SAWA UNIVERSITY

FIRST SEMESTER (CLINICAL ENZYMOLOGY)

CLASSIFICATION WITH EXAMPLES & ENZYME SPECIFICITY

Sawa University جامعـــــــة ســـــــاوة الاهلية

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four Stage المرحلــــــــــــــة الرابعة

محاضرة رقم 7 الجانب النظري

Lecture No. 7 Theoretical

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CLASSIFICATION WITH EXAMPLES & ENZYME SPECIFICITY

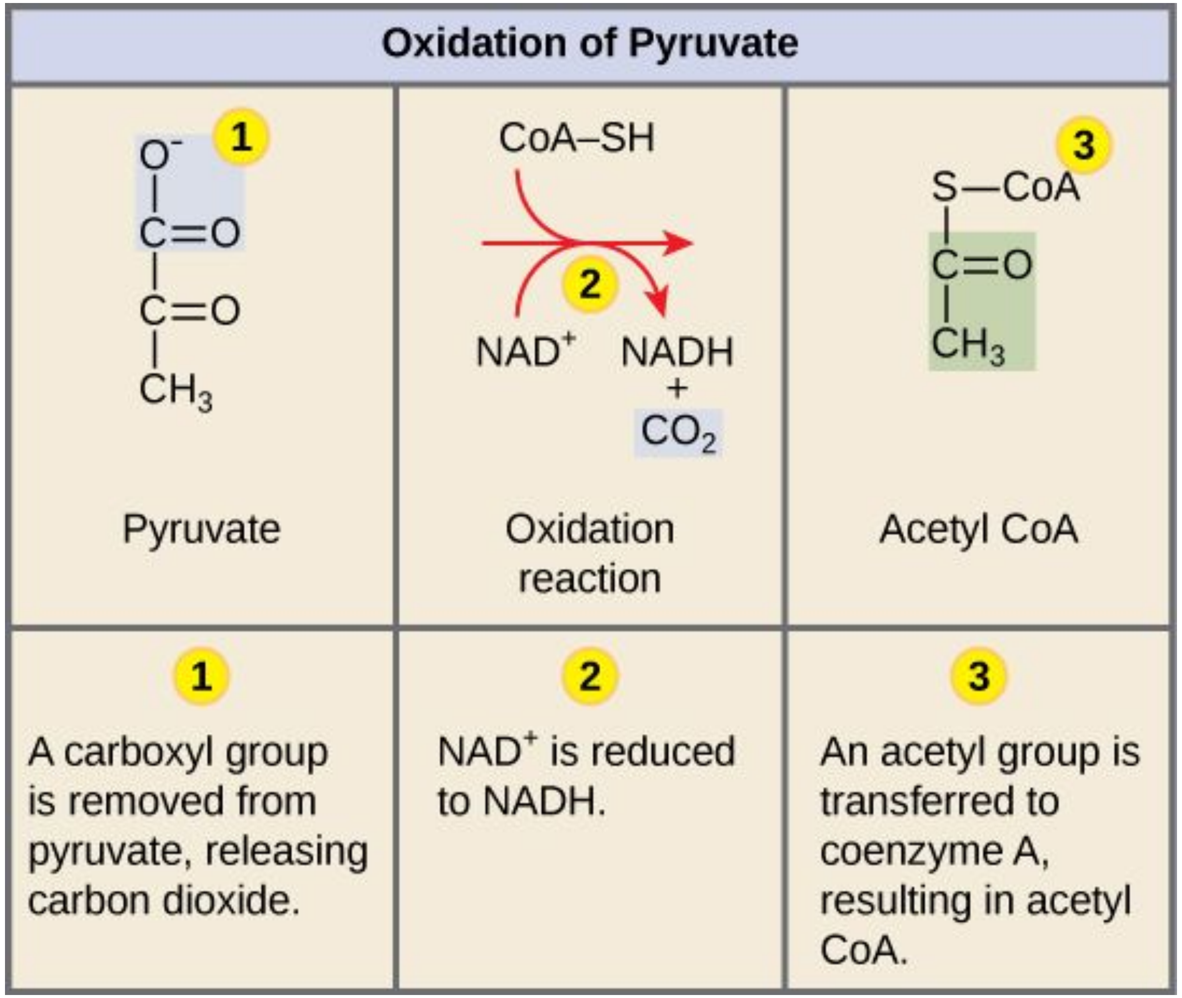
Enzymes are classified into seven types based on their function, including oxidoreductases, transferases, hydrolases, lyases, isomerases, ligases, and translocases. Enzyme specificity describes an enzyme's ability to distinguish between substrates and reactions; examples of specificity types are absolute specificity (e.g., urease acting only on urea), group specificity (e.g., pepsin acting on peptide bonds involving aromatic amino acids), and stereo specificity (e.g., L-amino acid oxidase acting only on L-amino acids)

ENZYME CLASSIFICATION

Enzymes Are Grouped Into Seven Main Classes Based On The Chemical Reaction They Catalyze.

1- Oxidoreductases: Catalyze Oxidation-reduction Reactions.

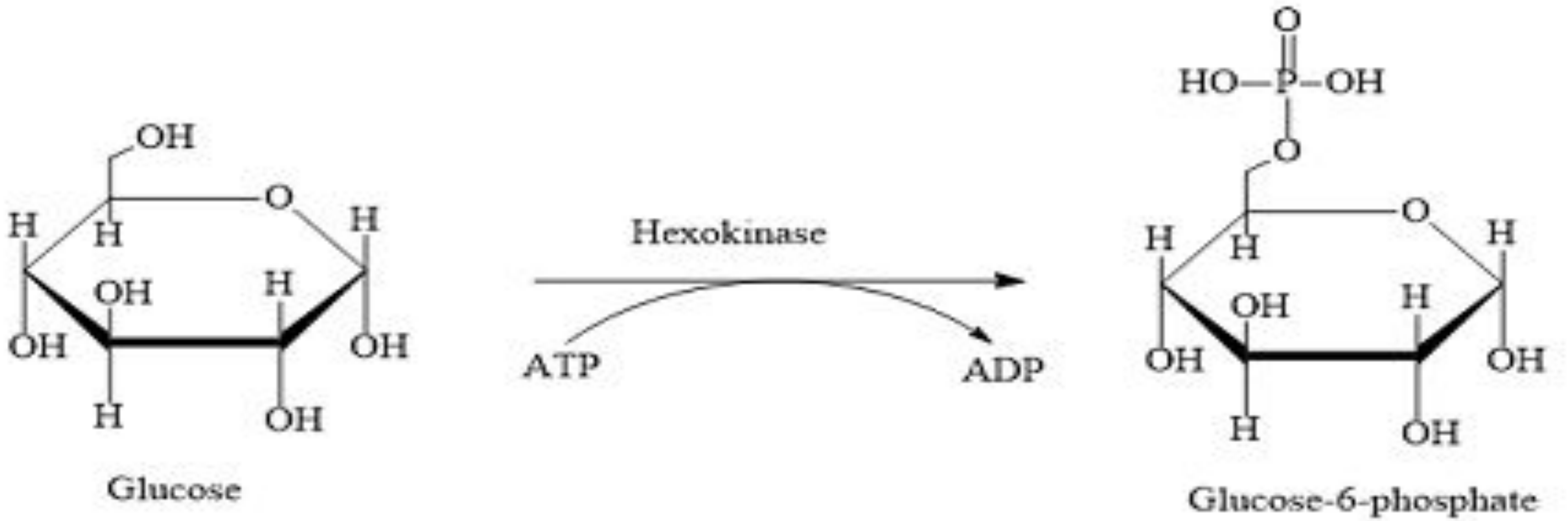
Example: Pyruvate Dehydrogenase, Which Catalyzes The Oxidation Of Pyruvate.



2- Transferases:

Transfer a chemical group (e.g., phosphate, methyl) from one molecule to another.

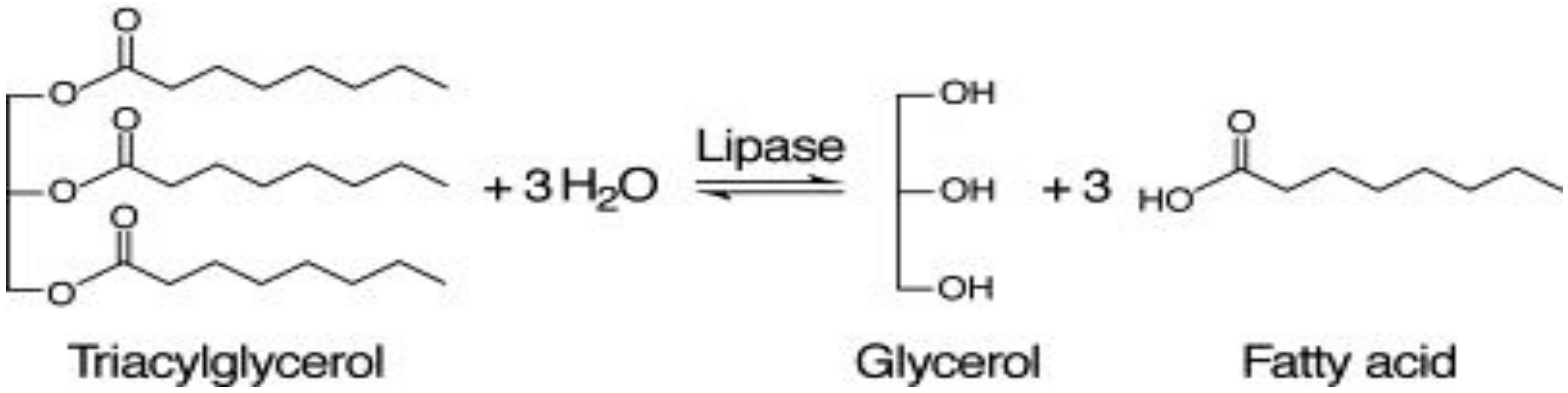
Example: Kinases (like hexokinase), which transfer phosphate groups.



3- Hydrolases:

Break chemical bonds by adding water.

Example: Lipases, which break down fats.



4- Lyases:

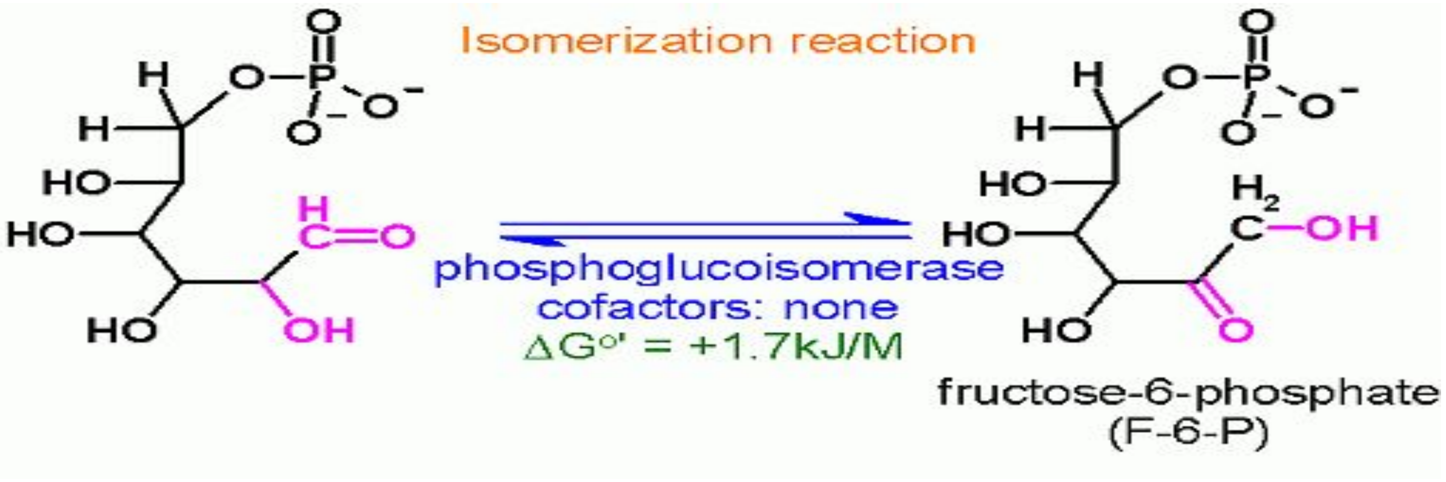
Break bonds (without hydrolysis) or form double bonds.

Example: Aldolase, which splits fructose-1,6-bisphosphate.

5- Isomerases:

Rearrange atoms within a molecule, forming an isomer.

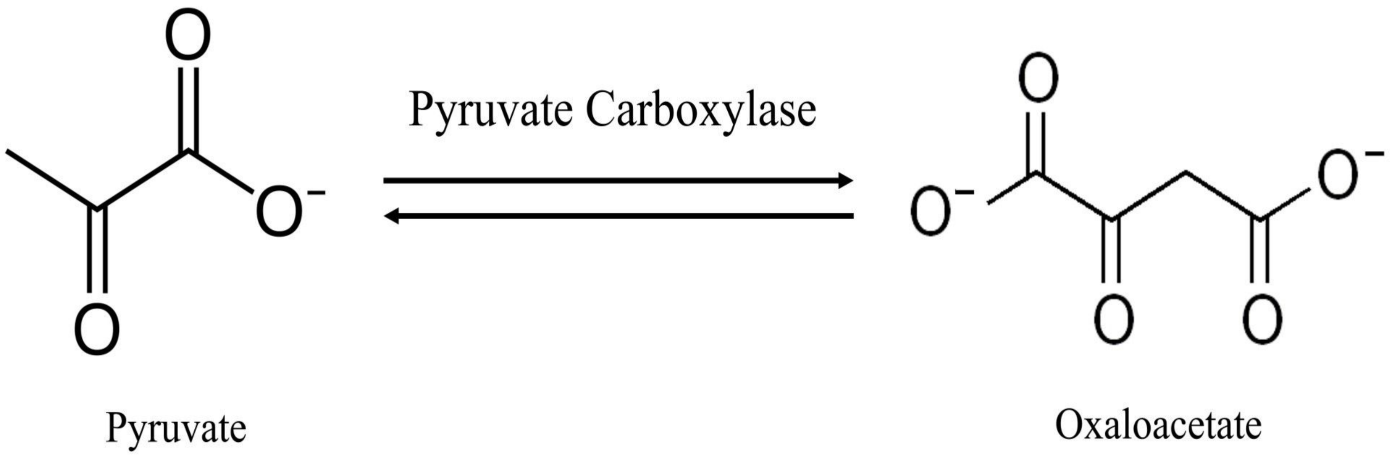
Example: Phosphoglucose isomerase.



6- Ligases:

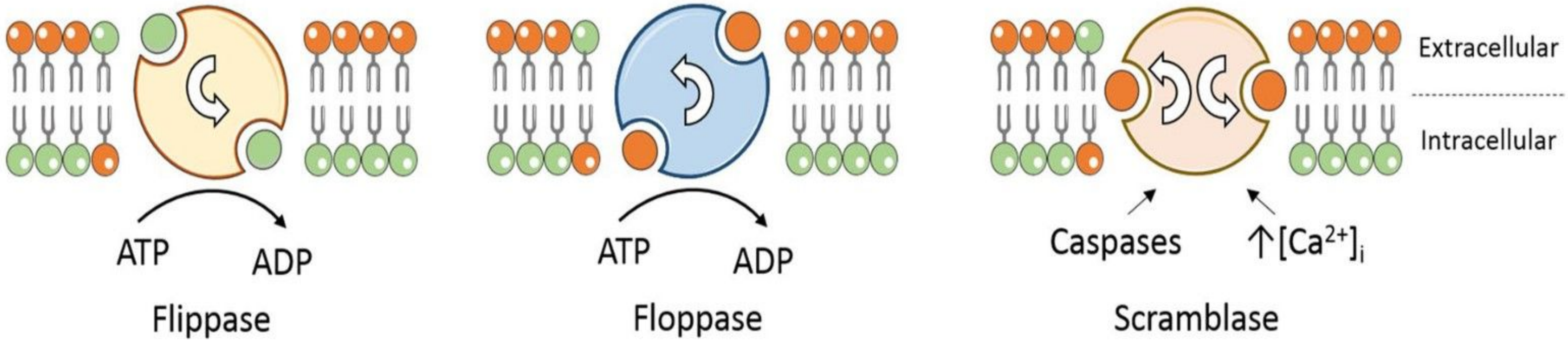
Join two molecules together, often using ATP.

Example: Synthetases.



7- TRANSLOCASES:

MOVE MOLECULES ACROSS A MEMBRANE



6 Types of Enzymes	
Enzyme	**Function**
Lyase	Dissociates molecules, breaks covalent bonds without using water, oxidation, or reduction (ex: Decarboxylase) $A \longrightarrow B + C$
Ligase	Joins two molecules together, forms covalent bonds between two molecules (ex: DNA ligase) $A + B \longrightarrow AB$
Isomerase	Rearranges bonds of a molecule, a reactant forms one of its isomers (ex: phosphoglucose isomerase, mutase) $A \longrightarrow B$
Transferase	Transfers functional group from one molecule to another (ex: kinase, phosphorylase, peptidyl transferease) $A + BX \longrightarrow AX + B$
Hydrolase	Uses water to cleave a molecule, breaks covalent bonds with water (ex: hydrolase, phosphatase, protease) $A + H_2O \longrightarrow B + C$
Oxidoreductase	Transfers electrons from one molecule to another, alters oxidation state of reactants (ex: lactate dehydrogenase) $A + B{:} \longrightarrow A{:} + B$

Enzyme Specificity

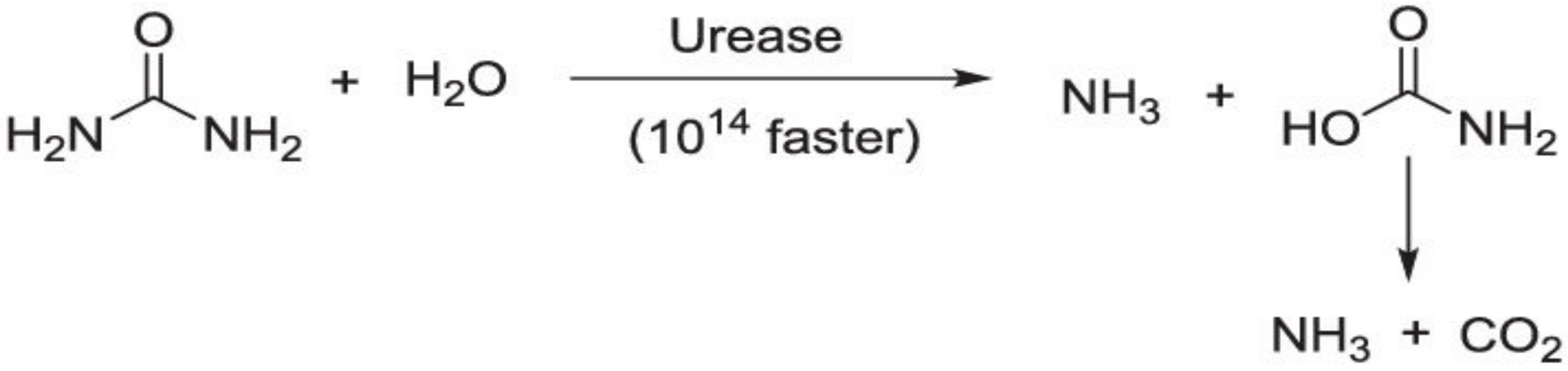
Is The Ability Of An Enzyme To Act On Only One Or A Limited Number Of Substrates And To Catalyze Only A Specific Type Of Chemical Reaction. This Selectivity Arises From The Precise Three-dimensional Shape Of The Enzyme's Active Site, Which Is Complementary To The Shape Of Its Specific Substrate. This Molecular Recognition Is Often Described By The "Lock And Key" Model, Where Only The Correct Substrate (Key) Can Fit Into The Active Site (Lock).

Enzyme Specificity

Enzyme Specificity Is The Ability Of An Enzyme To Recognize And Bind To A Particular Substrate Or A Group Of Similar Substrates.

Absolute Specificity: The Enzyme Acts On Only One Specific Substrate.

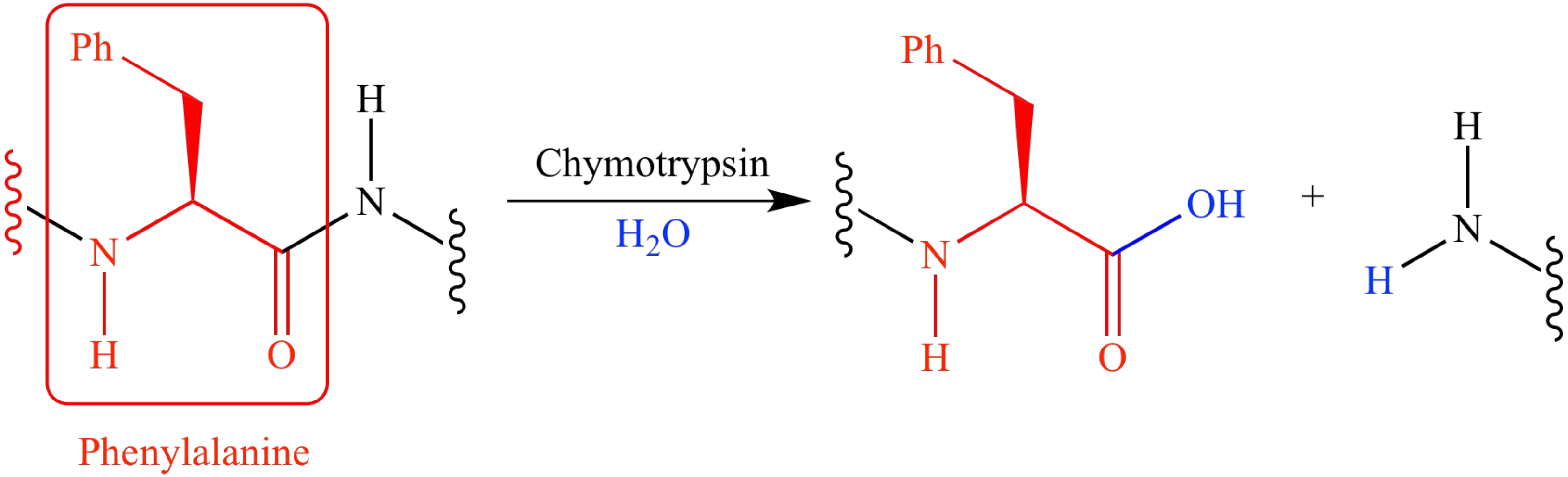
Example: Urease, Which Acts Only On Urea To Produce Ammonia And Carbon Dioxide.



Group Specificity:

The Enzyme Acts On A Group Of Structurally Related Molecules That Share A Common Functional Group.

Example: Chymotrypsin, A Protease That Hydrolyzes Peptide Bonds In Proteins Involving Aromatic Amino Acids.

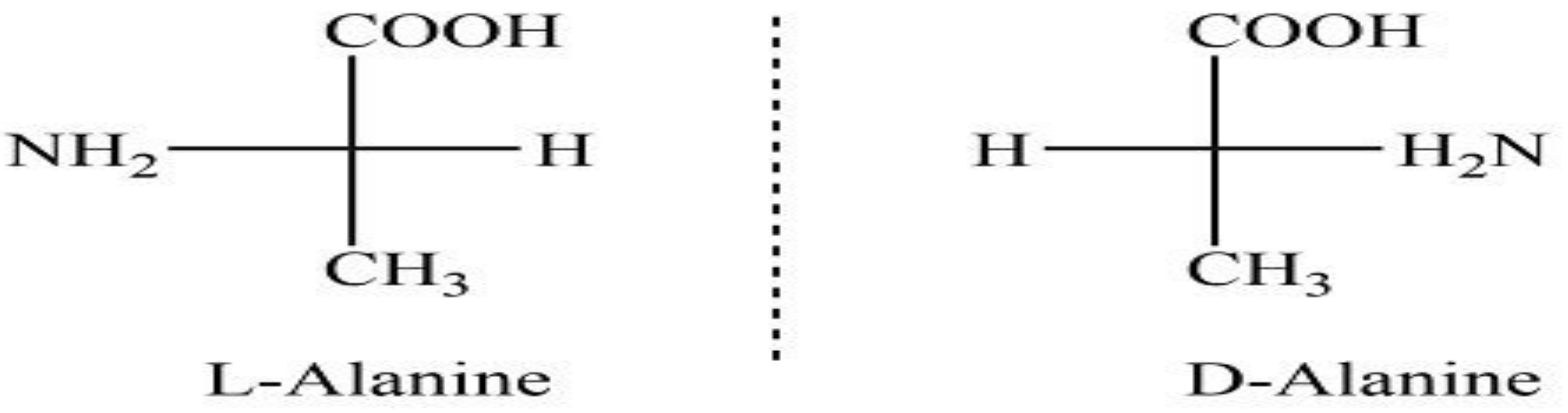


Stereospecificity:

The Enzyme Reacts With Only One Of Two Optical Isomers (Enantiomers) Of A Molecule.

Example:

L-amino Acid Oxidase, Which Acts Only On L-amino Acids And Not D-amino Acids.



Geometrical Specificity:

The Enzyme Distinguishes Between Cis And Trans Isomers.

Example:

Fumarase, Which Catalyzes The Interconversion Of Fumaric Acid (Trans) And Malic Acid (Cis).

Maleic acid
(cis-butenedioic acid)

Fumaric acid
(trans-butenedioic acid)

Importance of Enzyme Specificity

Enzyme specificity means an enzyme usually catalyzes only **one specific reaction** with a **specific substrate**. This high degree of precision is vital for several reasons:

Biological Systems:

It's the foundation for **order** and **proper function** in living things.

It ensures that complex biochemical pathways run smoothly by regulating **the right reaction at the right time**.

Industrial Applications:

High specificity is used to **measure specific substances** (diagnostics).

It allows scientists to **catalyze only the desired reaction** in industrial processes, leading to **minimal unwanted byproducts**.

Medical Applications:

It is essential for **accurate disease diagnosis** (e.g., measuring specific markers).

It is key to developing **personalized and targeted treatments**.

Any questions?

Thank You