SAWA UNIVERSITY

FIRST SEMESTER (CLINICAL ENZYMOLOGY)

DEFINITION OF ENZYME, CHEMICAL NATURE

Sawa University — جامعـــــة ســـــــاوة الاهلية

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Department of Medical Laboratories — قسم تقنيات المختبرات الطبية

four Stage — المرحلـــــــــــة الرابعة

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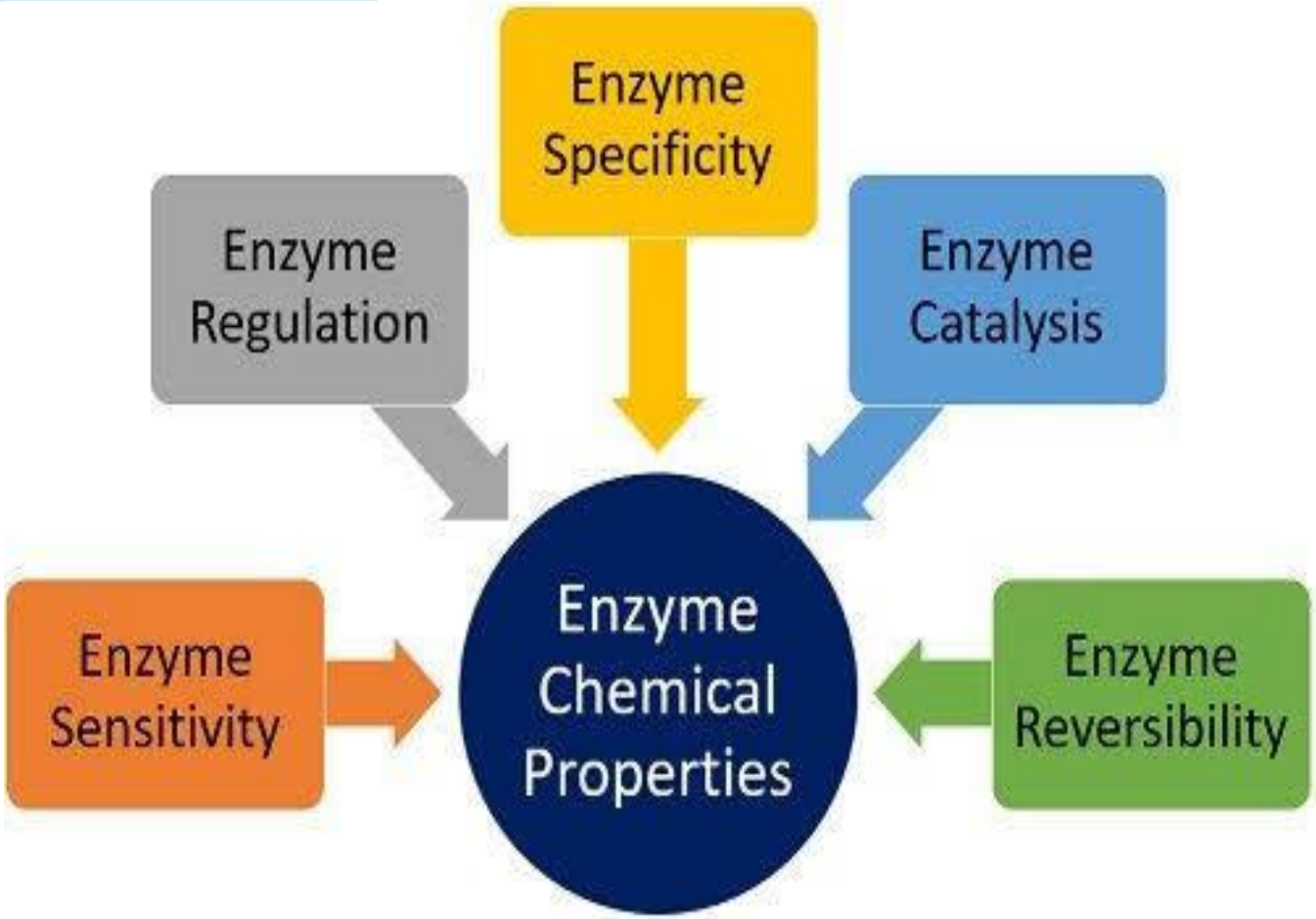
الجانب النظري — محاضرة رقم 1,2

Theoretical — Lecture No. 1,2

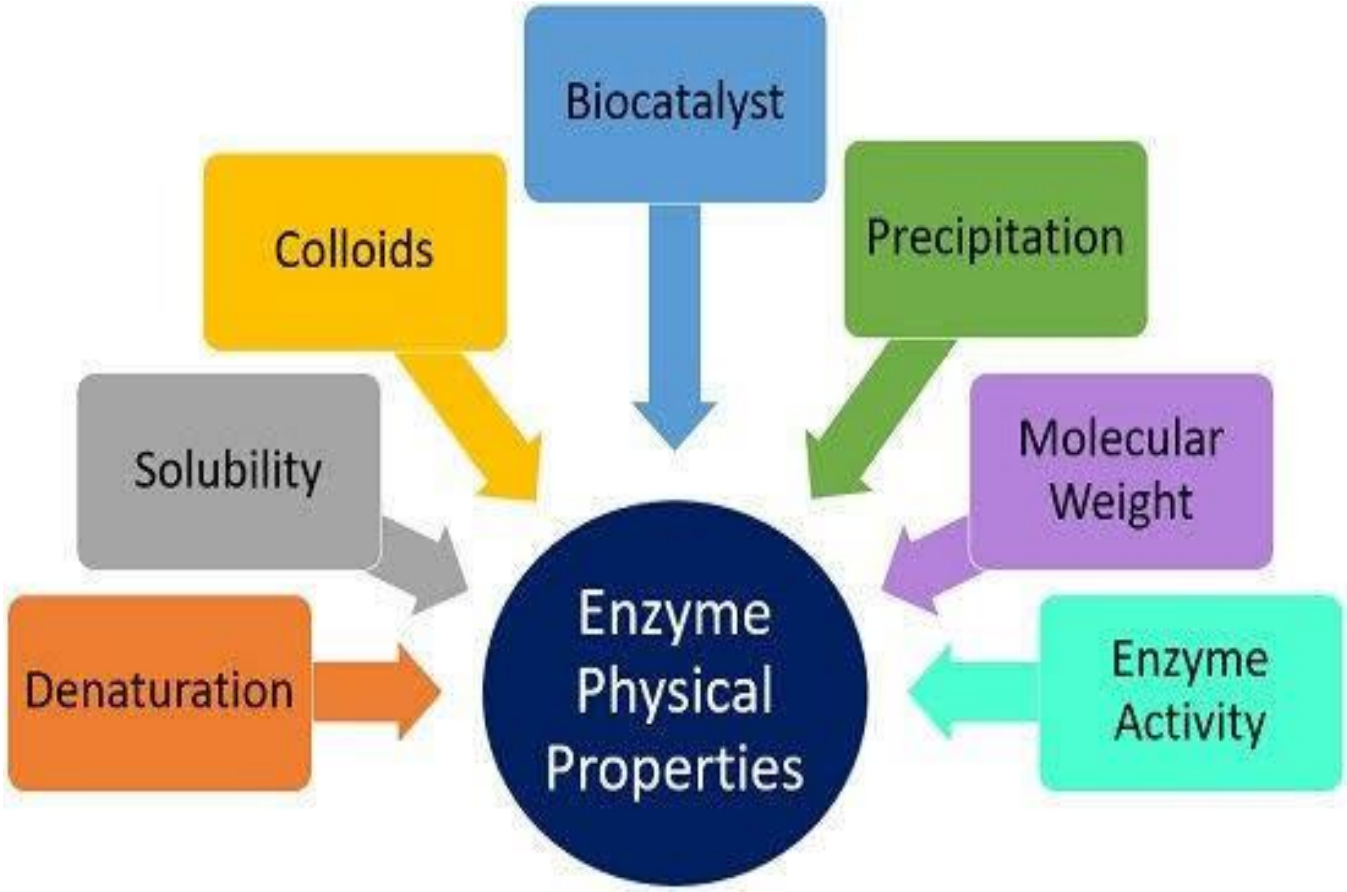
DEFINITION OF ENZYME

An Enzyme Is A Biological Catalyst That Speeds Up Chemical Reactions In Living Organisms Without Being Consumed In The Process. Most Enzymes Are Proteins.



DEFINITION OF ENZYME

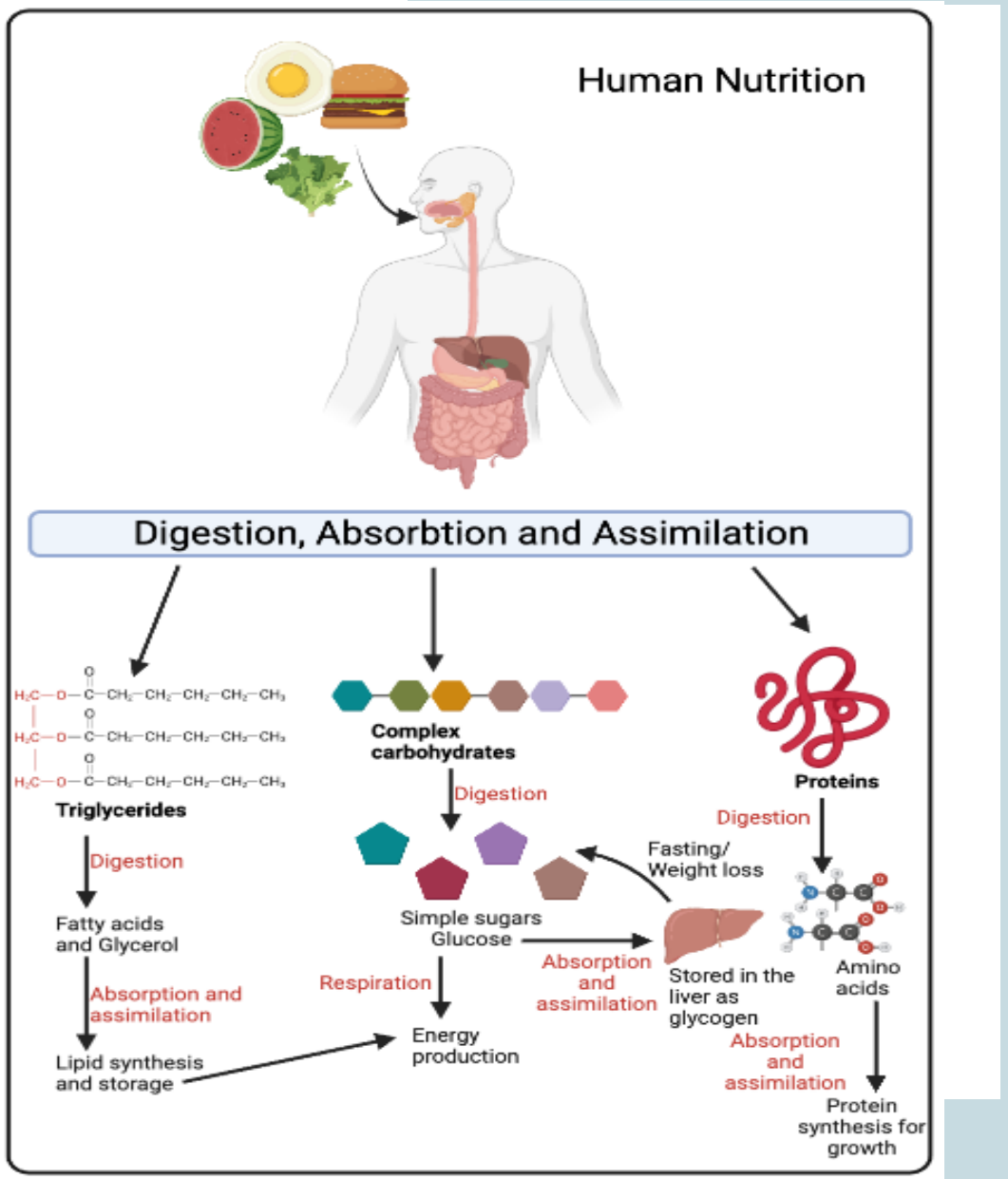
The Key Terms Describe The Processes And Components Of Metabolism, Which Is The Sum Of All Chemical Reactions In An Organism. Metabolic Reactions Are Carried Out By Enzymes And Can Be Divided Into Two Types: Catabolic And Anabolic.



Catabolic reaction

A catabolic reaction is a metabolic process that breaks down large, complex molecules into smaller, simpler ones.

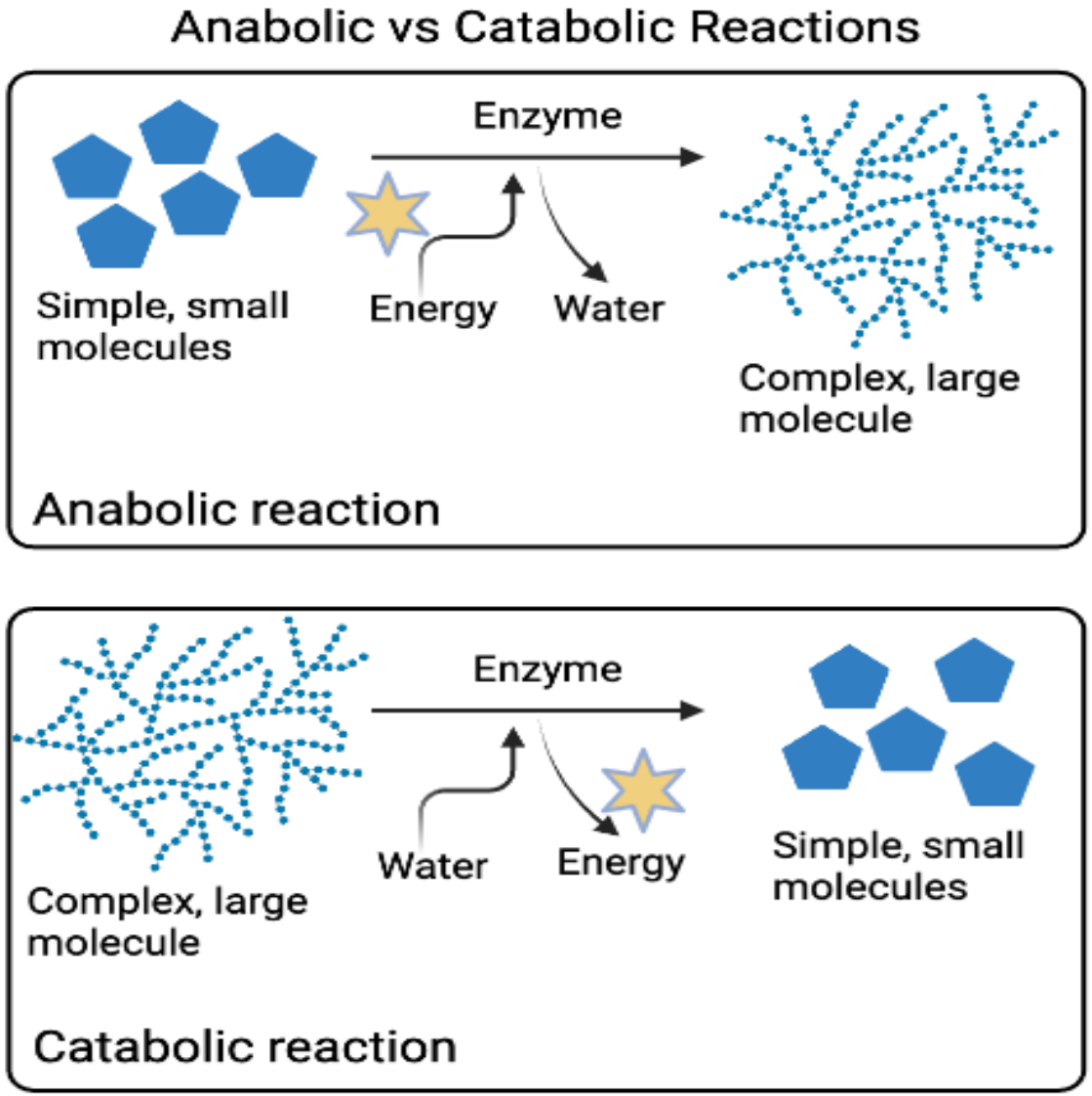
- Energy release: These reactions are exergonic, meaning they release energy. Approximately 40% of the energy is stored as the molecule adenosine triphosphate (ATP), while the remaining energy is released as heat.
- Example: The breakdown of carbohydrates into glucose for cellular respiration is a catabolic process



Anabolic reaction

An anabolic reaction is a metabolic process that synthesizes large, complex molecules from smaller ones.

- Energy consumption: These reactions are endergonic, meaning they require a net input of energy, often supplied by ATP.
- Example: The synthesis of proteins from amino acids to build muscle tissue is an anabolic process.



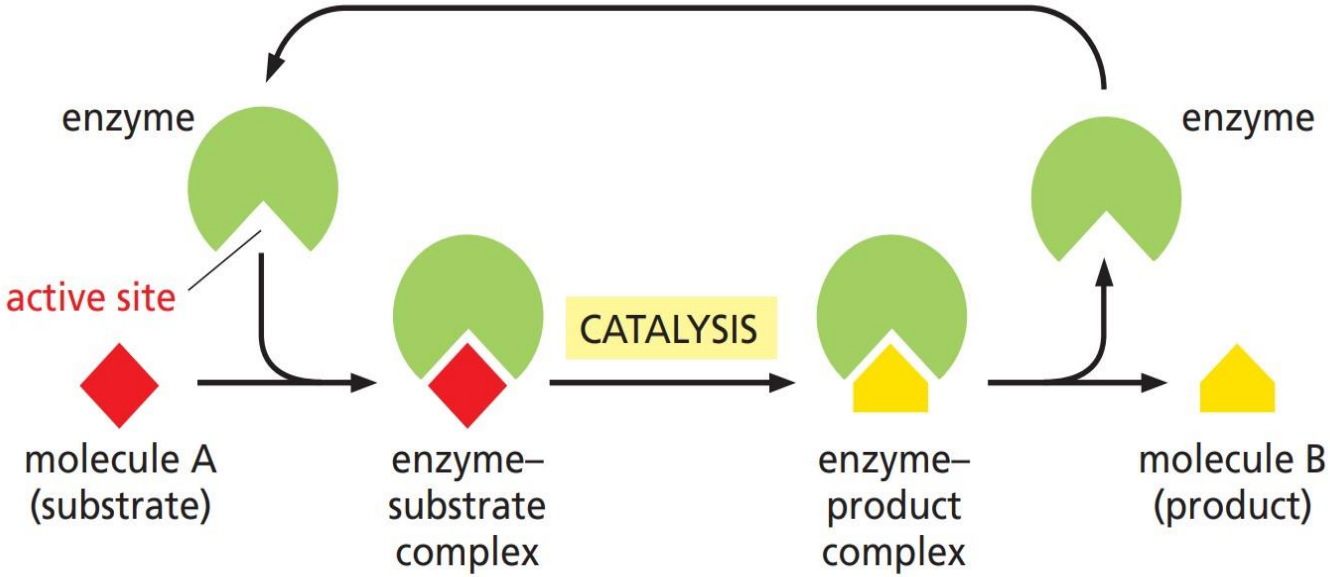
Enzyme

An enzyme is a protein that acts as a biological catalyst, speeding up the rate of a specific chemical reaction without being consumed in the process.

- Function: Enzymes work by binding to substrate molecules at a specific location called the active site, which lowers the activation energy needed for the reaction to occur.
- Specificity: Enzymes are highly specific and typically catalyze only one or a few types of reactions.

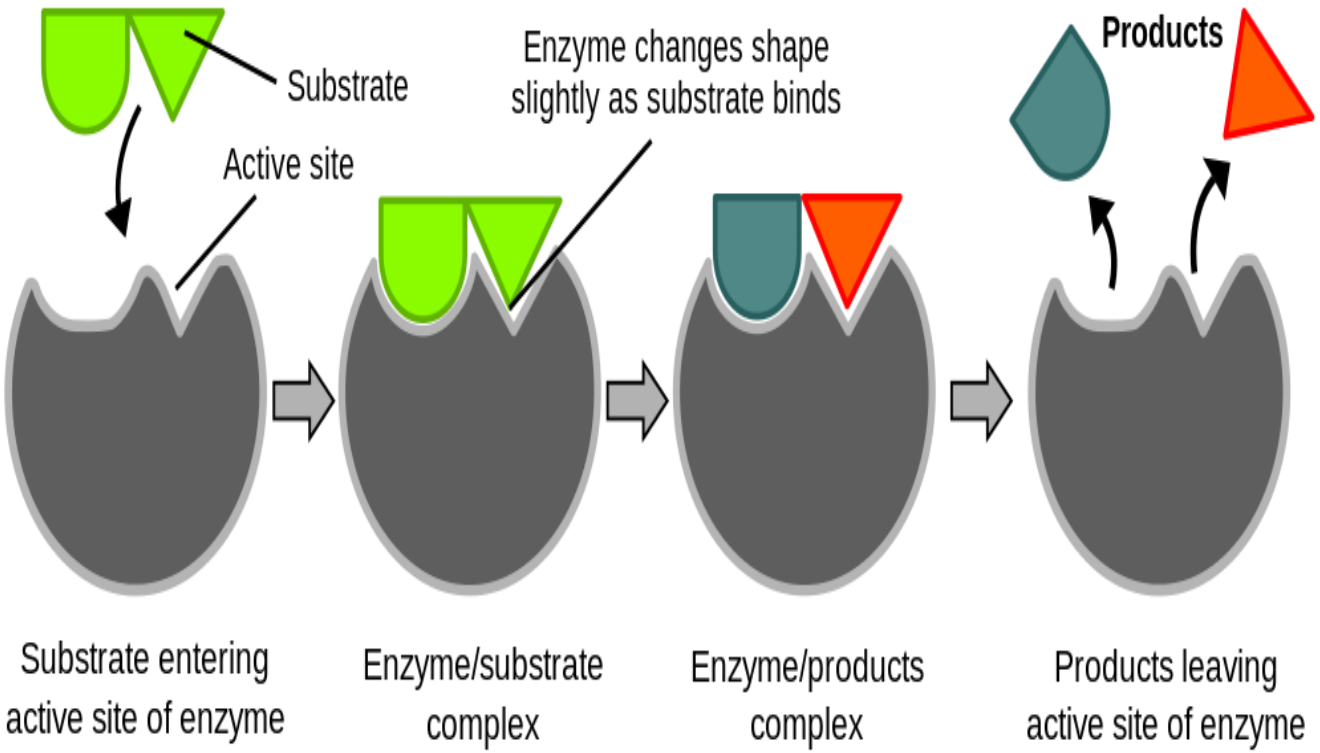
Substrate

A substrate is the molecule or substance upon which an enzyme acts. In an enzyme-catalyzed reaction, the substrate binds to the enzyme's active site and is converted into a product.



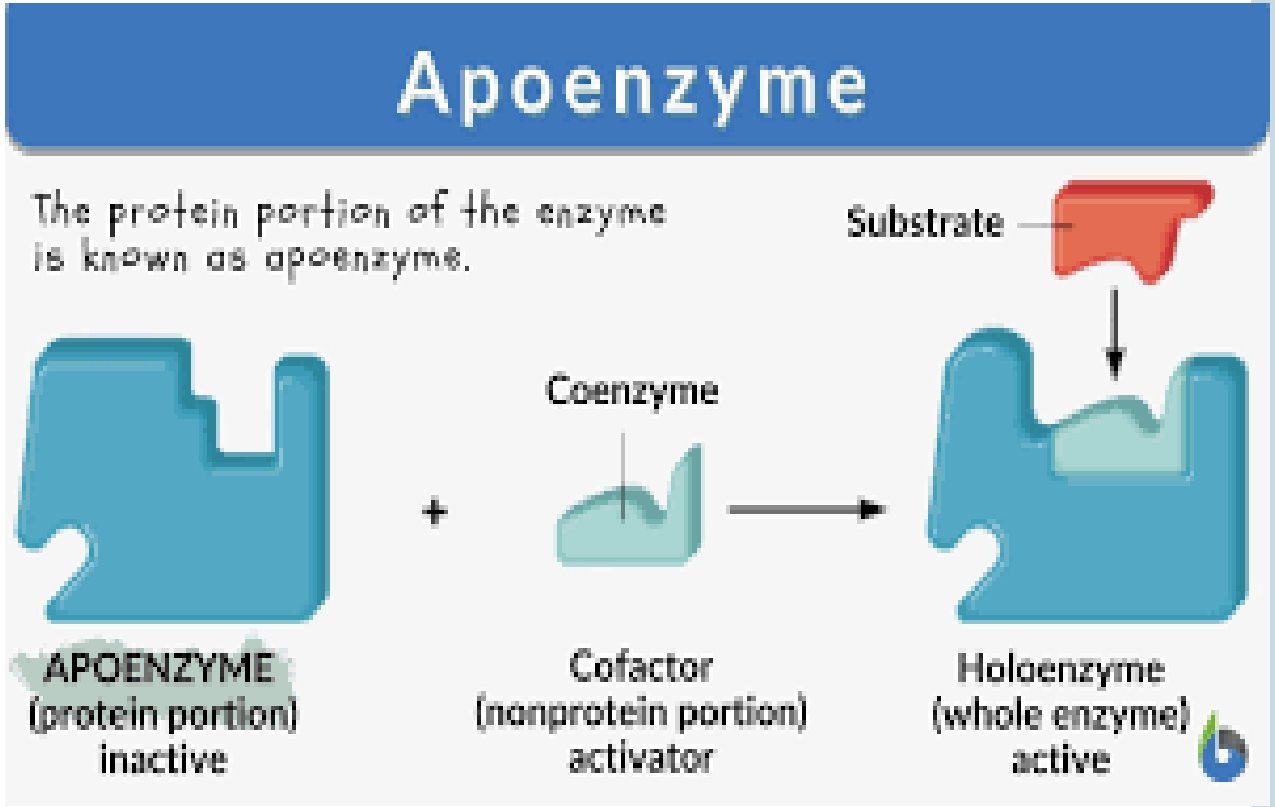
Active site

A key feature of an enzyme's structure is its active site. This is a specific groove or pocket formed by the folding of the amino acid chain where the substrate (the molecule the enzyme acts on) binds. The shape and chemical properties of the active site determine the enzyme's high specificity for a particular substrate.



Apoenzyme

An Apoenzyme is the protein part of an enzyme that is inactive on its own. It requires the presence of a non-protein component, called a cofactor, to become active.



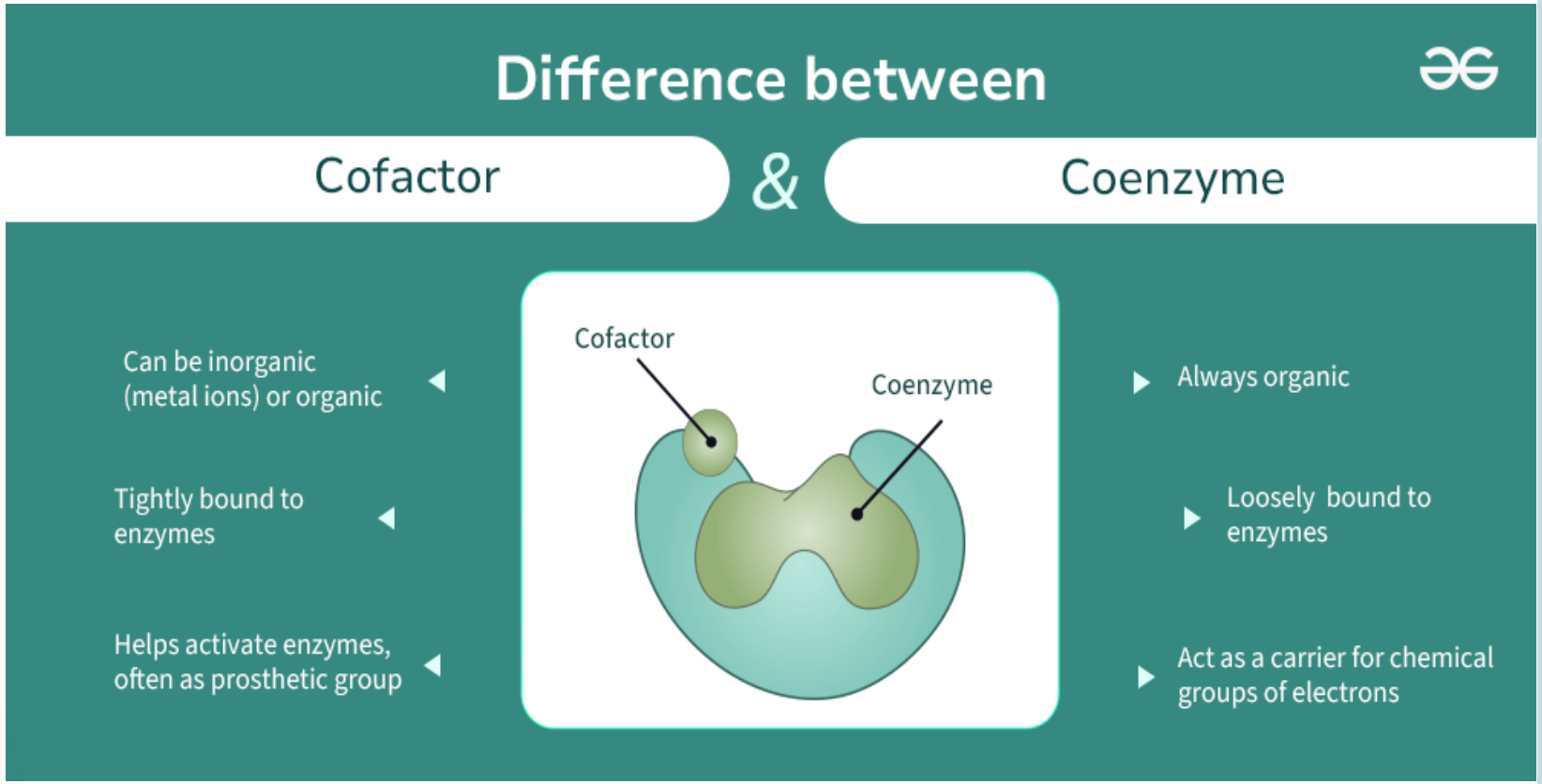
Holoenzyme

A holoenzyme is the fully functional, active form of an enzyme. It is formed when the apoenzyme (protein part) binds with its necessary cofactor.

Cofactor (Coenzyme)

A cofactor is a non-protein chemical compound or metallic ion that is required for an enzyme to function and catalyze a reaction. Coenzymes are a specific type of organic cofactor.

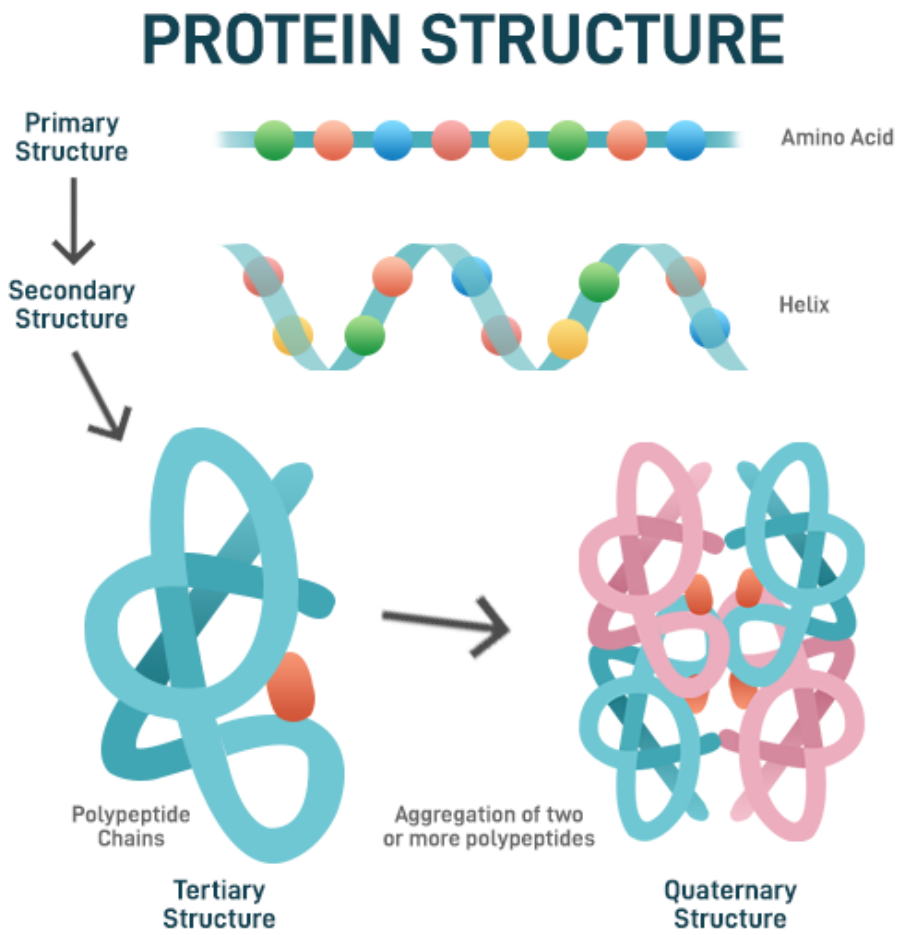
- Coenzyme: An organic molecule (often derived from vitamins, like NAD+(Nicotinamide Adenine Dinucleotide) or coenzyme A) that binds loosely to an apoenzyme. Coenzymes often act as carriers of chemical groups or electrons between enzymes.
- Other cofactors: Cofactors can also be inorganic metal ions (e.g., Mg or Fe



Chemical nature of enzymes

Chemical nature of enzymes

The chemical nature of enzymes is defined by their composition, structure, and functional components.

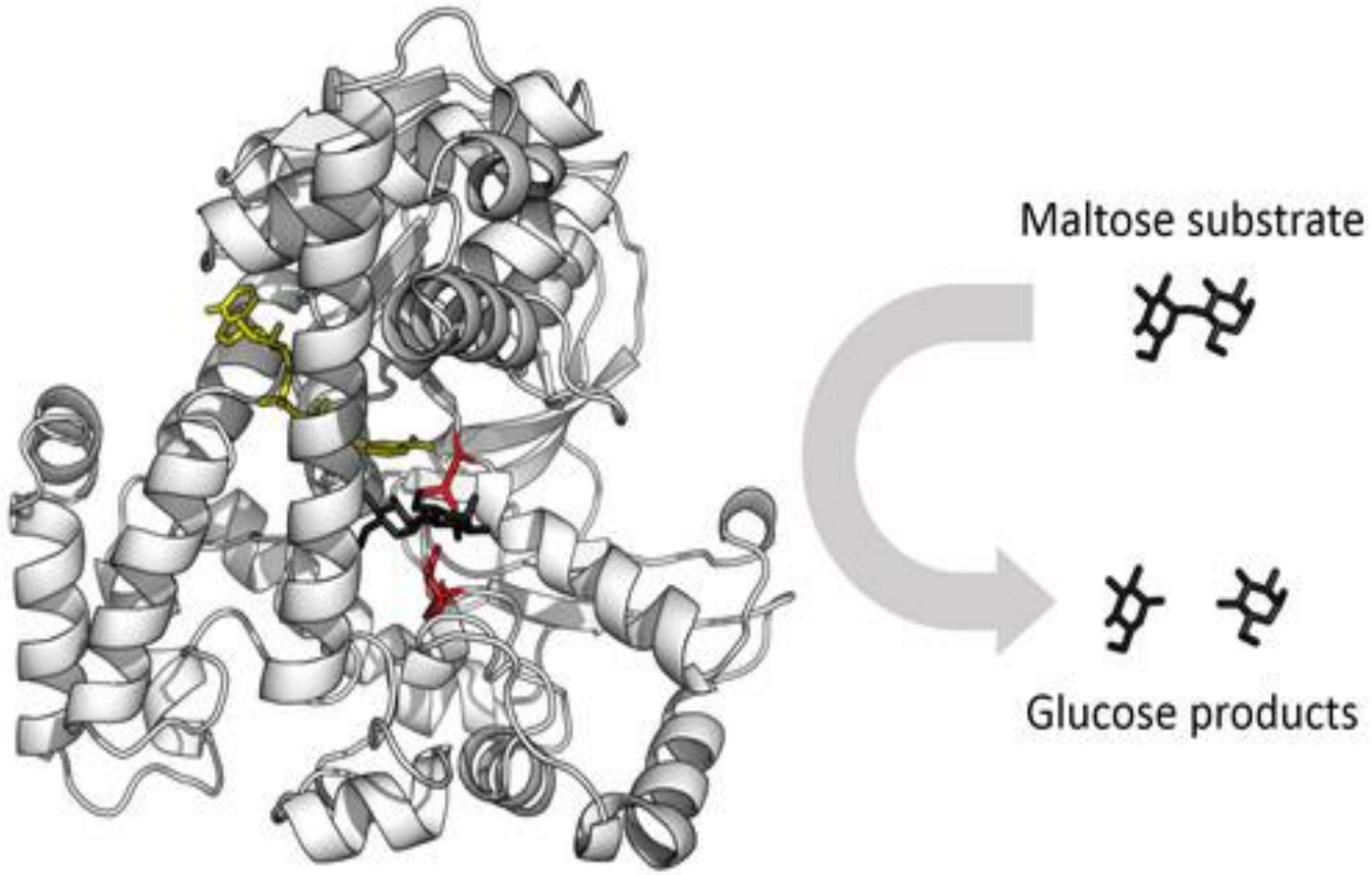


Composition and structure

Protein basis: The majority of enzymes are large, complex protein molecules. They consist of one or more polypeptide chains made of long sequences of amino acids linked together by peptide bonds.

Three-dimensional shape:

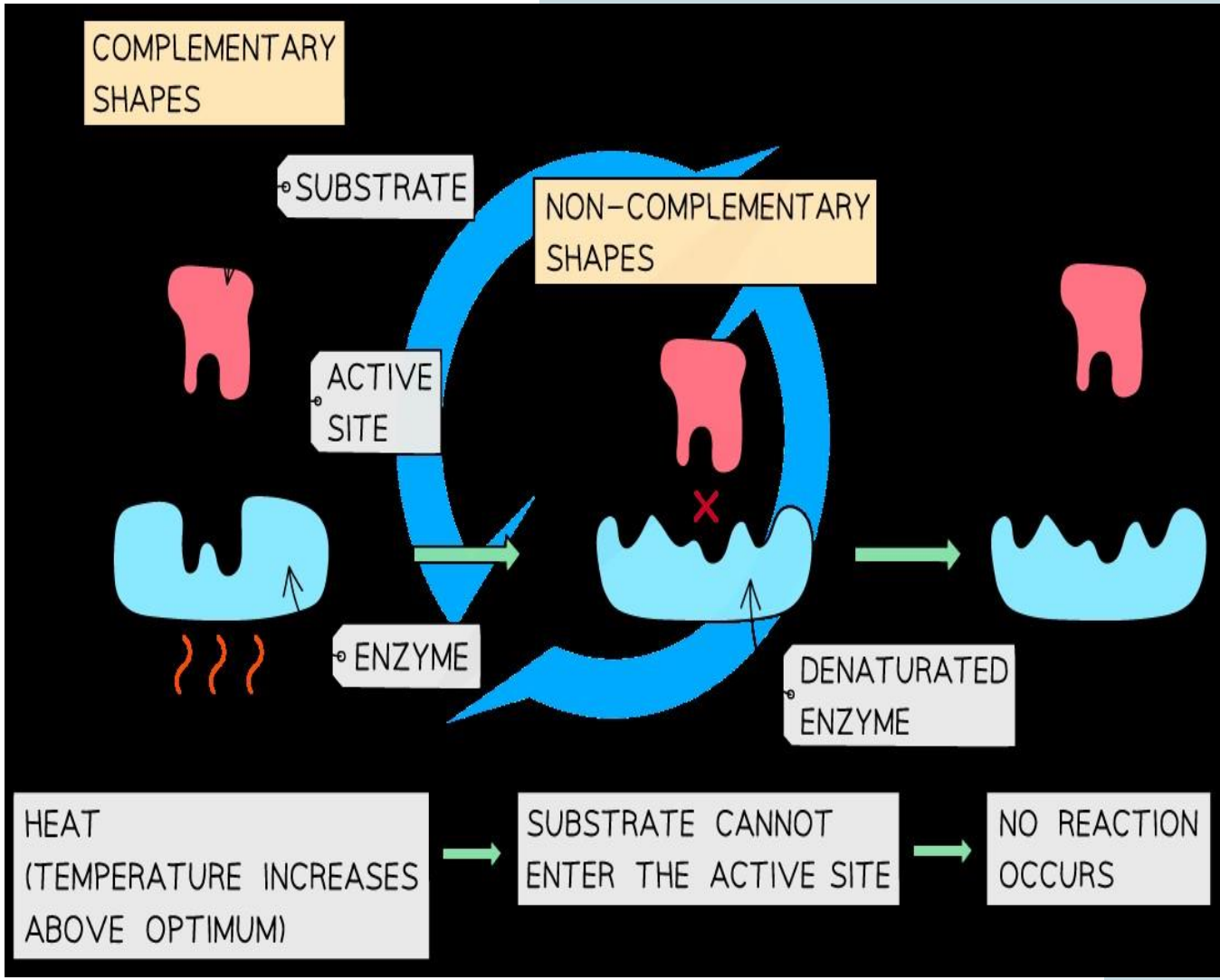
The unique sequence of amino acids causes the polypeptide chains to fold into a specific three-dimensional (tertiary) shape. This structure is crucial for the enzyme's function and is maintained by various chemical bonds, such as hydrogen bonds, ionic bonds, and disulfide bridges.



The enzyme glucosidase converts the sugar maltose into two glucose sugars. Active site residues in red, maltose substrate in black, and NAD cofactor in yellow.

Sensitivity to environment

Because their function depends on their precise three-dimensional structure, enzymes are very sensitive to environmental conditions such as temperature and ph. Extreme temperatures or pH levels can cause the enzyme to lose its shape, a process called denaturation, and lose its catalytic activity.



QUESTIONS

1- WHAT IS THE MAIN FUNCTION OF AN ENZYME

2- MOST ENZYMES ARE

3- WHICH OF THE FOLLOWING BEST DEFINES METABOLISM?

4- CATABOLIC REACTIONS ARE GENERALLY

5- WHAT PERCENTAGE OF ENERGY IN CATABOLIC REACTIONS IS TYPICALLY CAPTURED AS ATP

Any questions?