

Difference Between Glutamine and Glutamate

Key Difference – Glutamine vs Glutamate

Amino acids are essential biomolecules in living systems and are involved in the synthesis of many different kinds of proteins. Amino acids are organic compounds which contain an amine and a carboxyl as functional groups. Glutamine and glutamate are two important amino acids present in living systems. **Glutamine is a conditionally essential amino acid that has various functions of the body. Glutamate is a non-essential amino acid which is considered as the most abundant neurotransmitter in the nervous system.** This is the key difference between Glutamine and Glutamate.

What is Glutamine?

Glutamine is an important amino acid out of the 20 types of amino acids present in nature. It is considered as α -amino acid. Glutamine is utilized in the synthesis of proteins. The glutamine molecule is composed of a α -amino group and a α -carboxylic acid group which get protonated and deprotonated under certain biological conditions, respectively. It is formed due to the replacement of the hydroxyl side chain of glutamic acid by a side chain amide; amine functional group. This develops the glutamine molecule as a neutrally charged amino acid with polar properties at physiological pH conditions.

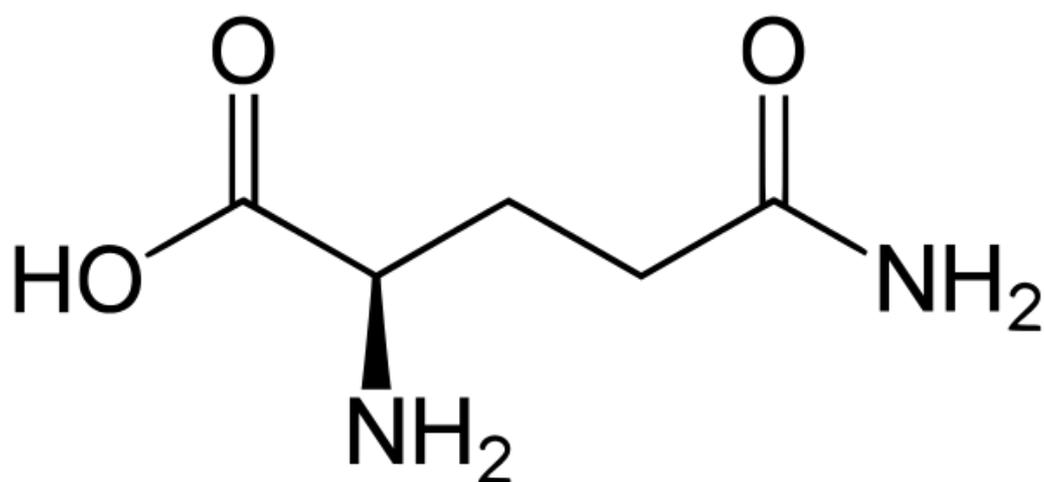


Figure 01: D-Glutamine Structure

Glutamine is a conditionally essential amino acid for humans under certain disease conditions and elevated stress levels. In humans, glutamine is synthesized sufficiently to address the demands of the system but during special

conditions like elevated stress levels, physical trauma (muscle wasting) and disease conditions, the demand for glutamine will increase. In order to provide sufficient amounts of glutamine in such conditions, glutamine should be obtained from the diet. Glutamine-rich food types include dietary meats and eggs. Whey protein and casein protein are also considered to have high levels of glutamine. Glutamine acts as an energy source in some intestinal cells and cells of the immune system. These cells prefer glutamine as an energy source rather than glucose. Glutamine is also important during the regulation of acid base balance in the kidney due to the production of [ammonium](#) when necessary. It provides nitrogen to many anabolic processes in the body, which includes the synthesis of purines. In the [TCA](#) (Tri Carboxylic Acid) cycle, glutamine acts as a donor of carbon. Glutamine also acts as a precursor for the synthesis of the amino acid glutamate and assist in the non-toxic transport of ammonia in the blood.

What is Glutamate?

Glutamate is a type of amino acid that is considered as the most abundant stimulating neurotransmitter present in the nervous system. It is an [anion](#) of the glutamic acid and upon its synthesis, glutamine acts as a precursor. Glutamate has a negative charge. It is a non-essential amino acid since it is synthesized by alpha-ketoglutaric acid present as a part of the citric acid (TCA) cycle. Glutamate is considered as one of the most abundant amino acid present in the human body and acts as a constituent molecule to a wide range of essential and non-essential amino acids present in the body. Glutamate requirement of the body under normal conditions is fulfilled through the diet.

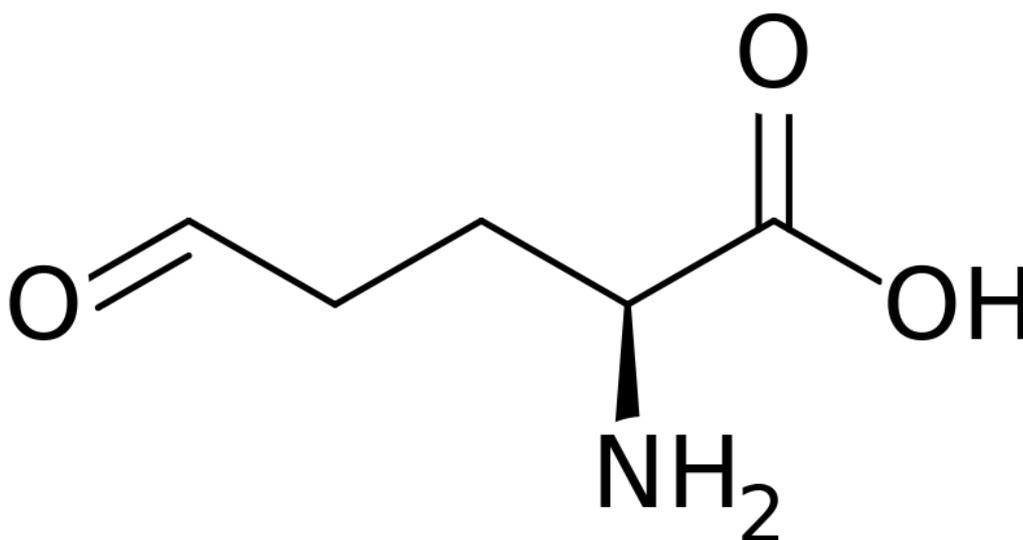


Figure 02: Glutamate

Synthesis of glutamate by the body itself only occurs only if the demand for glutamate increases in case of extreme conditions. Glutamate, by its own, cannot pass the blood brain barrier. But in the context of nervous coordination, glutamate is actively transported into the nervous system by a high affinity transport system which helps in maintaining concentrations of brain fluids, and cerebral spinal fluid at constant levels. In the central nervous system, glutamate is synthesized from the precursor glutamine and enzyme glutaminase acts as the catalyst. This cyclic process is known as the glutamate-glutamine cycle. Glutamate molecule has three types of chemical receptors: AMPA receptors, NMDA receptors, metabotropic receptors. AMPA and NMDA receptors help in increasing membrane permeability for [sodium and potassium](#) during nervous transmission.

What are the similarities between Glutamine and Glutamate?

- Both glutamate and glutamine are amino acids.
- They share common chemical characteristics.
- Both amino acids belong to the carboxylic acid chemical group.
- Glutamine and glutamate are alkaline and consist of nitrogen.

What is the difference between Glutamine and Glutamate?

Glutamine vs Glutamate	
Glutamine is an important amino acid out of the 20 types of amino acids present in nature.	Glutamate is a type of amino acid and the most abundant stimulating neurotransmitter present in nervous system
Charge	
Glutamine doesn't have a charge.	Glutamate molecule has a negative charge.
Requirement by the Body	
Glutamine is a conditionally essential amino acid.	Glutamate is considered as a non-essential amino acid.
Functions	
Glutamine acts as an energy source and a donor for carbon and nitrogen and maintains ionic balance in the kidney and non-toxic transportation of ammonia in the blood.	Glutamate acts as a neurotransmitter in the nervous system.

Summary – Glutamine vs Glutamate

Amino acids are essential biomolecules present in the living systems. They are involved in the synthesis of many different types of proteins. Glutamine and glutamate are two important amino acids. Glutamine is a conditionally essential amino acid. The demand for glutamine increases with elevated levels of stress, disease conditions, etc. It has many different important functions in the body, which includes maintenance of ionic balance inside the kidney, acting as the carbon and nitrogen donor for different biochemical processes, as an energy source, etc. Glutamate is a non-essential amino acid synthesized by alpha ketoglutaric acid. It is considered to be the most abundant neurotransmitter present in the nervous system. This is the difference between glutamine and glutamate.

Reference:

1. "Chapter 9 – Glutamate Metabolism." Glutamate Metabolism – Astrocytes and Epilepsy – Chapter 9, [Available here](#). Accessed 1 Sept. 2017.
2. "Glutamine." University of Maryland Medical Center, [Available here](#). Accessed 1 Sep. 2017.
3. Shen, Jun. "Modeling the glutamate–glutamine neurotransmitter cycle." *Frontiers in Neuroenergetics*, Frontiers Media S.A., 2013, [Available here](#). Accessed 1 Sept. 2017

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