



SNS COLLEGE OF ALLIED HEALTH SCIENCES

SNS Kalvi Nagar, Coimbatore - 35

Affiliated to Dr MGR Medical University, Chennai



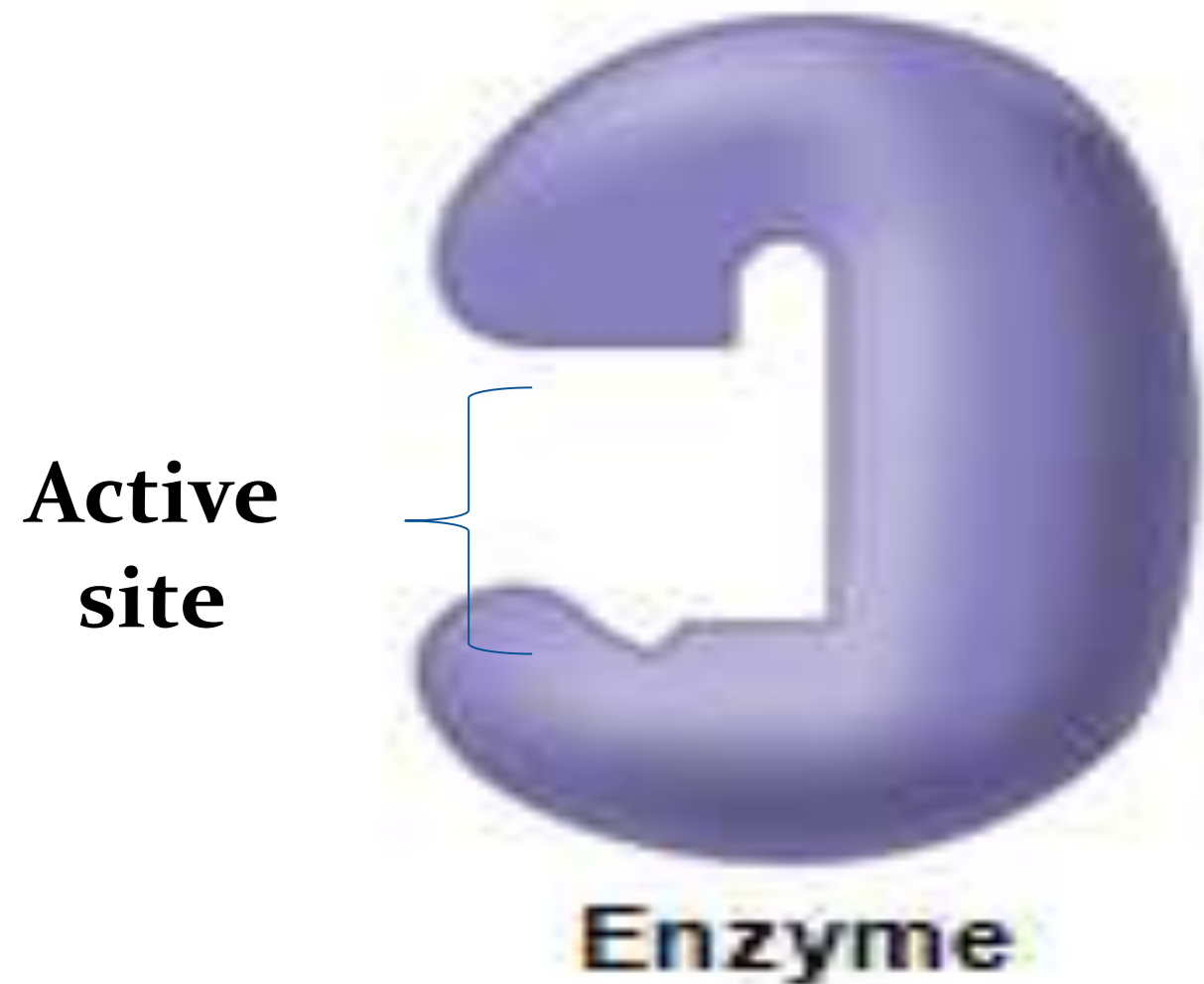
DEPARTMENT OF CARDIAC TECHNOLOGY

COURSE NAME : BIOCHEMISTRY

TOPIC : ENZYMES



ENZYMES



- It is a globular protein which functions as a biological catalyst, speeding up reaction rate by lowering activation energy without being affected by the reaction it catalyse.
- Enzymes are highly specific for the type of the reaction they catalyze and for their substrate.



Enzymes



- Enzymes are energy barriers separating the reactants (substrates) and the products.
- Virtually all reactions in the body are mediated by enzymes, which are protein catalysts that increase the rate of reactions without being changed in the overall process.

Definitions:

- **A. Enzymes:** These are specific protein catalysts that:
 - 1. Accelerate the rate of chemical reactions.
 - 2. Enzyme structure is not changed by entering the reactions,
 - 3. Enzyme does not affect the equilibrium constant (i.e. end products) of the reactions.
- **B. Substrate:** Is the substance upon which the enzyme acts.





Enzymes are protein in nature

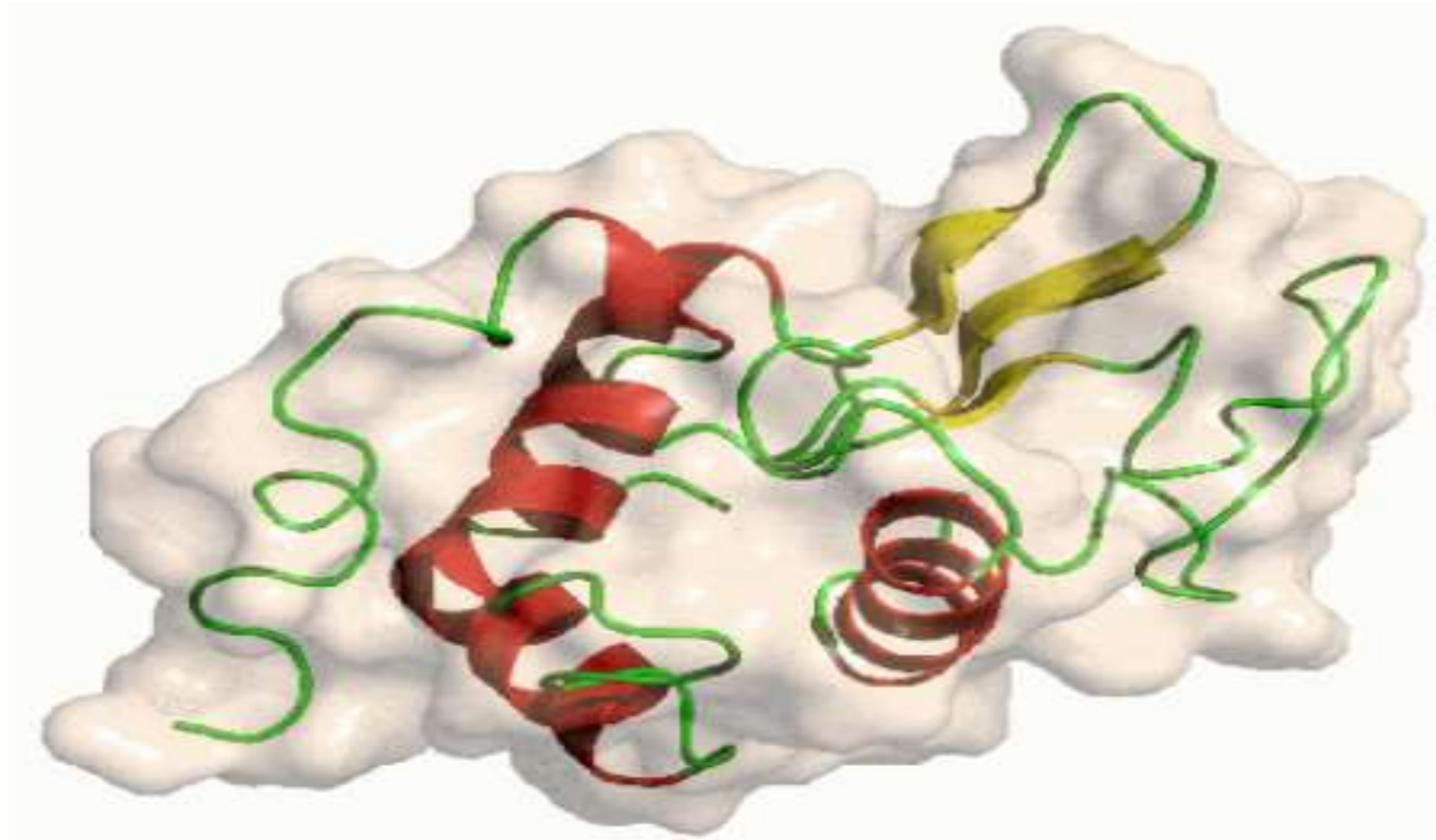


- Globular protein.
- Ribozymes are RNA molecule with enzymatic activity.
- Catalytic behaviour of any enzyme depends upon its primary, secondary, tertiary or quaternary structure.
- Enzymes of digestive tract and those found in blood are present in inactive form called **zymogen or proenzymes.**

- Enzymes are biological catalysts that increase the reaction rate of biochemical reactions.

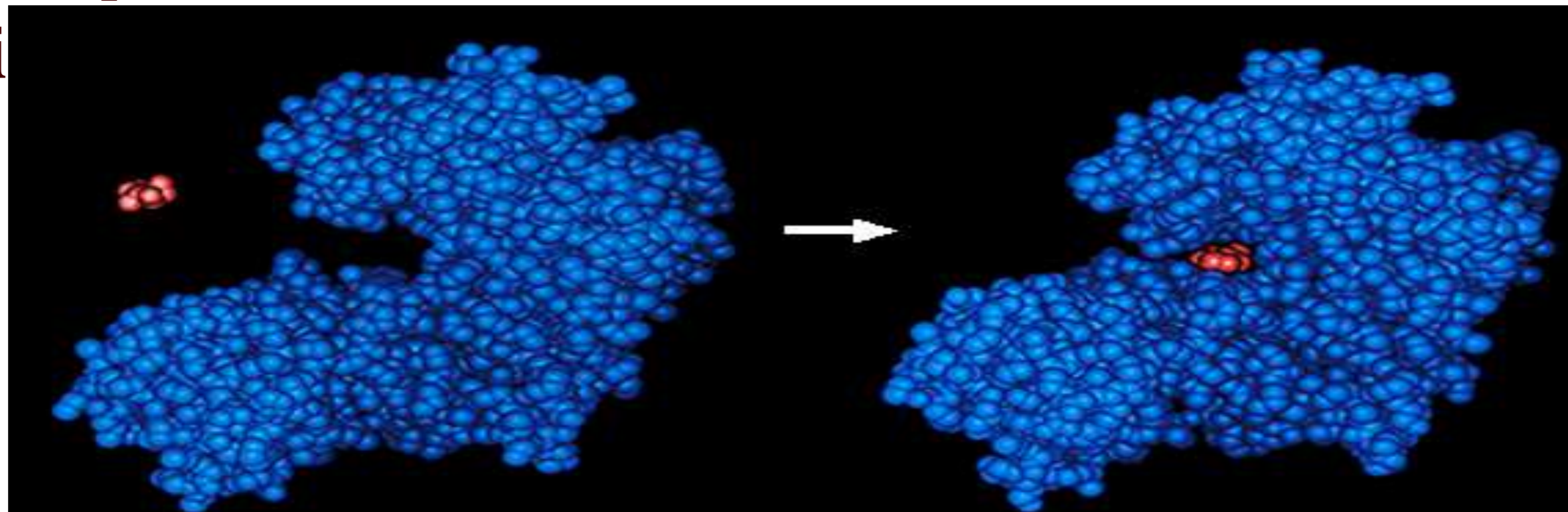
Characteristics of enzymes

- A. Made of proteins (or RNA).
- B. They are very specific and only work with a certain set of reactants or substrates that fit on their active site.



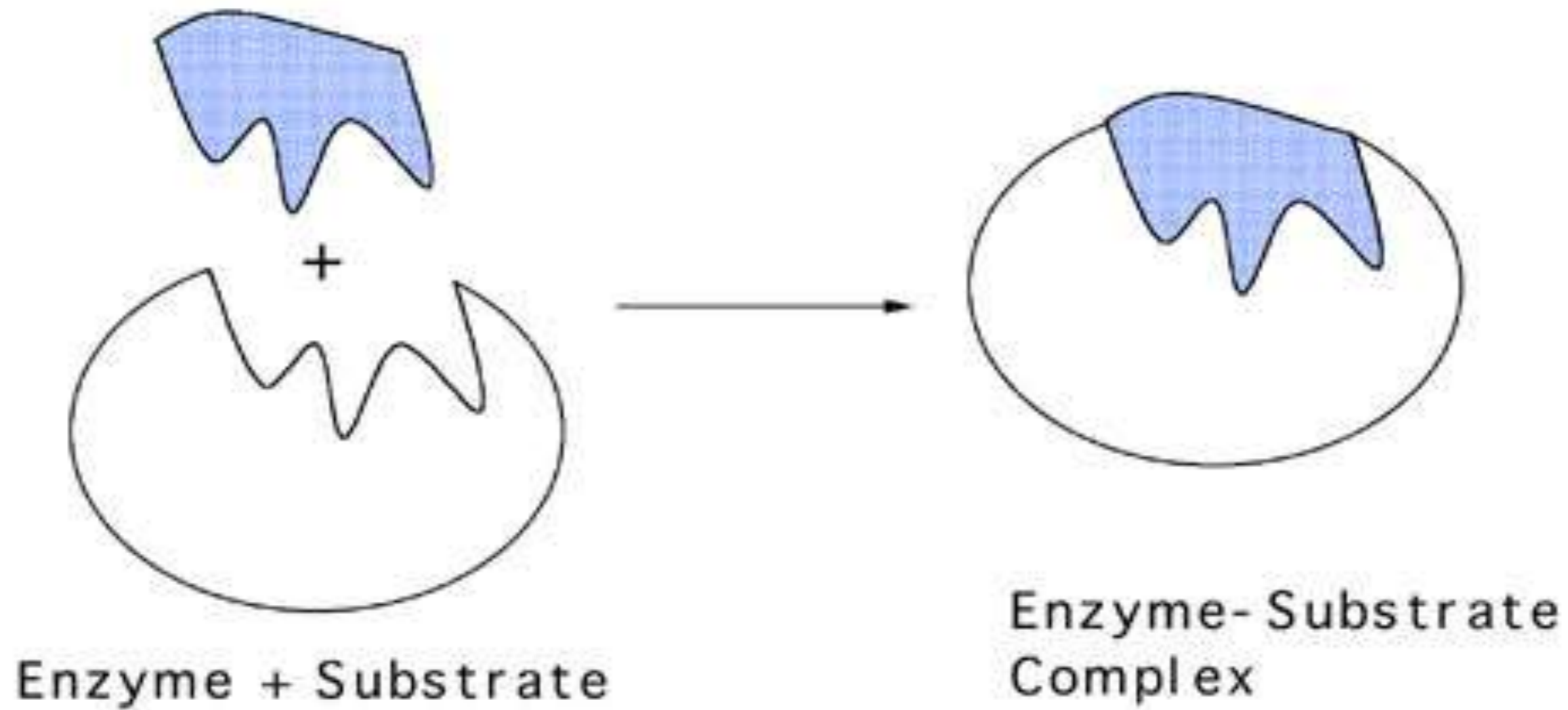
The enzyme shown is lysozyme

- C. Enzymes can be used over and over again.
- D. When an enzyme binds with the substrate, the substrate interacts with the enzyme causing it to change shape. This change in shape facilitates the chemical reaction to occur. This is called the i





When an enzyme is interacting with its substrate, during the chemical reaction, together they are referred to as the ...

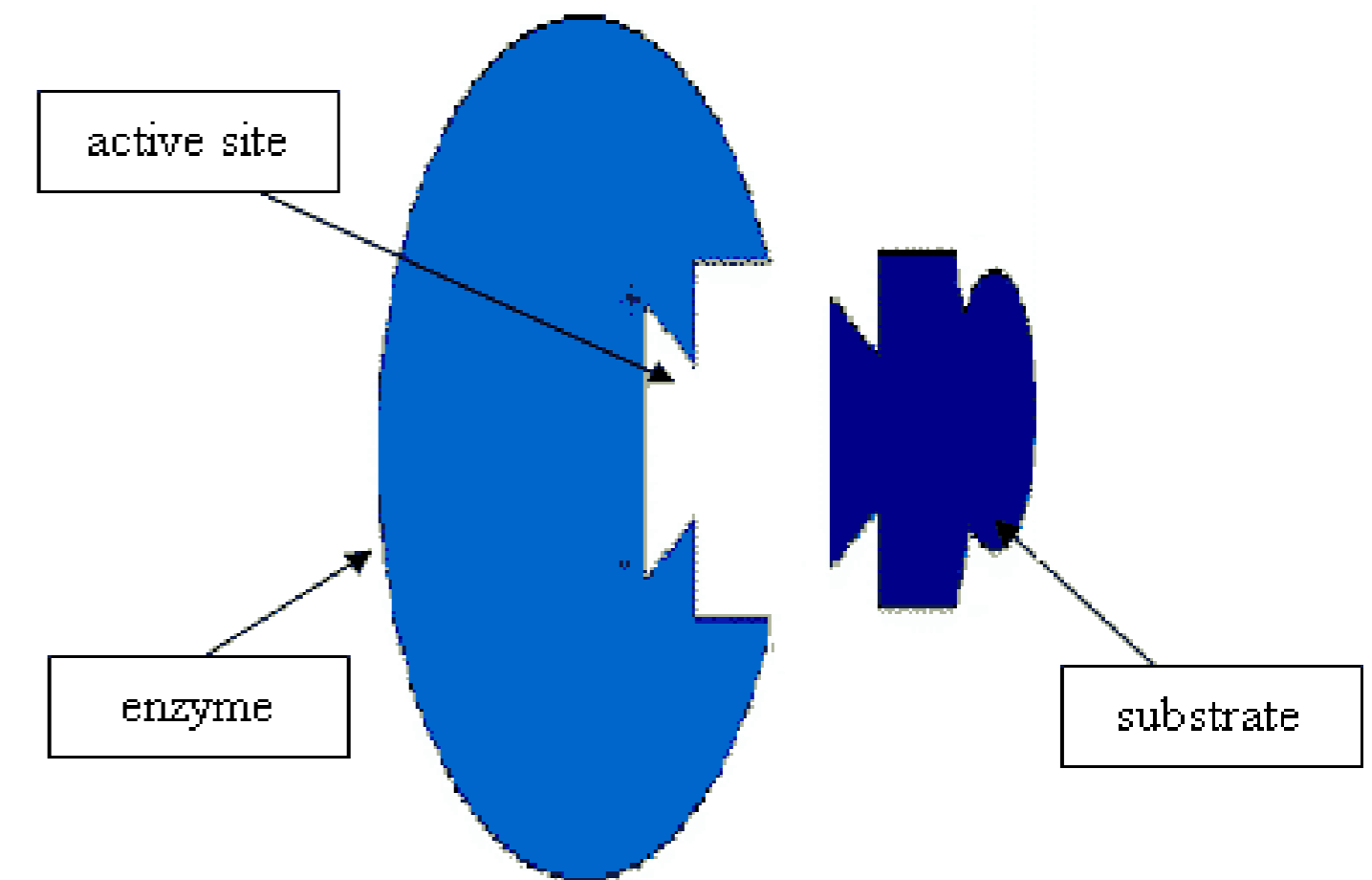




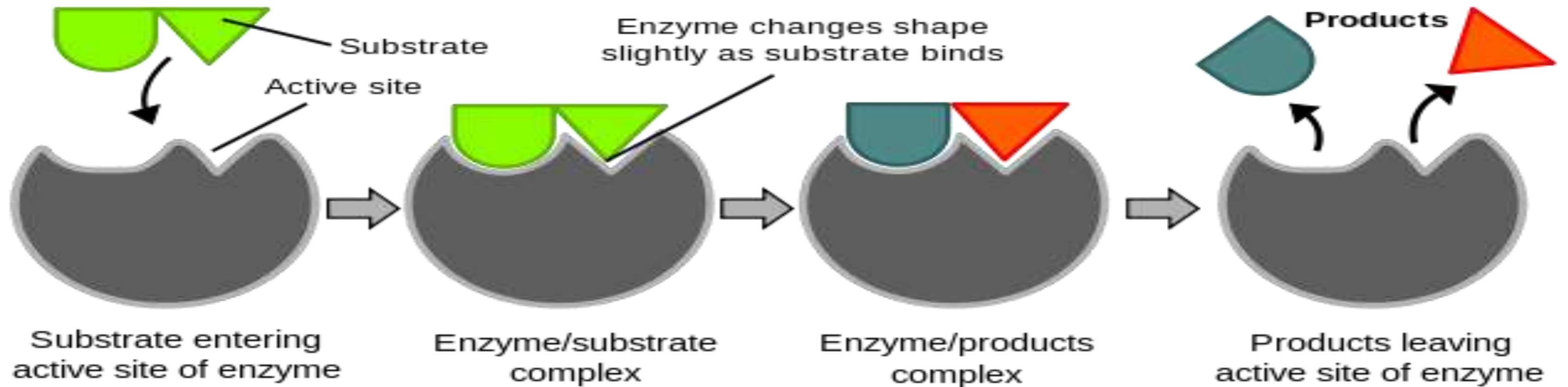
Active site



- Enzymes are composed of long chains of amino acids that have folded into a very specific three-dimensional shape which contains an active site.
- An **active site** is a region on the surface of an enzyme to which substrates will bind and catalyses a chemical reaction.



Enzymes





Some enzyme require non protein molecule for their activity. So enzymes are conjugated proteins known as **Holoenzyme**.

Holoenzyme = Apoenzyme + Cofactor/coenzyme

Enzyme without non protein part is inactive and called apoenzyme.

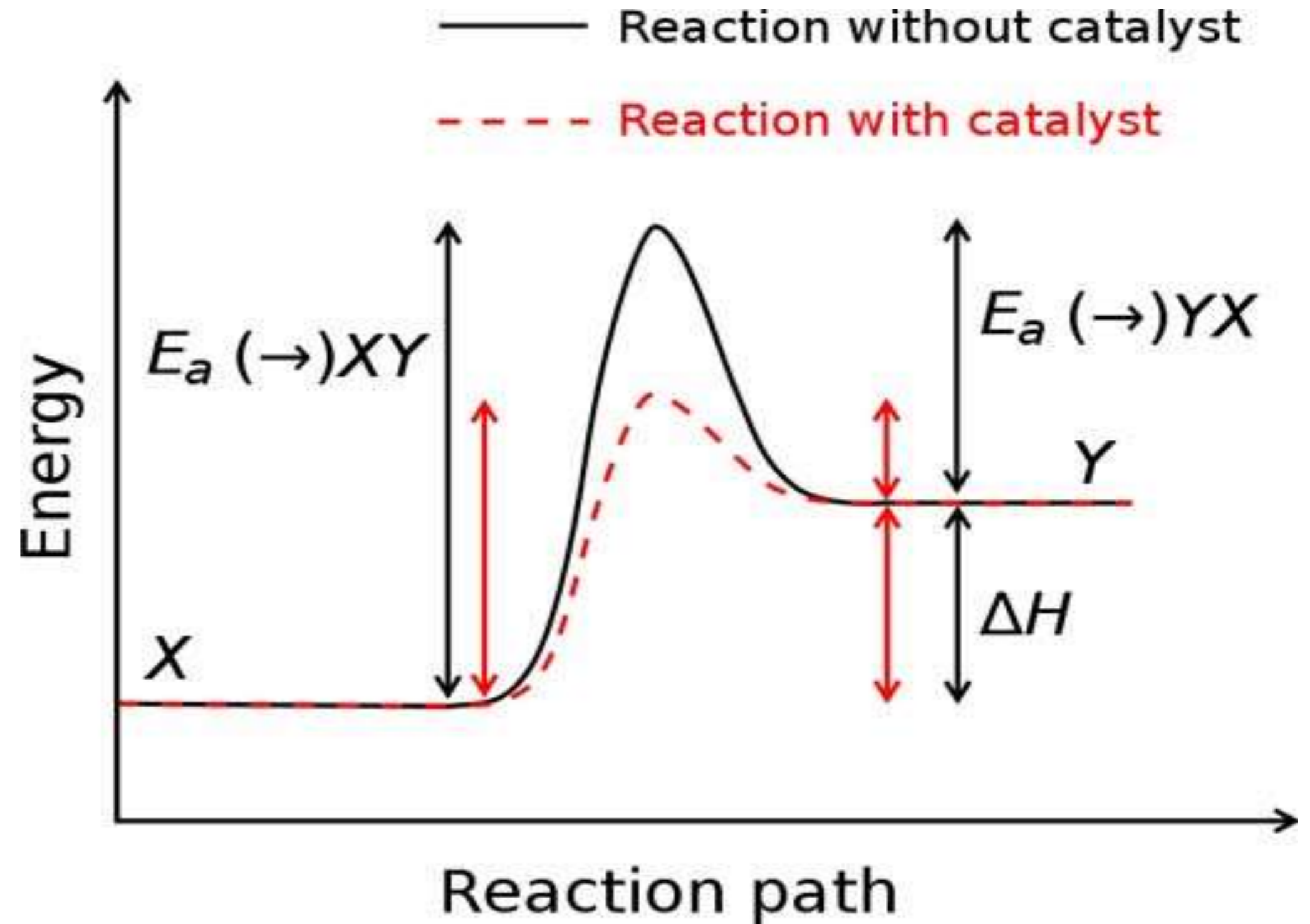
Cofactors can be either inorganic or organic compounds .



What do enzymes do?

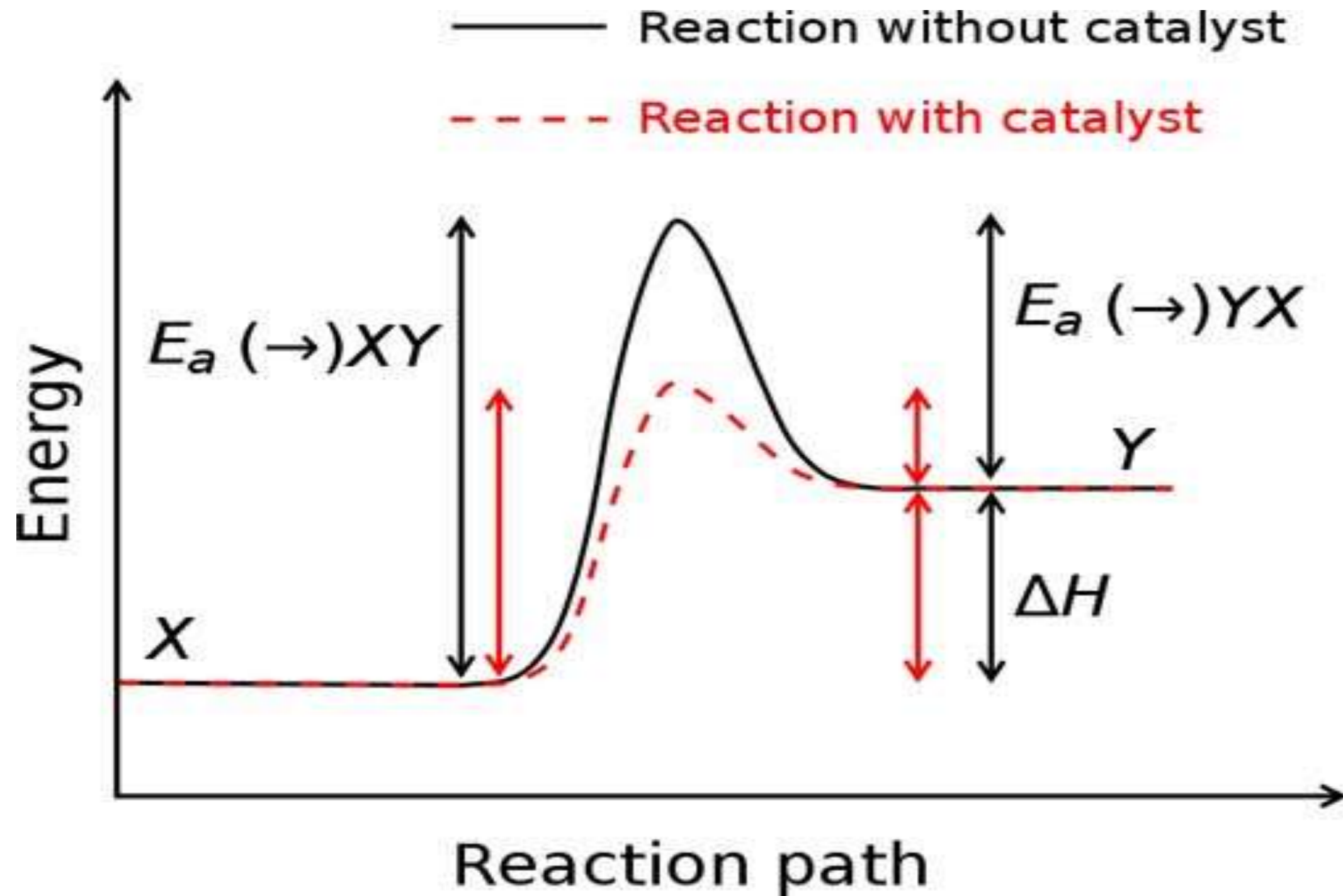


Enzymes act as catalysts in cellular reactions

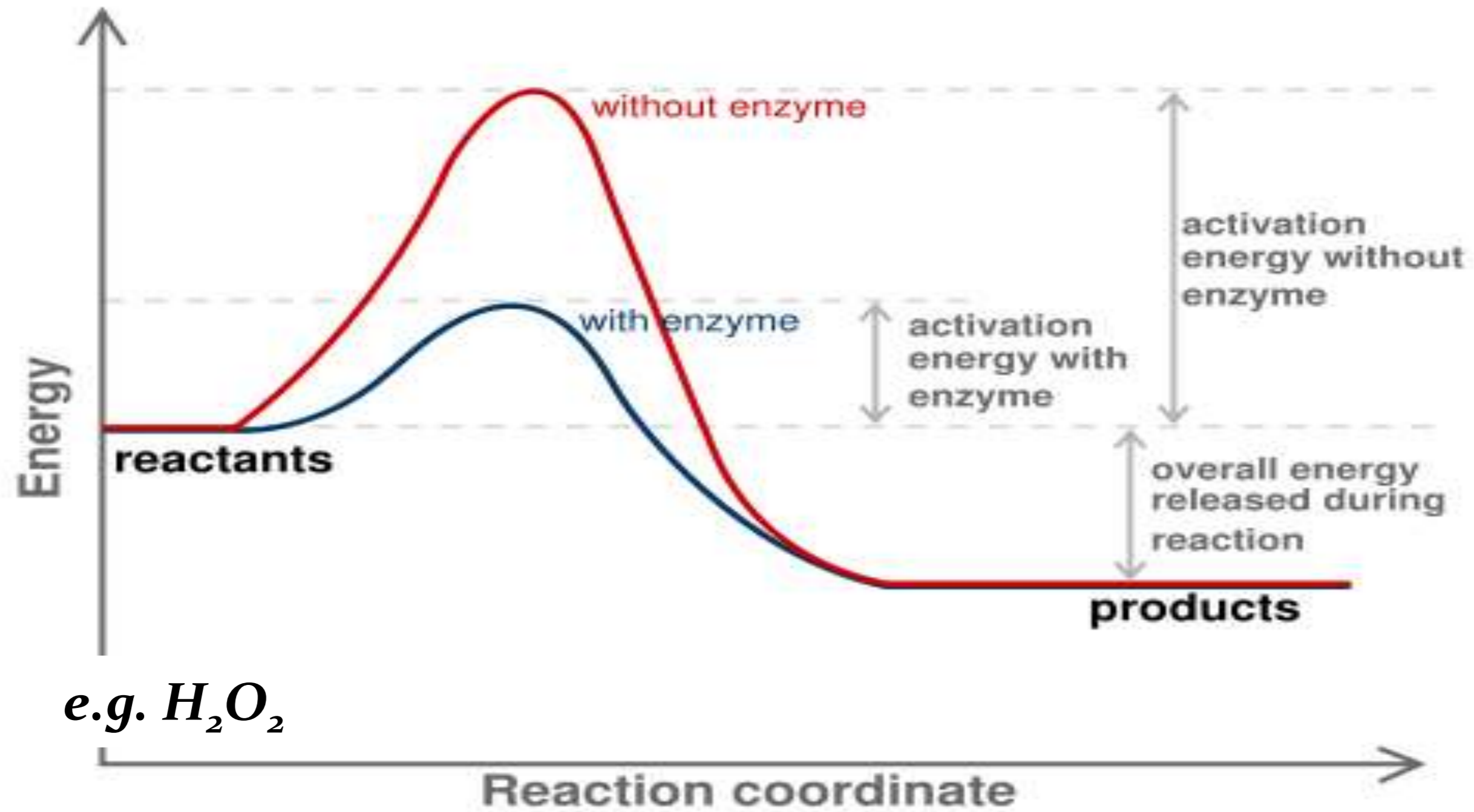




How do enzymes work?



Enzymes catalyze reactions by weakening chemical bonds, which lowers **activation energy**.



Progress of Reaction

e.g. O₂ + H₂O



How do enzymes work?



- Each enzyme has a unique 3-D shape, including a surface groove called an **active site**.
- The enzyme works by binding a specific chemical reactant (**substrate**) to its active site, causing the substrate to become unstable and react.
- The resulting **product(s)** is then released from the active site.

(a) Reaction





Nomenclature / enzyme classification



IUBMB has recommended system of nomenclature for enzymes & according to them each enzyme is assigned with two names:

- ✓ **Trivial name** (common name, recommended name).
- ✓ **Systemic name** (official name).



Systemic name



Each enzyme is characterized by a code no. called Enzyme Code no. or **EC number** and contain four Figure (digit) separated by a dot.

e.g. **EC m. n. o. p**

First digit represents the class;

Second digit stands for subclass ;

Third digit stands for the sub-sub class or subgroup;

Fourth digit gives the serial number of the particular enzyme in the list.

e.g. **EC 2.7.1.1 for hexokinase.**



Systemic name.....



According to the IUBMB system of enzyme nomenclature enzymes are grouped into 6 major classes

EC 1 OXIDOREDUCTASES

EC 2 TRANSFERASES

EC 3 HYDROLASES

EC 4 LYASES

EC 5 ISOMERASES

EC 6 LIGASES



Classification of enzymes:



There are 6 classes of enzymes which are:

A. Oxidoreductase: This group of enzymes catalyzes an oxidation-reduction reaction between two substrates:



1. Oxidoreductases are further classified according to the substrate oxidized and to the mechanism of oxidation.
2. The mechanism of oxidation is either by removal of hydrogen (dehydrogenase&) or by addition of oxygen (oxidases).



B. Transferase: This group of enzymes catalyzes the transfer of a group other than hydrogen from one substrate to another:



1. They are further classified according to the group transferred into: phosphotransferases, transaminases, transketolases, transacylase, transformylases and transmethylases. Synthase enzymes are transferase enzymes.

2. Example:

a) Phosphotransferases: Kinases:

b) Acyltransferases: synthases:





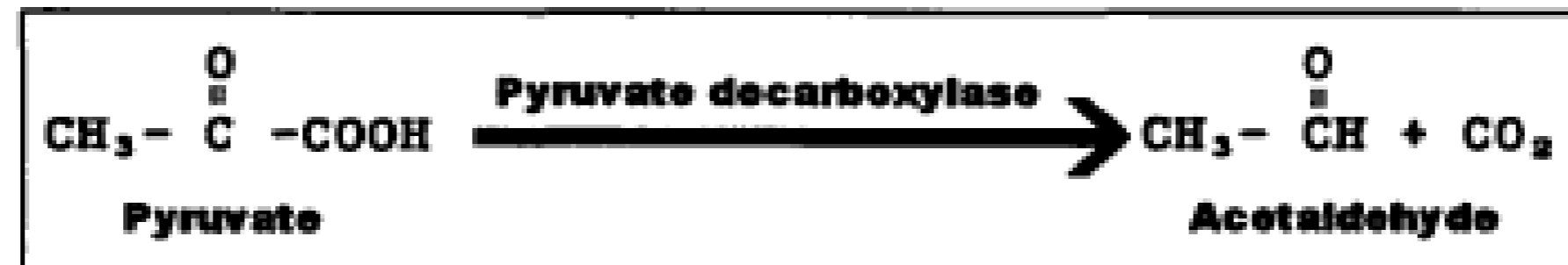
- **C. Hydrolase:** this group catalyzes hydrolysis i.e. breakdown of a chemical bond by addition of water: $A \cdot B + H_2O \rightarrow AH + BOH$

Example: peptidase:



D. Lyases: This group of enzymes catalyzes addition of carbon dioxide, water and ammonia across double bonds, or removes these elements to produce double bonds. Example:

Decarboxylase:

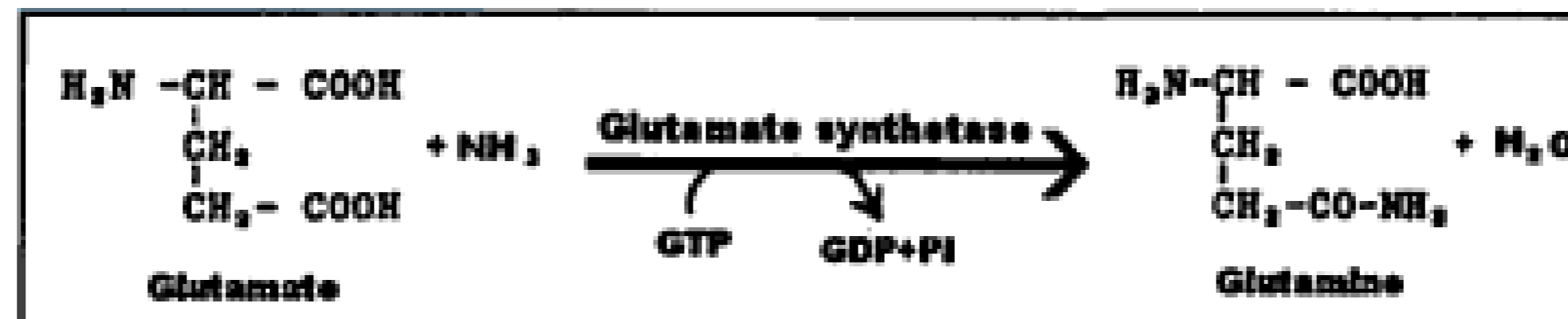




- **E. Isomerases:** This group of enzymes catalyzes the Interconversion of one isomer into another. This group Includes: Isomerases, mutases and epimerases. Example: phosphohexose Isomerase:



- **F. Ligases for synthetases:** This group of enzymes catalyzes joining of two substrates using the energy from ATP or GTP. Example: Glutamine synthetase.





Assessment



1. What are enzymes?
2. How do enzyme works?
3. Explain its nomenclature?
4. What is Active site?
5. List out the classification of enzymes?



THANK YOU