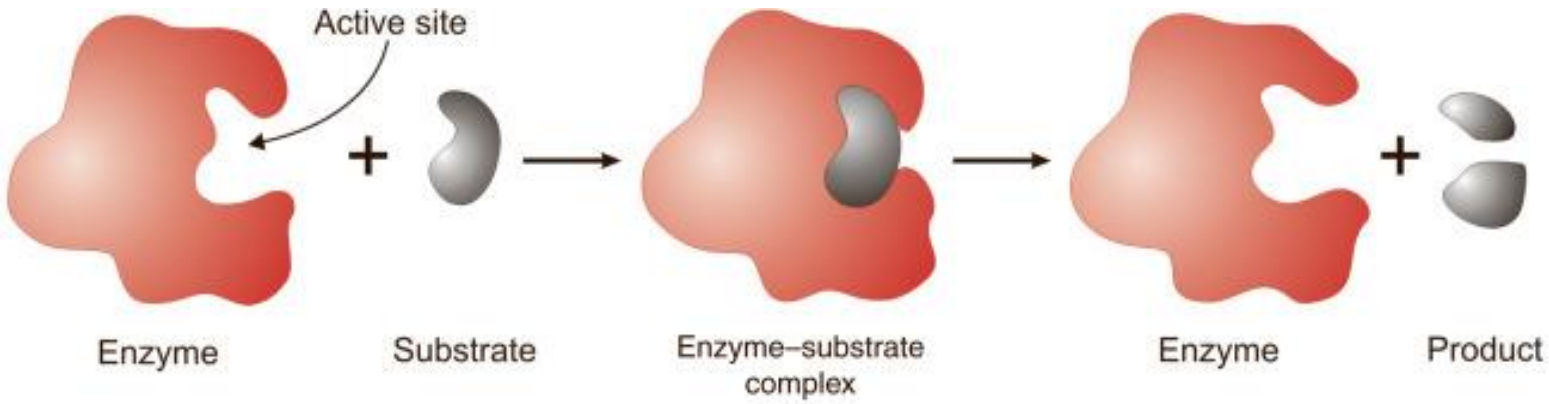
Lec1 enzymes -II

ENZYMES

- **Definition:** These are specific protein catalysts that accelerate the rate of chemical reactions.

They are **tertiary protein**(globular) structures.

- They are specific in action, i.e. each enzyme can catalyze only one type of reaction.
- The enzyme binds with its specific substrate and forms an **enzyme-substrate complex**. At the end of the reaction the substrate is converted into the product and the enzyme remains unchanged.



- **Cellular distribution of enzymes:**

A. Intracellular enzymes: Produced and act inside the cells e.g. metabolic enzymes.

B. Extracellular enzymes: Produced inside the cells and act outside the cells e.g. digestive enzymes.

TERMINOLOGY

- **PROENZYME (ZYMOGEN):** A number of proteolytic enzymes found in the blood or in the digestive tract are present in an inactive (precursor) form, called zymogen or proenzymes.
- • For example, chymotrypsin is secreted by the pancreas as chymotrypsinogen. It is activated in the digestive tract by the proteolytic enzyme trypsin.
- • Some enzymes require an additional nonprotein component for its optimum activity. This additional component is called **cofactor.**

- • Enzymes without its cofactor is referred to as an apoenzyme

Apoenzyme + cofactor = holoenzyme.

Enzyme Classification

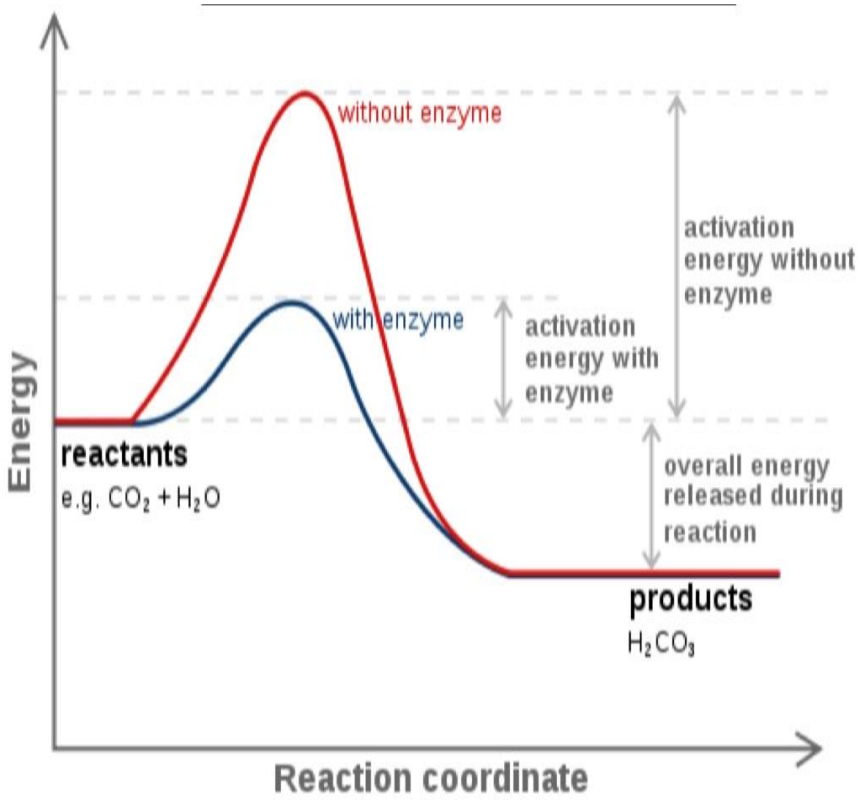
1. **Oxidoreductases** - catalyzing oxidation reduction reactions.
2. **Transferases** - catalyzing transfer of functional groups.
3. **Hydrolases** - catalyzing hydrolysis reactions.
4. **Lyases** - catalyzing group elimination reactions to form double bonds.
5. **Isomerases** - catalyzing isomerizations (bond rearrangements).
6. **Ligases** - catalyzing bond formation reactions couples with ATP hydrolysis.

MECHANISM OF ENZYME ACTION

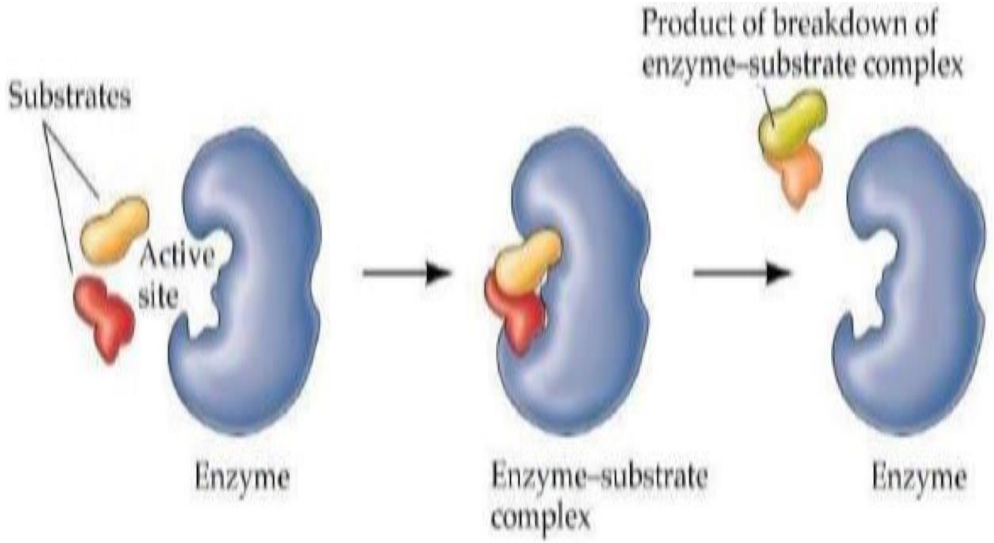
• A. Energy of activation:

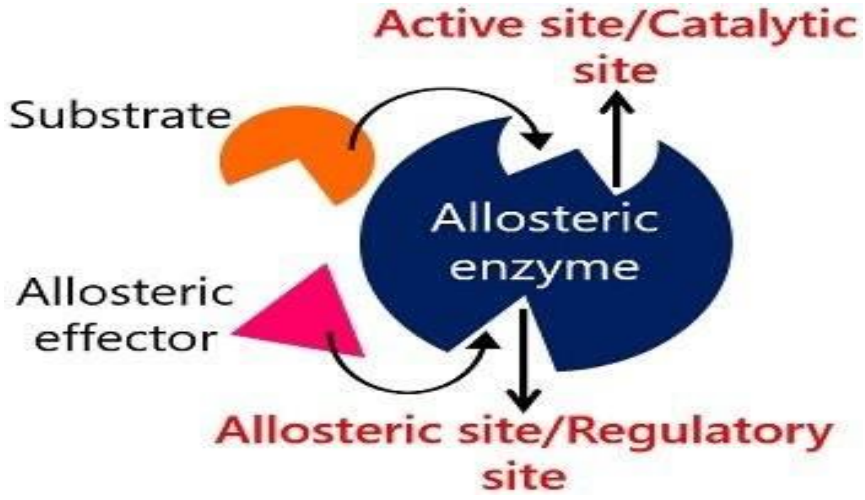
the substrates do not become products directly, but must be absorb energy to reach an activated or transition state. This energy is called activation energy.

- - At transition state, there is a high probability that a chemical bond will be made or broken to form the product.
- **- The effect of enzymes: is to decrease the energy of activation**

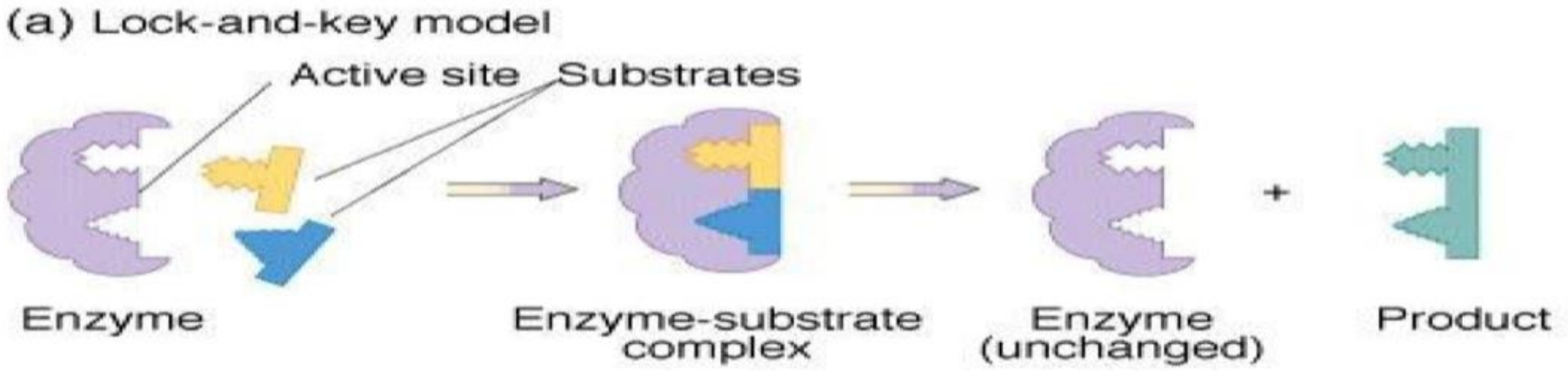


- **B. Active site:**
- 1) During the enzyme action, there is a temporary combination between the enzyme and its substrate at **active sites** of enzyme forming enzyme-substrate complex.
- 2) This is followed by dissociation of this complex into enzyme again and products.
- While **allosteric site** is another site on enzyme to which certain molecules attached that can increase or decrease enzyme activities

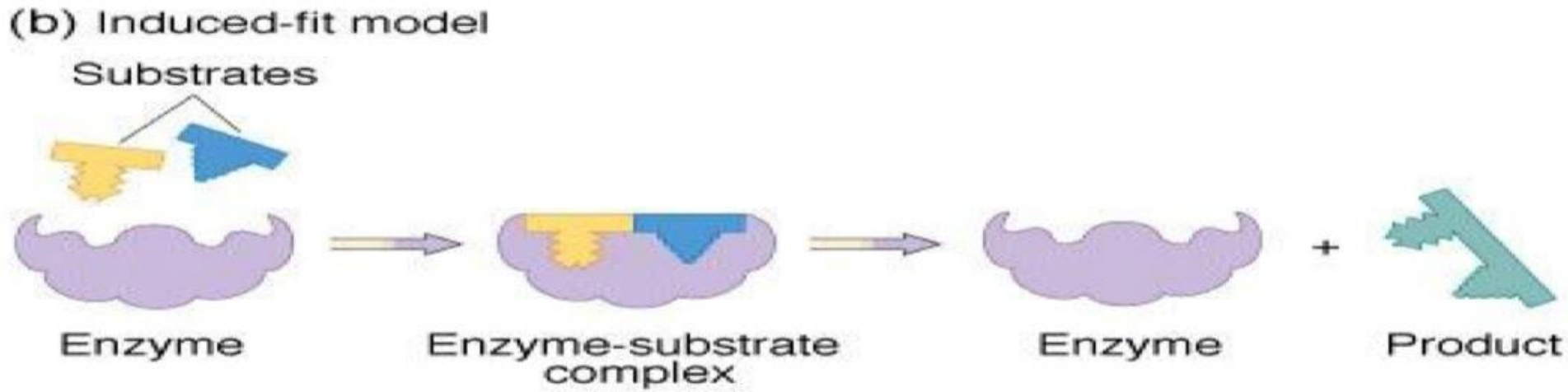




- **C. Theories of enzyme action:**
- Two theories have been proposed to explain the specificity of enzyme action:
- **a) The lock and key theory:** The active site of the enzyme is complementary in conformation to the substrate so that enzyme and substrate “recognize” one another. So enzyme **shape unchanged**



- **b) The induced fit theory:** The enzyme **changes shape** upon binding the substrate, so that the conformation of substrate and enzyme protein are only complementary after the binding reaction.



Factors Affecting Enzyme activity (rate of the reaction)

- **1-Enzyme Concentration**
- **2- Substrate concentration**
- **3-Effect of product concentration**
- **4-Effect of Temperature**
- **5-Effect of pH**
- **6- Effect of Activators and inhibitors**

THANK YOU