GENERAL WAYS OF AMINO ACIDS METABOLISM

The fates of amino acids:

- for protein synthesis
- for synthesis of other nitrogen containing compounds (creatine, purines, choline, pyrimidine)
- as the source of energy; for the gluconeogenesis.

The general ways of amino acids degradation:

- Deamination
- Transamination
- Decarboxylation

The major site of amino acid degradation - the liver.

Deamination of amino acids:

Deamination - elimination of amino group from amino acid with ammonia formation.

Three types of deamination:

- oxidative (the most important for higher animals)
- Reduction
- Hydrolytic

Reduction deamination:

R-CH(NH2)-COOH + 2H+ ⟶ R-CH2-COOH + NH3

amino acid fatty acid

Hydrolytic deamination:

$R\text{-}CH(NH_2)\text{-}COOH + H_2O \longrightarrow R\text{-}CH(OH)\text{-}COOH + NH_3$

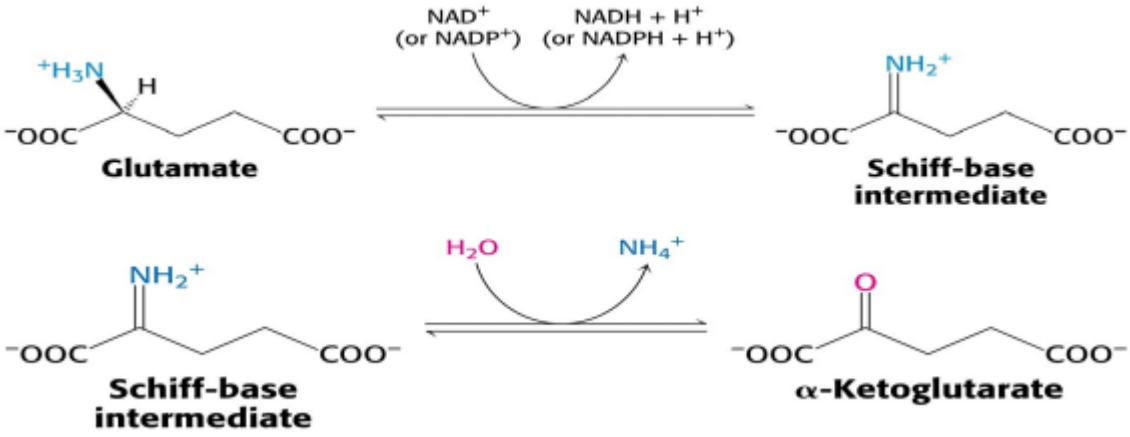
amino acid *hydroxyacid*

Oxidative deamination:

L-Glutamate dehydrogenase plays a central role in amino acid deamination

In most organisms glutamate is the only amino acid that has active dehydrogenase

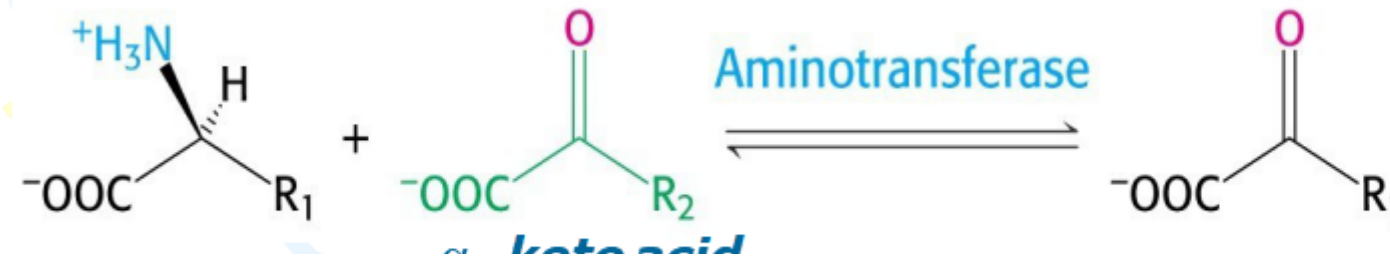
Present in both the cytosol and mitochondria of the liver



Transamination of amino acids

Transamination - transfer of an amino group from an □- amino acid to an □-keto acid (usually to □-ketoglutarate)

Enzymes: aminotransferases (transaminases)



The function of transamination is to funnel the amino nitrogen into one or a few amino acids.

□

For glutamate to play a role in the net conversion of amino groups to ammonia, a mechanism for glutamate deamination is needed so that □-ketoglutarate can be regenerated for further transamination. □

The generation is accomplished by the oxidative deamination of glutamate by glutamate dehydrogenase. □

Glutamate is oxidatively deaminated in the mitochondrion by glutamate dehydrogenase.

NAD+ or NADP+ functions as the coenzyme. □

Oxidation is thought to occur with the transfer of a hydride ion from glutamate's carbon to NAD(P)+ to form alpha iminoglutarate, which is then hydrolysed to alpha ketoglutarate and ammonia.The ammonia produced is then converted to urea in mammals

There are different transaminases

The most common:

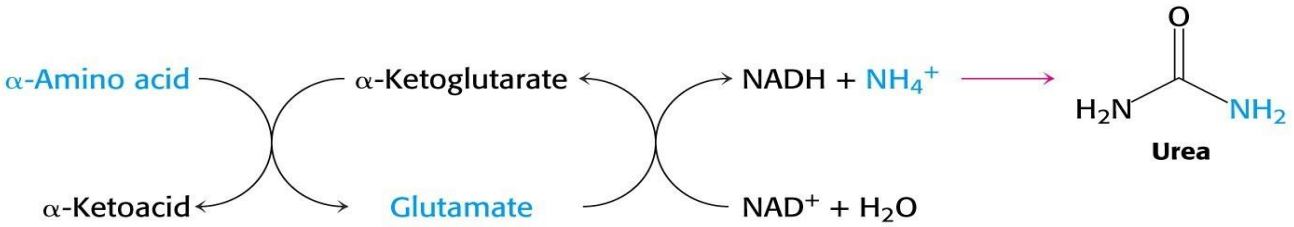
Alanine aminotransferase

alanine + alpha ketoglutarate □ ⟶ pyruvate + glutamate

Aspartate aminotransferase

aspartate + alpha ketoglutarate □ ⟶ oxaloacetate + glutamate

Aminotransferases funnel alpha amino groups from a variety of amino acids to alpha ketoglutarate with glutamate formation Glutamate can be deaminated with NH4+ release



All aminotransferases require the prosthetic group pyridoxal phosphate (PLP), which

is derived from pyridoxine (vitamin B6).

Non-oxidative deamination (Decarboxylation)

Amino acids such as serine and histidine are deaminated non-oxidatively

The other reactions involved in the catabolism of amino acids are decarboxylation, transulfuration,

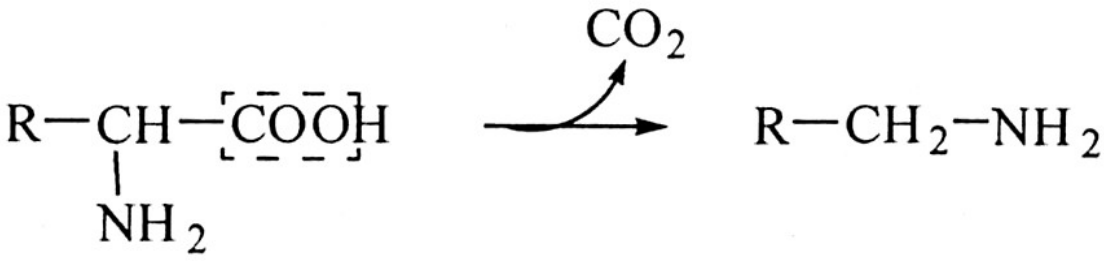
desulfuration, dehydration etc.

Decarboxylation

The decarboxylation process is important since the products of decarboxylation reactions give rise to physiologically active amines. □

The enzymes, amino acid decarboxylases are pyridoxal phosphate dependent enzymes.

Pyridoxal phosphate forms a Schiff's base with the amino acid so as to stabilise the alpha carbanion formed by the cleavage of bond between carboxyl and alpha carbon atom.



The physiologically active amines epinephrine, nor-epinephrine, dopamine, serotonin, gamma amino butyrate and histamine are formed through decarboxylation of the corresponding precursor amino acids.