

ENZYMES

INTRODUCTION TO ENZYMES

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The study of enzymes is called *enzymology*

Definition

- ❑ **Biological catalysts**
- ❑ Accelerates the rate of chemical reactions
- ❑ Capable of performing multiple reactions (recycled)
- ❑ Final distribution of reactants and products governed by equilibrium properties
- ❑ **Enzymes are biological catalysts –**
- ❑ Proteins, (a few RNA exceptions)
- ❑ Orders of magnitude faster than chemical catalysts -
Act under mild conditions (temperature and pressure)
- ❑ Highly Specific
- ❑ Tightly Regulated

Importance of enzymes

- Enzymes are critical for every aspect of cellular life Enzyme**
- Cell shape and motility**
- Surface receptor**
- Cell cycle**
- Metabolism**
- Transcription**
- Hormone release**
- Muscle contraction**
- Protein synthesis**

Properties

- **Vital for chemical reactions to occur in the cell (the breaking, forming and rearranging of bonds on a substrate (reactant))**
- **Modified substrate (now a product) often performs a different task**
- **Consequence: TMTransformation of energy and matter in the cell TMCell-cell and intracellular communication TMAllows for cellular homeostasis to persist**

Classification of Enzymes

- ❑ **Enzymes can be classified using a numbering system defined by the Enzyme Commission.**
- ❑ **This system consists of a four digit number which classifies based on the type of reaction the enzyme catalyzes**

Different classes of enzymes

- **EC 1. Oxidoreductases** – Transfer electrons (Redox reactions)
- **EC 2. Transferases** – Transfer functional groups between molecules
- **EC 3. Hydrolases** – Break bonds by adding H₂O
- **EC 4. Lyases** – Elimination reactions to form double bonds
- **EC 5. Isomerases** – Intramolecular rearrangements
- **EC 6. Ligases** – Join molecules with new bonds

Enzyme Nomenclature

EC 3.2.1.1

Type of general reaction
(eg. Hydrolase)

Indicates specific
enzyme
(eg. Alpha
Amylase)

Subclass of enzyme reaction
(eg. glycosidase)

Sub-Subclass of enzyme reaction
(eg. hydrolyze O glycosyl groups)



EC 1. Oxidoreductases

- **Catalyze oxidation/reduction reactions**
- **Oxidation** is the *loss* of electrons or an *increase* in the oxidation state of an atom, an ion, or of certain atoms in a molecule.
- **Reduction** is the *gain* of electrons or a *decrease* in the oxidation state of an atom, an ion, or of certain atoms in a molecule.
- **Eg. Alcohol dehydrogenase EC1.1.1.1.**
- **Cytochrome oxidase**
- **Amino acid oxidases**

EC 2. Transferases

- Involved in transfer of functional groups between molecules
- Eg. :-
 - **Hexokinase EC2.7.1.1.**
 - **Transaminases**
 - **Phosphorylase**

EC 3. Hydrolases

- Break bonds by adding H₂O
- Eg:-
- **Lipase (triacylglycerol acyl hydrolase E.C. 3.1.1.3)**
- **Choline esterase**
- **Acid and alkaline phosphatase**
- **Pepsin**
- **Urease**

EC 4. Lyases

- Elimination reactions to form double bonds
- Eg.-
- **Aldolase (E.C.4.1.2.7)**
- **Fumarase**
- **Histidase**

EC 5. Isomerases

- Intramolecular rearrangements
- Eg:-
- **Triose phosphate isomerase EC 5.3.1.1.**
- **Phosphohexose isomerase**

EC 6. Ligases

- Join molecules with new bonds
- Eg:-
- **Glutamine synthetase EC 6.3.1.2.**
- **Succinate thiokinase**
- **Acetyl CoA carboxylase**



THANK YOU