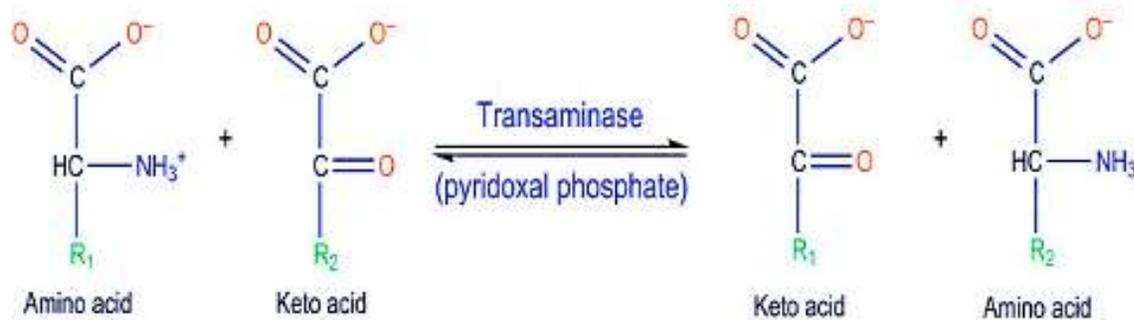


# What is Transamination?

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- Important method of **nitrogen metabolism of amino acids**.
- Transamination is the **transfer of an amine group from an amino acid to a keto acid** (amino acid without an amine group), thus **creating a new amino acid and keto acid**.
- Transamination reactions combine **reversible amination and deamination**, and they mediate redistribution of amino groups among amino acids.
- **Transaminases (aminotransferases)** are widely distributed in human tissues and are particularly active in **heart muscle, liver, skeletal muscle, and kidney**.
- The general reaction of transamination is:



## Concerned enzyme

- The reaction is catalyzed by **transaminase or amino transferase**.
- **Enzymes act on L-amino acid** but not on D-isomers.
- They occur **both mitochondria and cytosol** as separate enzyme.
- There are **many transferases, each acts on a particular amino acid and a particular keto acid**.

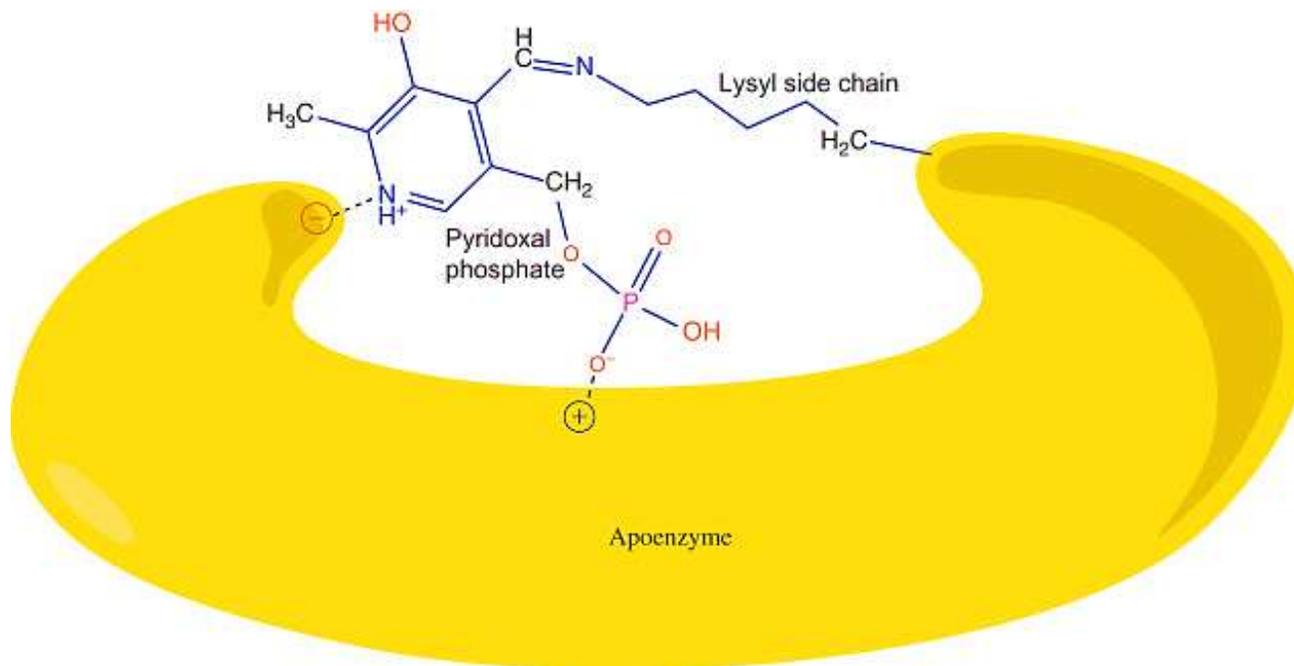
## Amino and keto acid

- All naturally occurring amino acids undergo transamination.
- **Exceptions** include basic amino acids **lysine, hydroxyl amino acids, serine and threonine** and heterocyclic amino acids **proline and hydroxyl-proline**.
- Keto acids like **pyruvic acid, oxaloacetic acid and  $\alpha$ -ketoglutaric acid** are commonly involved.
- Glyoxylate and glutamic  $\gamma$  semialdehyde may also act as amino-receptors in transamination.

# E-PLP Complex

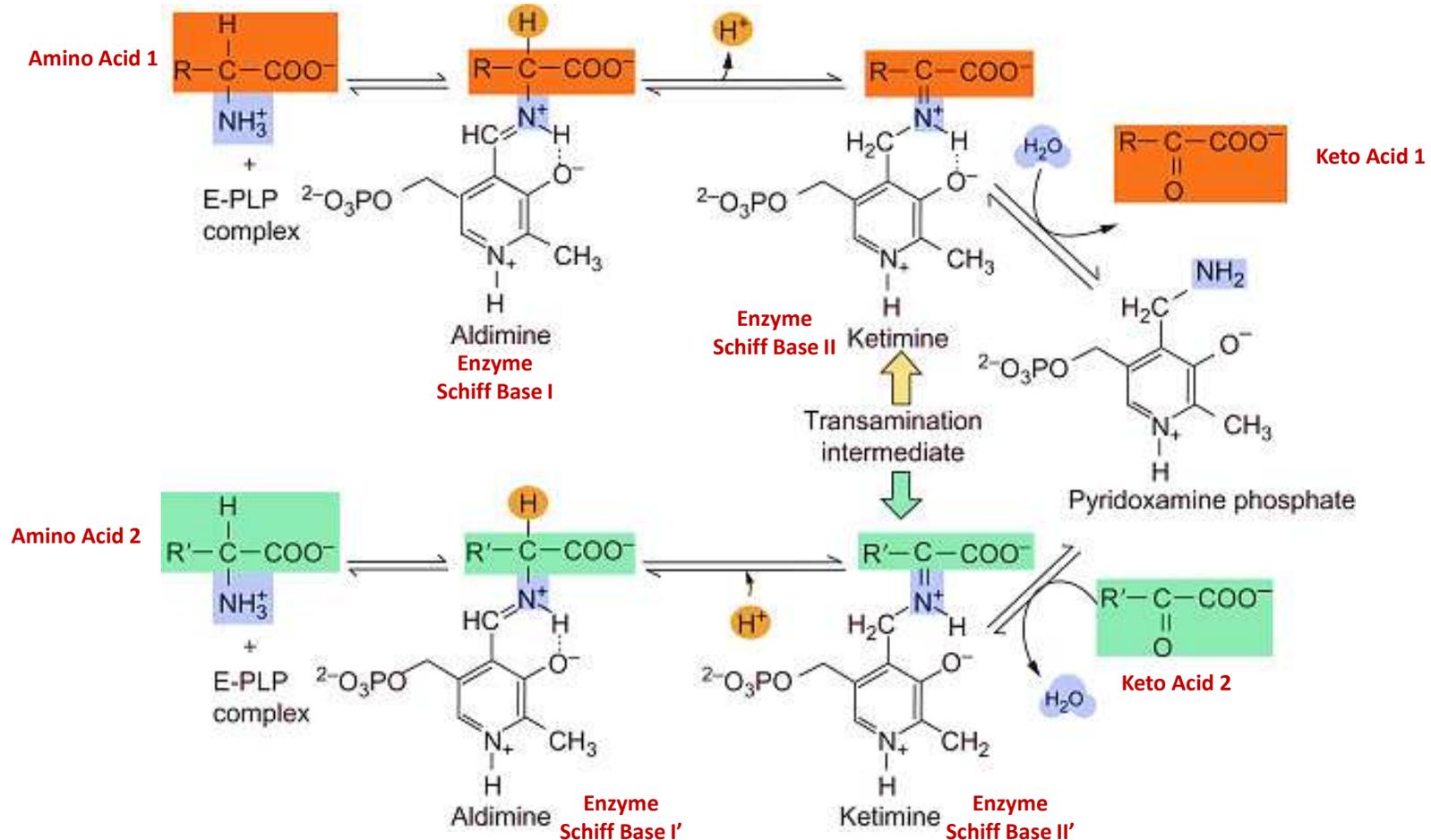
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All transaminase reactions have the same mechanism and use **pyridoxal phosphate (a derivative of vitamin B6)**. Pyridoxal phosphate is linked to the enzyme **by formation of a Schiff base between its aldehyde group and the  $\epsilon$ -amino group of a specific lysyl residue at the active site** and held **noncovalently through its positively charged nitrogen atom and the negatively charged phosphate group**.



# Mechanism

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Tautomers are **isomers of a compound which differ only in the position of the protons and electrons**. The carbon skeleton of the compound is unchanged. A reaction which involves simple proton transfer in an intramolecular fashion is called a **tautomerism**.

## Double displacement type of bisubstrate reaction

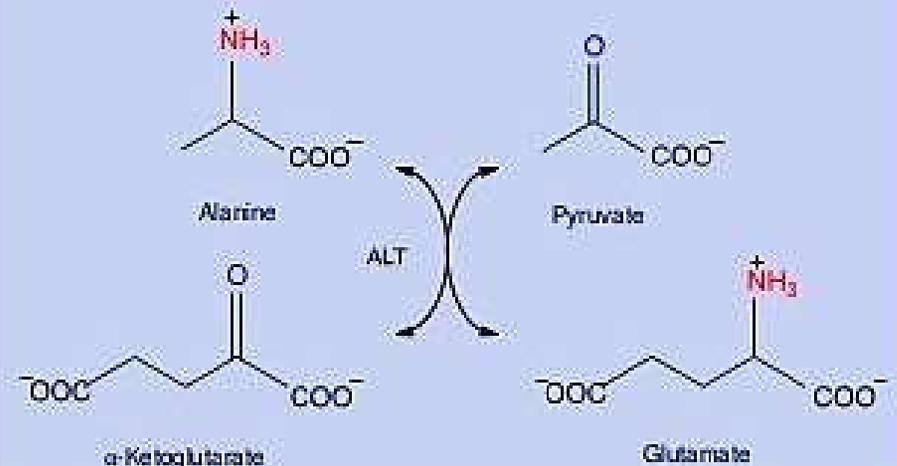
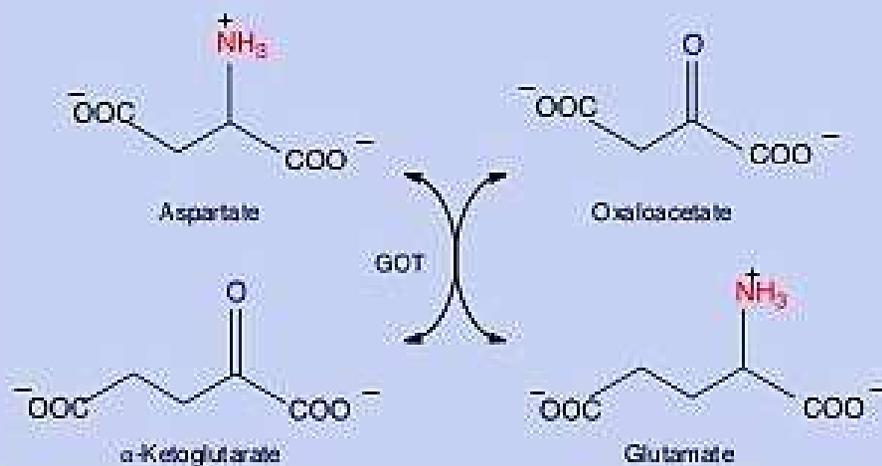
- Enzyme binds to its cofactor, pyridoxal phosphate and **enzyme-pyridoxal phosphate is formed.**
- The **participant amino acid (1) binds** with pyridoxal phosphate linked with enzyme . **Enzyme Schiff Base I formed and water goes out.**
- Next, enzyme Schiff Base I **tautomerizes from its aldimine form to the ketimine form or Enzyme-Schiff Base II,** which **reacts with water and dissociates into a new keto acid (1)** and enzyme pyridoxamine- phosphate.
- Then, the **original participant keto acid (2) combines with pyridoxamine phosphate linked with enzyme.**
- Enzyme **Schiff Base II' is formed and one molecule of water is goes out.**
- Next, **enzyme Schiff Base II' tautomerizes from its ketimine form to the aldimine form or Enzyme Schiff Base I',** which reacts with water and **dissociates into a new amino acid (2) and enzyme pyridoxal phosphate.**

# Examples of Transamination

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1. Interconversion of aspartate and  $\alpha$ -ketoglutarate into oxaloacetate and glutamate by *serum glutamate-oxaloacetate-aminotransferase (GOT)* also called *aspartate aminotransferase (AST)* found in cytoplasm as well as mitochondria

2. Interconversion of alanine and  $\alpha$ -ketoglutarate into pyruvate and glutamate by *serum glutamate-pyruvate aminotransferase (GPT)*, also called *alanine transaminase (ALT)* primarily found in liver



- Circulating levels of AST and ALT are key liver function test

## Significances

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- Important method of nitrogen catabolism of amino acids.
- It helps in synthesis of new amino acids from keto acid.
- It produces pyruvic acid, oxaloacetic acid which are in turn used for gluconeogenesis.

❖ SGPT (Serum Glutamate Pyruvate Transaminase)

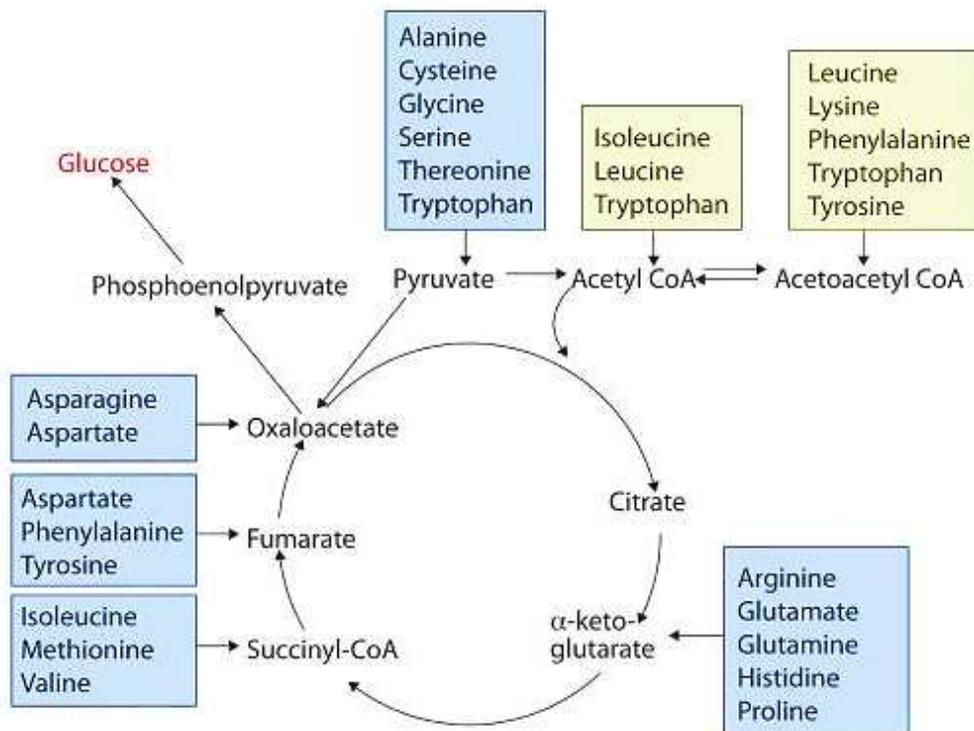


❖ SGOT (Serum Glutamate Oxaloacetate Transaminase)



# The Fate of the Carbon Skeleton

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Any amino acid can be converted into an intermediate of the citric acid cycle. Once the amino group is removed, usually by transamination, the  $\alpha$ -keto acid that remains is catabolized by a pathway unique to that acid and consisting of one or more reactions. For example, phenylalanine undergoes a series of six reactions before it splits into fumarate and acetoacetate. Fumarate is an intermediate in the citric acid cycle, while acetoacetate must be converted to acetoacetyl-coenzyme A (CoA) and then to acetyl-CoA before it enters the citric acid cycle.

Those amino acids that can form any of the intermediates of carbohydrate metabolism can subsequently be converted to glucose via a metabolic pathway known as gluconeogenesis. These amino acids are called glucogenic amino acids. Amino acids that are converted to acetoacetyl-CoA or acetyl-CoA, which can be used for the synthesis of ketone bodies but not glucose, are called ketogenic amino acids. Some amino acids fall into both categories. Leucine and lysine are the only amino acids that are exclusively ketogenic.