

Lecture 29

Ammonia assimilating enzymes, GDH, GS and GOGAT

Biosynthesis of ammonia

Ammonia is produced from **the catabolic pathways of amino acids**. Some of the ammonia that is generated is recycled and used in a variety of biosynthetic processes. The excess ammonia is excreted directly or converted to **uric acid or urea** for excretion depending on the organism.

- Many aquatic organisms simply excrete ammonia as NH_4^+ into the surrounding medium.
- Most terrestrial vertebrates convert the ammonia into urea (humans, other mammals and adult amphibians) or uric acid (birds, reptiles).
- In plants **ammonia is also derived from nitrate absorbed from the soil**. Nitrate is first converted to nitrite and then to ammonia.
- The major route for the **assimilation of ammonia into organic nitrogen** is the result of the **collaborative activity of glutamine synthetase (GS) and glutamate synthase** (also called as Glutamine oxoglutarate aminotransferase or GOGAT).
- Ammonia is fixed with the help of **glutamine synthetase** which catalyses the joining of ammonia to glutamic acid.
- The enzyme **GOGAT** is dependent either on NADPH (bacteria, roots and developing seeds but not in leaves) or ferredoxin (leaves, legume nodules, roots and legume seeds) to transfer the amino nitrogen from glutamine to oxoglutarate.
- The **net reaction** is the production of one molecule of glutamate from one molecule of oxoglutarate and one molecule of NH_4^+
- An additional enzyme **glutamate dehydrogenase(GDH)** is widely distributed but is not significantly involved in ammonia assimilation because of high K_m value.
- All the 20 protein amino acids are synthesised by plants and microorganisms.
- Human beings are able to synthesise only 10 amino acids, which are called as **non-essential amino acids**.

- The synthesis of non essential amino acids require only one or two step reactions whereas the synthesis of essential amino acids require multi step reactions.
- The synthesis of 20 amino acids is grouped into families where the precursor compounds are same for one family .

